VALPAC

A DISCOUNTED CASH FLOW APPROACH TO PROPERTY VALUATION

J.J.ROSE

E.M.REEVES

VALPAC IS DEDICATED TO THE RESIDENTS AND STAFF OF
THE ROYAL SCHOOL FOR THE BLIND AT LEATHERHEAD
AND THEIR PATRON,
HER ROYAL HIGHNESS THE PRINCESS OF WALES.

VALPAC IS APPROVED AND SPONSORED BY
THE INCORPORATED SOCIETY OF VALUERS AND AUCTIONEERS
THROUGH THE PHILIP ROSE MEMORIAL FOUNDATION

PREFACE

VALPAC would seem the appropriate diminutive of the valuation package which comprises:-

1. An application module to be inserted into a Hewlett Packard 41C, pre-programmed specifically to solve valuation calculations.

2. A keyboard overlay printed with valuation symbols.

3. An operator's manual.

4. An abbreviated Quick Reference Program Selector to fit into the calculator carrying case.

Users will of course need to purchase a standard HP41C or a HP41CV.

I unhesitatingly pay tribute to my colleague, Edward Reeves, who although a lawyer by training and not a practising Valuer, has been entirely responsible for the production of the application module. His long-standing connection with property investments has resulted in the application for his own use of most of the programs now presented and, in making these available to practising Valuers, it will undoubtedly place them in his debt.

Past publications, many of which have been my responisiblity have largely been based on traditional methods of valuation, but this current work represents a change in that VALPAC involves both a book and what is tantamount to computer software.

The cost of production and publication of the initial 250 VALPACS having been provided by the authors, the whole of the gross proceeds from sales will be split between The Royal School for the Blind and The Philip Rose Memorial Foundation.

The Royal School for the Blind at Leatherhead, to whom this work is dedicated, is a training establishment, workshop and residential home for blind adults who have additional handicaps. The sums received will be applied towards the appeal being undertaken to fund a £4 million building and refurbishment scheme now underway at their Leatherhead premises. The scheme will eventually provide standards of privacy, accommodation and training that should be the entitlement of anyone as of right, but all too frequently unavailable to those with the misfortune to be handicapped.

The Philip Rose Memorial Foundation, under the auspices of The Incorporated Society of Valuers and Auctioneers, is dedicated, inter alia, to fund further research into, knowledge of and understanding of applied valuation techniques.

Jack Rose

DISCLAIMER

Whilst a great deal of time and effort has gone into ensuring the accuracy of the program material, the authors supply this material and the book without any representation as to its precision or accuracy and without any guarantee or warranty of any kind. The application of this program material must be at the user's own risk and the authors will not be liable for any loss occasioned by its use, consequential or otherwise.

The authors would like to hear from any user experiencing difficulty in operating the application module and from any user who finds new applications for the module beyond those outlined in this book. The authors are aware of some areas that have potential, but have excluded comment for the sake of brevity; more esoteric supplements may be produced later.

IMPORTANT WARNING

Read below before switching on :-

DO NOT attempt to insert or remove the Application Module into or from the calaulator when the calculator is switched on , as this is likely to result in damage to the module and the calculator! Read the paragraphs entitled "HOW TO INSERT THE APPLICATION MODULE" on Pages 6 & 7 before attempting to place the module into the calculator.

CONTENTS

INTRODUCTION

The object of this book is to provide simple keying instructions for a pre-programmed calculator, enabling the user to carry out a wide variety of calculations of use to valuers based on Discounted Cash Techniques, including those valuations and analysis calculations involving specifically, elements of income variation, taxation and obsolescence, amongst others.

Investors in real estate would appear to regard yields on property as having no reference to other types of investment, particularly those with fixed interest yields, and tend to treat property investment in isolation.

It may well be that the practice of choosing an initial yield adjusted arbitrarily to reflect future changes in income, or indeed other factors, will remain the accepted norm. But it is postulated that an alternative, perhaps more logical approach is to analyse by DCF methods the relationship between yields from property and alternative investment opportunities to extract implied growth rates and to use the results of such analysis in the calculating process of valuations of similar properties, thus releasing the Valuer from the straight-jacket of the initial yield. These analytical DCF methods can, at the very least, serve as useful tools in the long overdue re-examination of traditional valuation methods.

Additionally, a considerable number of calculations allied to the compound interest tables used in traditional valuation practice are given in a separate section. Also included are calculations covering a multitude of other investment situations for example:- Stocks and Bonds, Development Appraisal, Mortgages and all manner of loan arrangements and Nominal/Effective Rate conversions.

It is intended that the book be used as a companion guide to the Hewlett Packard 41c programmable calculator, which has been adapted for the purpose by a specifically written series of programs inserted as a non-erasable module in one of the "ports" of the calculator. It will be noted that certain of the keys are automatically assigned to bring into play the required program to solve problems in conjunction with data chosen by the operator.

The calculator is classified as alpha numerical, i.e. it displays letters and words in addition to numerals. After calling up the program required, the display prompts the operator by words or abbreviations to insert data of his own choosing.

The authors claim to offer no more than a method of calculation, the second part of any valuation, the primary part of which is the data chosen by the valuer from his knowledge of market conditions.

The data used in examples of calculation are illustrative only and are not indicative of current market experiences, especially with reference to the Overall Yield requirement .

The Valpac Module turns the basic calculator into a very powerful valuation tool, it should be noted that the module offers an additional facility and does not materially diminish the calculator's capacity. It is possible to add to the facilities available on the calculator in any one of the following ways, by buying other Application Modules or off the peg programs through the Hewlett - Packard Users Library, alternatively by creating your own programs.

HOW THE CALCULATOR IS OPERATED

Whilst the Hewlett Packard HP41C has a Keyboard similar to most other calculators, it has in addition 130 separate functions plus the capacity for adding hundreds of others by the insertion of program modules, or by programming the calculator's own memory. These can be called up at will through the use of special keying instructions. If these functions are assigned to keys, they are automatically brought into play by pressing the 'USER' Key and, when user mode is operative, the display will actually read USER. The 56 normal functions which include addition, subtraction, multiplication, division, etc. are brought into play by re-pressing the USER key to bring the calculator back to normal functioning. The calculator, unlike most of the 'pocket' variety, uses Reverse Polish Notation.

The calculator comes with the maker's instruction manual, which should be studied for normal use, but the operator relying on the pre-programmed functions will be assisted by a numbered code as described on Page 8 below.

Although explained in the maker's instruction manual, it may assist first time operators to master the operation of the Reverse Polish Notation by explaining that the calculation involving any two numbers is dealt with by

1. Keying the first number (a).
2. ENTERING this by pressing the ENTER Key.
3. Keying (only) the second number (b).
4. Choosing whether to add, subtract, multiply or divide (a) and (b), by keying the appropriate Key.

If the two numbers are 9 and 4 respectively, then:-

	Step	Key	Display
FOR ADDITION	1	9	9
	2	ENTER	9
	3	4	4
	4	+	13
FOR SUBTRACTION	1	9	9
	2	ENTER	9
	3	4	4
	4	-	5

N.B.
If any of the Arithmetical Function Keys are given 'USER' assignments, then in making these calculations, it is necessary to ensure the 'USER' sign does not appear in the display. If it does, it can be erased by pressing the 'USER' Key, as this operates as a toggle switch. If the calculator is in 'USER' and no assignment has been made to a Key, that Key will perform its normal function.

ADDITION

EXAMPLE (15 + 16 + 7) **ANSWER = 38**

KEY	DISPLAY		
15	15		
ENTER	15		
16	16		
+	31		
7	7		
+	38	=	ANSWER

SUBTRACTION

EXAMPLE (32 - 8) **ANSWER = 24**

KEY	DISPLAY		
32	32		
ENTER	32		
8	8		
-	24	=	ANSWER

MULTIPLICATION

EXAMPLE (8 x 4) **ANSWER = 32**

KEY	DISPLAY		
8	8		
ENTER	8		
4	4		
x	32	=	ANSWER

DIVISION

EXAMPLE (8 ÷ 4) **ANSWER = 2**

KEY	DISPLAY		
8	8		
ENTER	8		
4	4		
÷	2	=	ANSWER

RECIPROCAL

EXAMPLE $^{1}/_{4}$ ANSWER = 0.25

KEY	DISPLAY
4	4
1/X	.25 = ANSWER

RAISING A NUMBER TO A POWER

EXAMPLE 4^{3} ANSWER = 64

KEY	DISPLAY
4	4
ENTER	4
3	3
SHIFT	3
Y^{x}	64 = ANSWER

EXTRACTION OF A ROOT

EXAMPLE $64^{1/3}$ ANSWER = 4

KEY	DISPLAY
64	64
ENTER	64
3	3
1/X	.333
SHIFT	.333
Y^{x}	4 = ANSWER

CONSTANT

EXAMPLE: £1,000 P.A. AT:

A 13 YP = £13,000
B 14 YP = £14,000
C 15 YP = £15,000
D 16 YP = £16,000
E 17 YP = £17,000

STEP	KEY	DISPLAY	
1	1,000	1,0000	
2	ENTER	1,0000	
3	ENTER	1,0000	
4	ENTER	1,0000	
5	13	13	
6	X	13,000	RESULT A
7	CLX	0.0000	
8	14	14	
9	X	14,000	RESULT B
10	CLX	0.0000	
11	15	15	
12	X	15,000	RESULT C

DEPOSIT ACCUMULATION

EXAMPLE: £100 AT 15% FOR 3YEARS.

STEP	KEY	DISPLAY
1	1.15	1.15
2	ENTER	1.15
3	ENTER	1.15
4	ENTER	1.15
5	100	100
6	X	115
7	X	132.25
8	X	152.0875

HOW TO INSERT THE APPLICATION MODULE

Reference to the Owner's Handbook (supplied with the calculator) should be made to learn how to insert the batteries (and any peripheral device e.g. printer). Also refer to this handbook for basic operating instructions.

An explanation is set out below of the procedure to follow for inserting the application module once the batteries have been installed.

When the HP41C is switched on for the first time it arbitrarily allocates the memory capacity (63 registers) between the Data Storage Registers and the Program Registers in the ratio 17/46 respectively. The Application Module itself requires no Program Registers except for the allocation of the 'USER' Key Assignments, this requires nine Program Registers.

The following steps are required to become operational after inserting the batteries. This is known as a "SIZE" operation:-

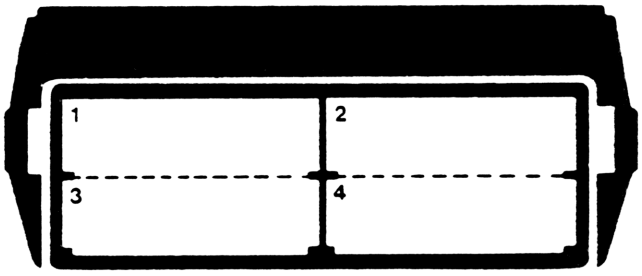
1) Switch on.
2) Press Key marked 'XEQ'.
3) Press 'Alpha' Key.
4) Press Key 'S' (Primary Marking '8').
5) Press Key 'I' (Primary Marking 'COS').
6) Press Key 'Z' (Primary Marking '1')
7) Press Key 'E' (Primnary Marking 'LN').
8) Press 'Alpha' Key.
9) Press 0.
10) Press 5.
11) Press 4.
12) Switch off.

The calculator now has 54 registers available for Data Storage.

The subject of memory allocation is covered in the Owner's Handbook and shoud be referred to if necessary.

The calculator's memory allocation will remain fixed, even when the calculator is switched off, until the batteries are removed, or the whole contents are cleared from the calculator, or a different 'SIZE' allocation is specified as above.

The calculator is off, so the Application Module can now be inserted. The plastic cover can be removed from Port No.1 (see diagram below) by just pulling it out. No.1 Port is the top left-hand Port when viewing the head of the calculator with the Key face uppermost. Insert the module with the handle tab uppermost. Removal can be achieved by pulling the module handle when the calculator is in the off position.



The HP41c calculators with expanded memory capacity ranging from the HP 41 CV or the HP 41c with a Quad memory module inserted, both having a total register capacity of 319, down to the HP 41c with a single memory module inserted (giving a capacity of 127 registers), all "wake up" with 46 registers allocated to Program memory, the balance being all allocated as Data Storage Registers. Any module providing extra memory capacity must be inserted before any application module, i.e. in a lower Port number. For instance the memory module should be in Port 1 and the Valpac Module in Port 2.

The question of memory allocation is touched on again later but it should be noted that 9 Program Registers are needed for automatic key assignments,and 25 Data Registers are required to run the programs .The additional Data Register requirements of the NPV, IRR and MIRR Programs are dealt with in Section IV.

THE KEYS AND KEYBOARD

The Application Module comes with a printed Keyboard Overlay-card, the abbreviated symbols on the overlay are provided to help the user when running the programs. The gold symbols relate to the 'Basic' Section and the silver relate to both the 'Advanced' Section and also the five other programs ((E/N),(IRR),(MIRR),(NPV) and (MTGE)). Those symbols in brackets show that prior use of the yellow shift key is required to operate that particular function.

The Overlay marks the position of those Keys which have been assigned functions for operation when the calculator is in 'USER' Mode. The top row Keys are permanently designated A,B,C,D,E; and after keying the Yellow Shift Key, a,b,c,d,e, which initiates the secondary operating mode of the individual Keys. The A - E and (a)-(e) keys have different functions in the different sections and within the separate programs. The symbols shown in gold on the top row of the overlay are those functions relating to the 'Basic' Section only. The operation of those top row Keys in other circumstances is explained later under the individual sections or program headings.

The insertion of the VALPAC Module automatically sets the calculator to 'User' Mode and assigns the functions marked on the overlay to the individual Keys. There are 18 such assignments, and this requires that there be 9 registers available in the Program Memory (as opposed to being designated as Storage Registers). Attempting to insert the module with less than 9 registers of program memory being available, will result in the calculator displaying 'TRY AGAIN'. First execute the SIZE routine described above in "How to insert the Application Module".

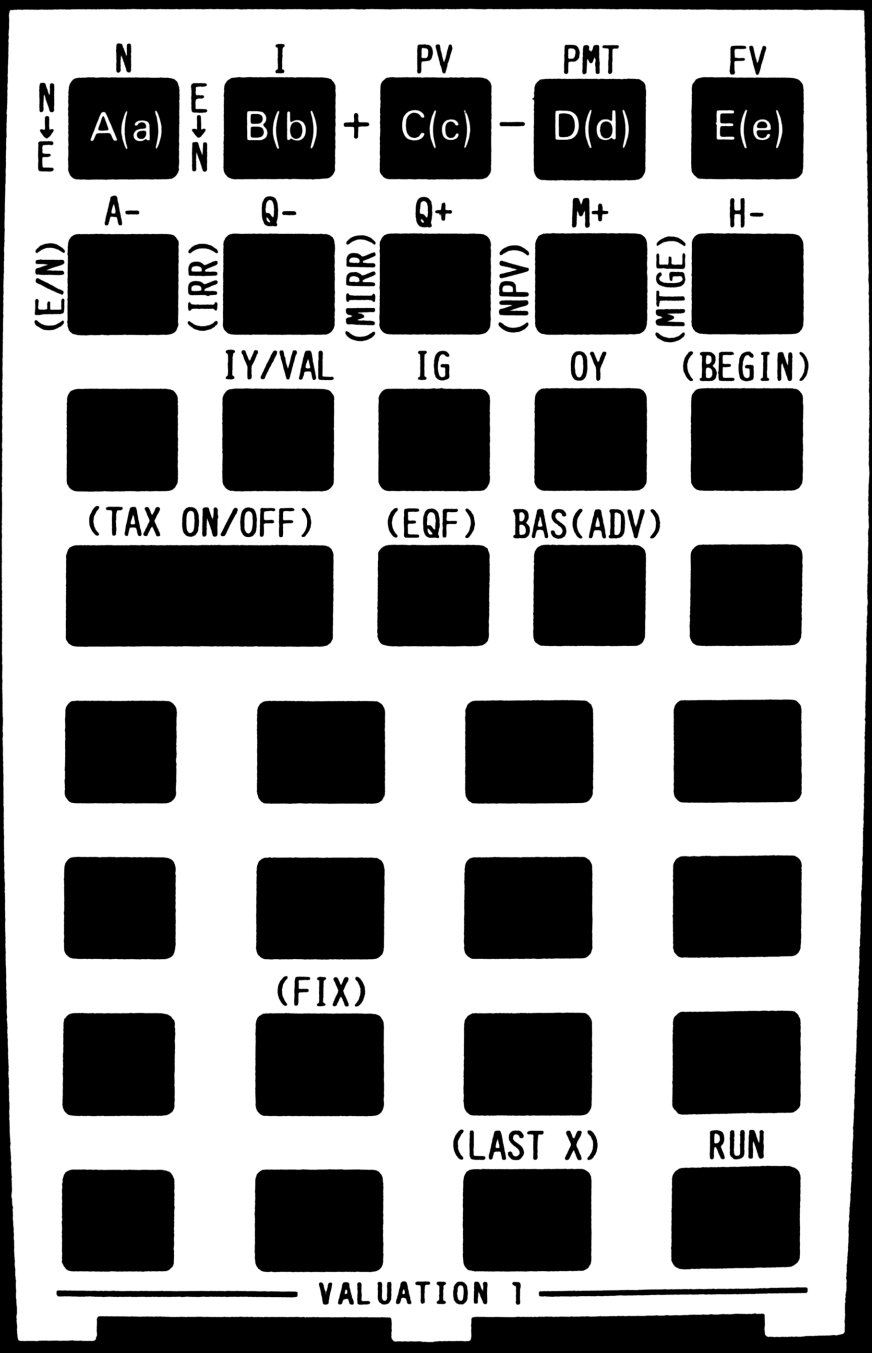
When the calculator is in 'USER' mode, all the Keys which have not been assigned USER functions will operate their normal function as shown marked, either on the Keys or the permanent Keyboard face of the calculator itself. Thus, when VALPAC is inserted, all the numerals and the basic arithmetical functions can be used, even though in 'User Mode'.

The 18 Key assignments can be cleared using the 'CLKEYS' functions to free the memory for other uses, whilst the module is plugged in. This process is described in the Introduction to the IRR, MIRR and NPV Programs, Section IV. The effect of operating the CLKEYS function is to add 9 registers to the Program Memory which can then be reallocated as Data Stores.

A numbered keycode for identifying individual Keys is described in the Owner's Handbook. This code consists of two numerals, the first number identifies the Keys in a vertical plane from the top to the bottom, 1 being the top Key and 8 the bottom. The second numeral identifies the Keys in a horizontal plane from the left to the right, 1 being the left and 4 or 5 being the right, dependent on whether the row has four or five Keys in it. Thus Key 11 is the top left-hand Key, the Shift Key is 31 and 84 is the bottom right-hand Key. See Page 1 of the Quick Reference Program Selector for a Keycode Diagram.

This Keycode is used in the examples that follow. All the examples assume without expressly so stating that the calculator is on and set to 'User' mode.

KEYBOARD OVERLAY - ALL KEYS (IN GOLD AND SILVER)



GLOSSARY OF ABBREVIATED TERMINOLOGY

USED ON THE KEYBOARD OVERLAY AND

WITHIN THE PROGRAMS (except IRR, MIRR & NPV)

KEYBOARD OVERLAY ABBREVIATIONS

(ADV)	-	Advanced Section.
A-	-	Annual in Arrear Mode of Rental Payment.
Q-	-	Quarterly in Arrear Mode of Rental Payment.
Q+	-	Quarterly in Advance Mode of Rental Payment.
M+	-	Monthly in Advance Mode of Rental Payment.
H-	-	Half-yearly in Arrear Mode of Rental Payment.
IY/VAL	-	Initial Yield/Valuation.
IG	-	Implied Annual Growth Rate.
OY	-	Overall Yield.
(EQF)	-	Equivalence (Constant Rent) Factor.
TAX ON/OFF	-	Tax Mode Change Key. Toggles between 'on' and 'off'.
BAS	-	Basic Section.
N	-	Financial Key. Enters the number of compounding periods in the investment term.
I	-	Financial Key. Enters the interest rate appropriate to 'N' above.
PV	-	Financial Key. Enters the Present Value.
PMT	-	Financial Key. Enters the periodical payment appropriate to 'N'.
FV	-	Financial Key. Enters the Future Value.
(BEGIN)	-	Sets the calculator to assume periodical payments are made at the beginning of the period.
(E/N)	-	Effective/Nominal Rate Conversions Program.
(IRR)	-	Internal Rate of Return Program.
(MIRR)	-	Modified Internal Rate of Return Program.
(NPV)	-	Nett Present Value Program.
(MTGE)	-	Mortgage Instalment and APR Program.
N→E	-	Selects Nominal to Effective Conversion.
E→N	-	Selects Effective to Nominal Conversion.
+	-	Selects payments in Advance for E/N Program.
-	-	Selects payments in Arrear for E/N Program.

PROGRAM PROMPTS

MODE?	-	Mode of Rental Payments (i.e Q+ or A- etc.).
WHICH CALC.?	-	Which Calculation (prompts for IG, OY, IY/VAL or EQF selection).
REVIEW P?	-	Rent Review Period.
OVRL.YIELD%?	-	Overall Yield expressed as a percentage (or Remunerative Rate when used in Sinking Fund Calculation).
GROWTH %?	-	Annual Growth Rate expressed as a percentage.
INIT.YIELD%?	-	Initial Yield expressed as a percentage.
RENT RES.?	-	Rent Reserved under the lease (the rent passing).
RACK RENT?	-	Current Market Rental Value.
TERM?	-	Period to the next Rent Review (or Reversion).
PV?	-	Present Value or Present Capital Value.
MOD.REVIEW P?	-	The current pattern of modern rent review periods.
NUMBER OF P?	-	Number of rent review periods after the term until - in the case of a freehold, reversion to a modern r.r. pattern: or - in the case of a leasehold, reversion to a modern r.r. pattern or, in the absence of a remainder, to the end of the head lease.

REMAINDER - The period of years of the remainder following a term and one or more abnormal rent review period(s).

SALE PRICE? - Prospective or actual sale price.

FVG? - Future Value Growth = Annual Growth Rate expressed as a percentage to find the future capital value (Sale price).

INCOME TAX? - Tax on income receipts(including Corporation Tax) expressed as a percentage.

COST PRICE? - The base value for Capital Gains Tax purposes.

CGT? - Capital Gains Tax.

HEAD RENT? - The rent passing between the Freeholder and the Head Lessor.

SF TERM? - Period for which the Sinking Fund will run (also the period of the terminable interest).

SF RATE? - The rate of accumulation for the Sinking Fund expressed as a percentage.

NO.PMTS P.A? - Number of periodical payments per annum.

I = ? - Prompts for Interest Rate in Basic Programs (b) and (c).

N = ? - Prompts for the number of years in Basic Programs (b) and (c).

NOM ⇄ EFF? - Prompts for selection of Nominal to Effective or Effective to Nominal Conversion.

ADV OR ARR? - Prompts for selection of '+' for in advance or '-' for in arrear in the E/N Program.

NOM%=? - Prompts for input of Nominal Rate.

EFF%=? - Prompts for input of Effective Rate.

MTGE TERM=? - The Period that the mortgage is to run.

RATE%=? - Nominal Interest Rate charged.

LOAN=? - Amount of the Advance.

PROGRAM STATUS INDICATORS

ADVANCED - Shows Advanced Section has been selected and prompts user to select a program.

BASIC - Shows Basic Section has been selected and prompts user to use Financial Keys or to select a program.

BEGIN - Denotes payments are to be made at the beginning of the compounding period. (Flag 0 will be set).

TAXED - Shows Tax Mode is set. (Flag 4 will be set).

UNTAXED - Shows Tax Mode is not set (Flag 4 will be clear).

IN ADVANCE - Basic Program (a). Toggles between 'in Arrear'.

IN ARREAR - Basic Program (a). Toggles between 'in Advance'.

PROGRAM RESULT INDICATORS

IY%= - Labels the result of the Initial Yield Calculation.

IG%= - " " " " " Implied Growth "

OY%= - " " " " " Overall Yield "

EQF= - " " " " " Equivalence Factor "

L = - The value of an investment leasehold where there is a gearing element produced by a fixed ground rent.

RF= - Reduction Factor to convert a Single Rate YP to Dual Rate.

YP= - Years Purchase used in the context of Dual Rate Calculations.

ASF= - Annual Payment to a Sinking Fund to produce £1 at a given time in the future.

N = - Labels the Input or the Result as appropriate.

I = - " " " " " " " " .

PV= - " " " " " " " " .

PMT= - " " " " " " " " .

FV = - " " " " " " " " .

AF = - Adjustment Factor to reflect periodic payments more frequent than annual in arrear.
ESR= - Equivalent Single Rate for given Dual Rate Data.
MON.PMT= - Monthly Payment under normal Building Society Repayment Mortgage.
EFF%= - Annual Percentage Rate (APR) on normal Building Society basis.
EFF% - Labels result from Nominal to Effective conversion.
NOM% - Labels result from Effective to Nominal conversion.

GRADUATED MORTGAGE PROMPTS

GROWTH%? - The Growth Rate to be applied.
OVRL.YIELD%? - The Mortgage Interest Rate.
TERM? - The length of the mortgage.
GR P? - The initial period over which graduation/growth is to be calculated.
LOAN? - The Mortgage Advance.

GRADUATED MORTGAGE RESULT INDICATOR

PMT 1 = - The first annual payment.

ADVANCED DUAL RATE PROMPTS

FVG? - The growth rate to be applied to the sum to be recouped.
INCOME TAX? - Income Tax Rate (as a percentage) for grossing up.
OVRL.YIELD%? - Remunerative rate on the investment.
SF TERM? - Period for which the Sinking Fund will run (also the period of the terminable interest).
SF RATE%? - The rate of accumulation for the Sinking Fund expressed as a percentage.
GROWTH%? - The rate of growth to be applied to the Sinking Fund Payments.
REVIEW P? - The number of years between SFP growth adjustments.

ADVANCED DUAL RATE RESULT INDICATORS

YP= - Years Purchase.
ASF= - The 1st annual SFP to produce £1 (plus growth factor) at a given time in the future.

SECTION I

ADVANCED DISCOUNTED CASH FLOW ANALYSIS AND SYNTHESIS RELATIVE TO INVESTMENT VALUATION

THE ADVANCED SECTION PROGRAMS

WITH NOTES AT THE END OF THE SECTION.

THE ROLE OF DISCOUNTED CASH FLOW CALCULATIONS IN PROPERTY VALUATION.

Perhaps the simplest way to introduce the use of Discounted Cash Flow Analysis is to consider the present capital value of an income receivable from a property or indeed any other type of investment by applying a figure of Years Purchase, i.e. the Present Value of the right to receive £1 per annum for any number of years to infinity.

The total sum is therefore each year's income deferred at a given rate per cent to the present time and the Years Purchase figure is the sum of these individual deferred payments.

In real life these individual payments do not necessarily remain the same for every year and a method can be used which takes into account such variations, suitably discounted to the present time. This method is simply the addition of Discounted Cash Flows, since it examines the actual or implied Cash Flows for each individual year.

To show the relationship between a Discounted Cash Flow calculation and that using published tables, we may examine the Years Purchase for £1 per annum for 5 years @ 10% (single rate). The figure obtained from the tables is

3.79079

The Present Value of £1 , i.e. £1 discounted at 10% for

1 year	=	0.90909
2 years	=	0.82645
3 years	=	0.75131
4 years	=	0.68301
5 years	=	0.62092
TOTAL		3.79078

The deviation in the 5th decimal place is due to the "rounding off" process and may be ignored.

What the example shows is that, in the event of a change in the amount of income, this traditional method of applying a Years Purchase figure would be incorrect. Any Discounted Cash Flow calculation which can reflect these changes would have been laborious until programmable calculators have made it possible to shorten the calculation of even the most complex patterns of change, by Keying for the appropriate program and the insertion of the Valuer's chosen data - the most important part of the exercise.

Discounted Cash Flow calculations have been adopted to offer an alternative method to solve problems arising from Term and Reversion Valuations, Equated Yields, Review Rents and the like, besides providing for the analysis of property performance. The incidence of tax, gearing and obsolescence can be Keyed into the appropriate programs at the discretion of the Valuer.

THE RELATIONSHIP BETWEEN IMPLIED ANNUAL GROWTH,

OVERALL YIELD & INITIAL YIELD.

In an era when fixed interest stocks have shown yields in double figures, whilst properties let with frequent rent reviews have changed hands at yields showing 5% or less, it is obvious that growth was implied in the lower yielding property. The use of the term 'GROWTH' in this book includes change in money terms that can be positive or negative and applicable to inflation or deflation, and supply and demand.

1. Traditional property valuation techniques have generally been concerned with the yield applicable to an initial income. Such future variations as could be expected have traditionally been catered for by arbitrarily adjusting the initial yield to reflect all the risks involved. For convenience sake, this may be termed THE ALL RISK RATE.

2. The use of this rate is often justified by reference to known market transactions, but many of these transactions reflect the influence of calculations adopted by the actuaries of the larger financial institutions, using more sophisticated methods applicable to the expected long term performance of both their property and other types of investment.

3. The attraction of property as an investment has always been its ability to combat inflation, but outside a small circle of actuaries and expert analysts, its precise performance has so far escaped detailed comparison with other investment opportunities.

4. Any property valuation is synthetic, the component parts of the valuation consisting of the yield and the income. The technique of Discounted Cash Flow allows for a detailed analysis in terms of other opportunities and there can be no doubt that the major financial institutions are influenced in their property purchases by other investment opportunities; value accordingly and thus, in turn, influence the property market.

5. Analysis of both fixed interest and variable income opportunities obviously creates a need to assess GROWTH (or otherwise) in evaluating the choice and price to pay for any particular investment property, and the initial yield may no longer be the only yard-stick by which to assess the price.

6. An alternative approach is to examine the OVERALL YIELD expected over the life of the investment and it is on this that the Discounted Cash Flow method of valuing is based. Given an OVERALL YIELD requirement, a Discounted Cash Flow calculation can provide the appropriate initial yield taking rent review patterns, modes of payment and tenure into account and, moreover, can analyse recorded transactions to reveal the implied income growth related to specific data.

7. Dramatic changes in the purchasing power of money makes suspect the addition or subtraction of an odd 1% or some other number to adjust for "ALL RISKS" in the initial yield. Whilst much of the data to be inserted into a valuation is a subjective approach by the Valuer, the use of the OVERALL YIELD would seem more objective and possibly make for a more logical and overt basis of valuation.

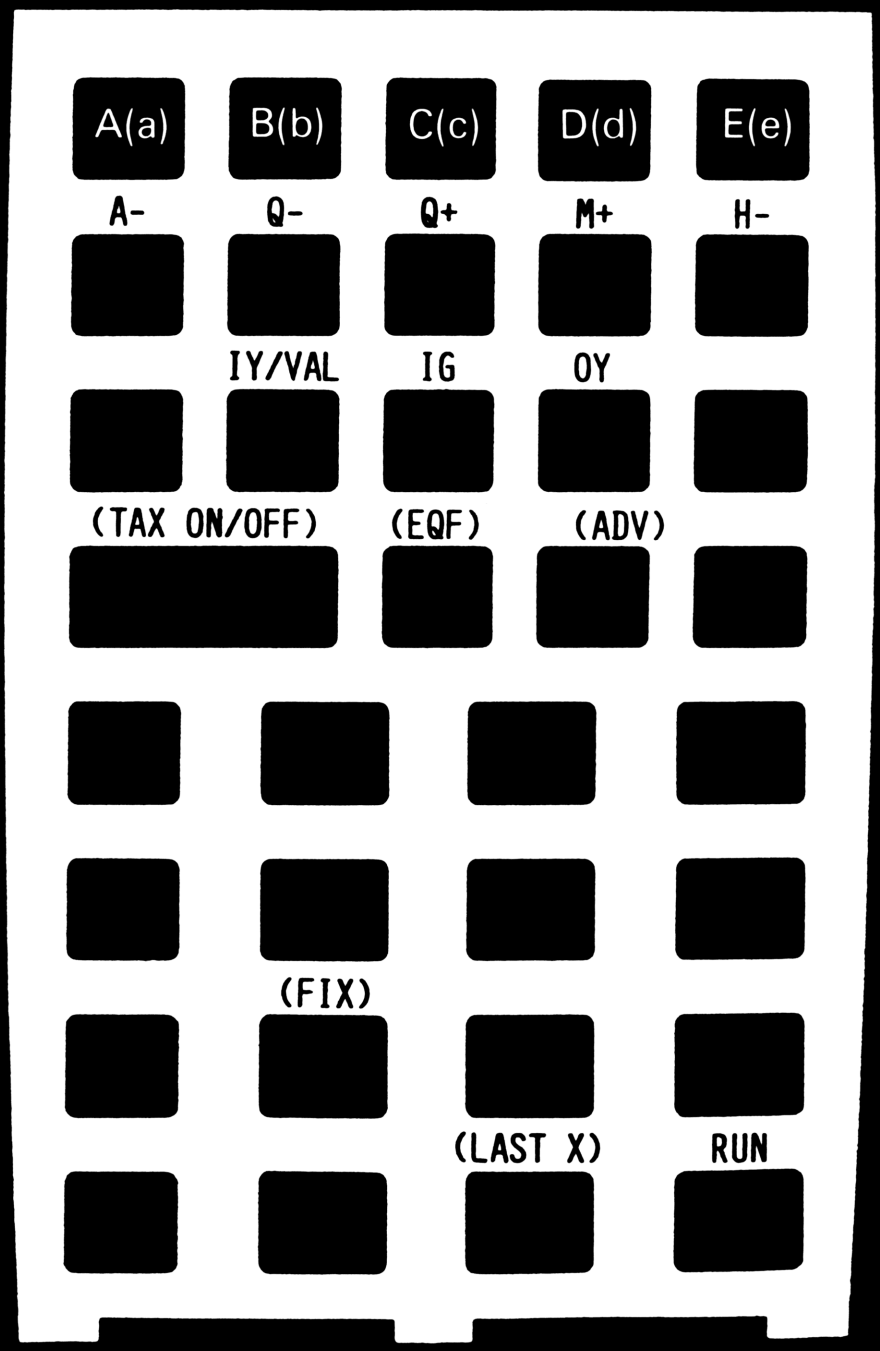
8. Whilst the mathematical concepts on which the Advanced Programs have been based are believed to be correct, the result of any calculation is entirely dependent on the data chosen by the Valuer and in particular the assumptions he makes as to the OVERALL YIELD requirement and thus the IMPLIED GROWTH RATE and INITIAL YIELD, which are all relative to one another, even if GROWTH is nil or negative, as could be the case in circumstances of recession.

However, it cannot be over-emphasised that the rate chosen for the OVERALL YIELD suggests a connection with a fixed interest stock, possibly but not necessarily a rate for a GILT EDGED STOCK . At the time when freehold rack-rented multiple shops with 5 year rent reviews were selling to show a yield of 5% whilst fixed interest GILTS were showing yields of 14%, the difference of (apparently) 9% would seem to represent the IMPLIED ANNUAL GROWTH RATE. This would be true if there were annual rent reviews but allowing for 5 year rent reviews, the Implied Growth Rate is 9.78% on the basis that rent is received annually in arrear, and 9.39% if received quarterly in advance.

If conditions exist where there is minimal or no growth, then yields from property would be expected to come close to those of gilts and the rate chosen for the OVERALL YIELD could then be close to and even equal to the INITIAL YIELD.

Evidence of pre-war prime property transactions at 5% INITIAL yield when GILTS yielded 4½% coincided with the grants of 21, 42 and even 99 year leases at fixed rents with no reviews, thus implying nil GROWTH in property investment. Valuing investments where these long reviews existed was still carried out at yields of about 6% into the early 1960's. This not only reflected lower interest rates of the period but also the unawareness of valuers about the effects of inflation on this type of investment.

ADVANCED SECTION KEYS
(IN SILVER)



INDEX OF ADVANCED SECTION EXAMPLES

FREEHOLDS

DCF Analysis of Rack Rented Freeholds (no tax allowance)

DCF Valuation and Analysis of Term and Reversion Freeholds
including the extraction of an "**Equated Yield**".
(Growth and Tax inclusion optional).

DCF Valuation and Analysis of Term and Reversion Freeholds where the lease provides for one or more abnormal rent review periods before ultimate reversion to a modern rent review pattern.
(Growth and Tax inclusion optional)

LEASEHOLDS

DCF Valuation and Analysis of Term and Reversion Leaseholds on a Single Rate basis.
(Growth and Tax inclusion optional)

Program **D.**

DCF Valuation and Analysis of Term and Reversion Leaseholds with one or more intermediate abnormal rent review periods before reversion to modern terms on Remainder.
(Growth and Tax inclusion optional)

Program **E**

DCF Valuation of a Term and Reversion Leaseholds allowing for a gearing element produced by a fixed ground rent.
(Tax inclusion optional)

Program **(c)**

Factor for the conversion of a Single Rate Leasehold Valuation into a Dual Rate Valuation.
(Optional grossing up of the Sinking Fund Payments to reflect tax)

Program **(d)**

LEASEHOLDS AND FREEHOLDS

DCF Valuation and Analysis of Freeholds and Leaseholds with Term, Reversion and Remainder elements and ultimate receipt (on sale) or payment (dilapidations claim) of a capital sum.
(Income and Capital Gains Tax allowance optional)

DCF Valuation as above in the Taxed Mode where the value calculated is to form the base value for Capital Gains Tax purposes.

CONSTANT RENT FACTOR

The Equivalence Factor extracted from the comparison of investments with differing rent review periods.

ADVANCED CALCULATIONS IN COMBINATION

ADVANCED SECTION EXAMPLES

FREEHOLDS

Program **A**.

THE DISCOUNTED CASH FLOW ANALYSIS OF RACK RENTED FREEHOLDS.

The analysis takes into account the Implied Growth Rate, the Initial Yield and the Overall Rate of Return where the lease to the tenant is just commencing or where there has just been a rent review.

EXAMPLE **1. THE EXTRACTION OF THE IMPLIED ANNUAL GROWTH RATE.**

Given:- Example 1 Data:-

The Rent Payment Mode - - - - - - - - - Quarterly in Advance.
The Rent Review Pattern - - - - - - - - 5 Yearly.
The Overall Yield Required - - - - - - - 14% per annum.
The Initial Yield - - - - - - - - - - - 5% per annum.

EXAMPLE **1**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	ADVANCED		See note 1
2	Program A	A	11	MODE?	Rent Payment Mode	See notes 2&3
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Implied Growth	IG	33	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	See note 4
7	14% Overall Yield	14		14		
8		RUN	84	INIT.YIELD%?	Initial Yield	See note 4
9	5% Initial Yield	5		5		
10		RUN	84	IG%=9.391623		RESULT

EXAMPLE 2. **THE EXTRACTION OF THE INITIAL YIELD.**
(Rack Rented Freehold)

Given:- Example 2 Data:-

The Rent Payment Mode - - - - - - - - - Quarterly in Advance.
The Rent Review Pattern - - - - - - - - 5 Yearly.
The Overall Yield Required - - - - - - - 14% per annum.
The Assumed Growth Rate- - - - - - - - - 9.3916% per annum.

EXAMPLE 2

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	ADVANCED		See note 1
2	Program A	A	11	MODE?	Rent Payment Mode	See notes 2&3
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Initial Yield	IY/VAL	32	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	See note 4
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.3916% Growth Rate	9.3916		9.3916		
10		RUN	84	(19.9999) IY%=5.0000		1 Second Y.P. display RESULT
11		(LASTX)	31/83	19.9999		Recalls Y.P. See note 5

EXAMPLE 3. **THE EXTRACTION OF THE OVERALL YIELD.**
(Rack Rented Freehold)

Given:- Example 3 Data:-

The Rent Payment Mode - - - - - - - - - Quarterly in Advance.
The Rent Review Pattern - - - - - - - - 5 Yearly.
The Initial Yield - - - - - - - - - - - 5% per annum.
The Assumed Growth Rate- - - - - - - - - 9.3916% per annum.

EXAMPLE 3

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	ADVANCED		See note 1
2	Program A	A	11	MODE?	Rent Payment Mode	See notes 2&3
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Overall Yield	OY	34	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	INIT.YIELD%?	Initial Yield	See note 4
7	5% Initial Yield	5		5		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.3916% Growth Rate	9.3916		9.3916		
10		RUN	84	OY%=14.0000		RESULT See note 4

The result displayed is the annual effective rate.

PROGRAM **B**

DCF VALUATION AND ANALYIS OF TERM AND REVERSION FREEHOLDS including the extraction of an "**EQUATED YIELD**" (GROWTH & TAX inclusion optional)

EXAMPLE **4. THE VALUATION AND EXTRACTION OF THE INITIAL YIELD.**

Given:- Example 4 Data:-

The Rent Payment Mode - - - - - - - - Quarterly in Advance.
The Rent Review Pattern - - - - - - - - 5 Yearly.
The Overall Yield Required - - - - - - - 14% per annum.
The Assumed Growth Rate- - - - - - - - 9.3916% per annum.
and The Length of the Term to Reversion
(or to a Rent Review)- - 8 Years.
The Rent Reserved - - - - - - - - - - - £10,000 p.a.
The Rack Rent - - - - - - - - - - - - - £23,000 p.a.

EXAMPLE **4**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program B	B	12	MODE?	Rent Payment Mode	See note 8
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.3916% Growth Rate	9.3916		9.3916		
10		RUN	84	RENT RES.?	Rent Reserved	See note 11
11	£10,000Passing Rent	10000		10,000		
12		RUN	84	RACK RENT?	Rack Rent	See note 12
13	£23000 Est.Mkt.Rent	23000		23,000		
14		RUN	84	TERM?	Length of Term to Reversion or Review	See note 13
15	8 Years to Review	8		8		
16		RUN	84	(IY%=2.6244) 381,046.6372		Flash of I.Y. RESULT-Value
17		ALPHA		IY%=2.6244		Recalls I.Y.
18		ALPHA				Out of ALPHA

EXAMPLE 5. **THE VALUATION AND EXTRACTION OF THE INITIAL YIELD**
(Term and Reversion Freehold)
allowing for the incidence of INCOME TAX on the revenue received.

Example 5 Data is as in Example 4 above, additionally allowing for Income Tax at 30% and an 'after tax' Overall Yield of 12.75%.

EXAMPLE 5

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
	Taxed Mode	(TAX)	31/41	TAXED		
	Advanced Section	(ADV)	31/43	ADVANCED		Select again
2	Program B	B	12	MODE?	Rent Payment Mode	See note 8
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	After Tax OY
7	12.75%Overall Yield	12.75		12.75		See note 9
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.3916% Growth Rate	9.3916		9.3916		
10		RUN	84	RENT RES.?	Rent Reserved	See note 11
11	£10,000Passing Rent	10000		10,000		
12		RUN	84	INCOME TAX?	Rate of Income Tax	
13	30% Income Tax	30		30		
14		RUN	84	RACK RENT?	Rack Rent	See note 12
15	£23000 Est.Mkt.Rent	23000		23,000		
16		RUN	84	TERM?	Length of Term to Reversion or Review	See note 13
17	8 Years to Review	8		8		
18		RUN	84	(IY%=1.8404) 380,351.2036		Flash of I.Y. RESULT-Value
17		ALPHA		IY%=1.8404		Recalls I.Y.
18		ALPHA				Out of ALPHA

N.B. The IY shown is after the deduction of tax.

EXAMPLE 6. **THE EXTRACTION OF THE IMPLIED ANNUAL GROWTH RATE.**
(Term & Reversion Freehold)

Given:- Example 6 Data:-

The Rent Payment Mode - - - - - - - - Quarterly in Advance.
The Rent Review Pattern - - - - - - - 5 Yearly.
The Overall Yield Required - - - - - - 12.75% per annum.
The Current Capital Value- - - - - - - £380,351.
The Length of the Term to Reversion
(or to a Rent Review)- - 8 Years.
The Rent Reserved - - - - - - - - - - £10,000 p.a.
The Rack Rent - - - - - - - - - - - - £20,000 p.a.
The Tax Rate - - - - - - - - - - - - - 30%.

i.e. The same data as used in Example 5 above except £20,000 is substituted for £23,000 as the Estimated Rack Rent.

EXAMPLE 6

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(TAXED) ADVANCED		See note 7
2	Program B	B	12	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Implied Growth	IG	33	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	RENT RES.?	Rent Reserved	See note 11
7	£10,000Passing Rent	10000		10,000		
8		RUN	84	INCOME TAX?	Rate of Income Tax	
9	30% Income Tax	30		30		
10		RUN	84	RACK RENT?	Rack Rent	See note 12
11	£20,000Est.Mkt.Rent	20000		20,000		
12		RUN	84	TERM?	Term to Reversion	See note 13
13	8Years to Reversion	8		8		
14		RUN	84	OVRL.YIELD%?	Overall Yield	After Tax
15	12.75%Overall Yield	12.75		12.75		See note 9
16		RUN	84	PV?	Present Value	
17	£380,351 Mkt. Value	380351		380,351		
18		RUN	84	IG%=9.7684		RESULT

EXAMPLE 7. **THE EXTRACTION OF THE OVERALL (After Tax) YIELD**
(Term & Reversion Freehold)

Given:- Example 7 Data:-

The Rent Payment Mode - - - - - - - - Quarterly in Advance.
The Rent Review Pattern - - - - - - - 5 Yearly.
The Assumed Growth Rate - - - - - - - 9.3916% per annum.
The Current Capital Value- - - - - - - £380,351.
The Length of the Term to Reversion
(or to a Rent Review)- - 8 Years.
The Rent Reserved - - - - - - - - - - £10,000 p.a.
The Rack Rent - - - - - - - - - - - - £23,000 p.a.
The Tax Rate - - - - - - - - - - - - - 30%.
i.e. The same data as used in Example 5.

EXAMPLE 7

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(TAXED) ADVANCED		See note 7
2	Program B	B	12	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Overall Yield	OY	34	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	RENT RES.?	Rent Reserved	See note 11
7	£10,000Passing Rent	10000		10,000		
8		RUN	84	INCOME TAX?	Rate of Income Tax	
9	30% Income Tax	30		30		
10		RUN	84	RACK RENT?	Rack Rent	See note 12
11	£23,000Est.Mkt.Rent	23000		23,000		
12		RUN	84	TERM?	Term to Reversion	See note 13
13	8Years to Reversion	8		8		
14		RUN	84	GROWTH%?	Assumed Growth Rate	
15	9.3916%Growth Rate	9.3916		9.3916		
16		RUN	84	PV?	Present Value	
17	£380,351 Mkt. Value	380351		380,351		
18		RUN	84	OY%=12.7497		RESULT=After Tax OY

EXAMPLE 8. **THE EXTRACTION OF THE EQUATED YIELD**
where different yield bases are used for the Term and for the Reversion.

Given:- Example 8 Data:-

The Term Yield - - - - - - - - - - - - 5% p.a.
The Yield on Reversion - - - - - - - - 6% p.a.
The Length of the Term to Review - - 10 Years.

N.B.(a)There is no growth and therefore any number other than zero can be entered for the rent review period.
(b)The PV is 100 to accord with the percentage inputs for rents.
(c)5% and 6% are nominal Initial Yields therefore it is appropriate to use the 'annual in arrear' (A-) mode for this calculation.

EXAMPLE 8

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program B	B	12	MODE?	Rent Payment Mode	
3	Annual in Arrear	A-	21	WHICH CALC?	Element for Analysis	
4	Overall Yield	OY	34	REVIEW P?	Rent Review Period	
5	Any number except 0	1		1		
6		RUN	84	RENT RES.?	Term Rent (Yield)	
7	5% Yield for Term	5		5		
8		RUN	84	RACK RENT?	Rack Rent (Yield)	
9	6% Reversion Yield	6		6		
10		RUN	84	TERM?	Term to Reversion	
11	10 Yrs to Reversion	10		10		
12		RUN	84	GROWTH%?	Assumed Growth Rate	
13	Zero Growth Rate	0		0		
14		RUN	84	PV?	Present Value	
15	100 Present Value	100		100		
16		RUN	84	OY%=5.5810		RESULT= Equated Yield

EXAMPLE 9. **THE EXTRACTION OF THE EQUATED YIELD**
where there are different yield bases for the term and reversion also allowing for a rental weighting, i.e.where the rent reserved differs from the current market rental value.

Example 9. uses the same data as above in Example 8 but assumes the rent reserved is £1000 and the full rack rental value is £3000. The value figure will have been extracted from the market and probably based on a calculation using one of the traditional term and reversion methods.

For this example it is assumed that the value figure was calculated using a vertical split of the income and a value of £35,641.47 has been arrived at as follows:-

£1,000 p.a x 7.7217 (£1 p.a. at 5% for 10 years) = 7,721.73
£3,000 p.a. x 9.3066 (Reversion to £1 p.a. in perpetuity at 6%) = 27,919.74
35,641.47

EXAMPLE **9**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program B	B	12	MODE?	Rent Payment Mode	
3	Annual in Arrear	A-	21	WHICH CALC?	Element for Analysis	
4	Overall Yield	OY	34	REVIEW P?	Rent Review Period	
5	Review Period	5		5		
6		RUN	84	RENT RES.?	Rent Reserved	
7	£1,000 Passing Rent	1000		1,000		
8		RUN	84	RACK RENT?	Rack Rent	
9	£3,000 Est.Mkt Rent	3000		3,000		
10		RUN	84	TERM?	Term to Reversion	
11	10 Yrs to Reversion	10		10		
12		RUN	84	GROWTH%?	Assumed Growth Rate	
13	Zero Growth Rate	0		0		
14		RUN	84	PV?	Present Value	
15	£35,641.47 Mkt.Val.	35641.47		35,641.47		
16		RUN	84	OY%=5.9529		RESULT = Equated Yield

EXAMPLE 10. **CALCULATION OF THE PRESENT VALUE of an investment in the course of development where the start of income receipts are deferred.**

Using the data in Example 2 namely:-

Rent Payment Mode - - - - - - - - - - - - - Q+.
Rent Review Pattern - - - - - - - - - - - - 5 yearly.
Overall Yield - - - - - - - - - - - - - - - 14% p.a.
Assumed Growth Rate - - - - - - - - - - - - 9.3916.p.a.

Given also:-

A Current Rack Rent - - - - - - - - - - - - £5 p.a.
Term of years until income starts - - - - 3 years.

EXAMPLE **10**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		
2	Program B	B	12	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.3916% Growth Rate	9.3916		9.3916		
10		RUN	84	RENT RES.?	Term Rent Reserved	
11	Zero Passing Rent	0		0		
12		RUN	84	RACK RENT?	Rack Rent	
13	£5 Est. Mkt. Rent	5		5		
14		RUN	84	TERM?	Term to first letting	
15	3 Yrs to 1st.Income	3		3		
16		RUN	84	(IY%=0.0000) 88.3559		Ignore IY RESULT-Value

In these development situations, analysis in the terms of Implied Growth or Overall Yield can be undertaken if the P.V.* is known, provided the Term to the commencement of income stream is not above 10 years. The resultant IG or OY figure will be less accurate than with the other programs but should be correct to a tenth of one percent. The calculation should be checked using the IY/VAL

calculation to see if the PV obtained corresponds with the original PV input. The IY/VAL Calculation will be as precise as can be obtained within the overall limitations of the calculator since it is not subject to the vagaries of the reiteration process.

* N.B. The PV will be the amalgam of past payments plus interest foregone and the discounted future expenses i.e. the present value of the cost of creating the investment.

PROGRAM C.

DCF VALUATION AND ANALYSIS OF TERM AND REVERSION FREEHOLDS WHERE THE LEASE PROVIDES FOR ONE OR MORE ABNORMAL RENT REVIEW PERIODS BEFORE ULTIMATE REVERSION TO A MODERN RENT REVIEW PATTERN. (GROWTH AND TAX INCLUSION OPTIONAL)

EXAMPLE 11. **VALUATION AND EXTRACTION OF THE INITIAL YIELD**

Given:-	Example 11 Data:-
Rent Payment Mode provided in lease - - - -	Quarterly in Advance.
Rent Review Period (or Periods) - - - - - -	21 years.
Overall Yield Required - - - - - - - - - -	14% p.a.
Assumed Growth Rate - - - - - - - - - - - -	9.3916% p.a.
Length of the term to rent review - - - - -	8 years.
Rent Reserved - - - - - - - - - - - - - - -	£10,000 p.a.
Rack Rent - - - - - - - - - - - - - - - - -	£23,000 p.a.
(Tax Rate - if required) - - - - - - - - -	Not required.
and Normal Modern Rent Review periods for this type of investment - - - - -	5 yearly.
Number of whole Rent Review Periods still to run under the lease - - - -	2 Periods.

See overleaf for Example Listing.

N.B.(1) It is always assumed that the Rent Payment Mode on Reversion to modern terms at the end of the lease will be quarterly in advance and the calculator is permanently set to calculate the reversion in this mode. The Rent Payment Mode for the Term and the Abnormal Rent Review Periods is determined by the second row keys in the usual way.

N.B.(2) The program assumes that no Constant Rent is fixed to reflect the disadvantage to the landlord of abnormally long rent reveiew periods. If a Constant Rent is substituted the investment can be valued using the rack rent and assuming normal rent reviews in the place of the abnormal review periods.

EXAMPLE **11.** VALUATION OF TERM AND REVERSION FREEHOLD (WITH ABNORMAL RENT REVIEWS).

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program C	C	13	MOD.REVIEW P?	Modern Rent R. P.*	Current Norm
3	5Yr.RP*on Reversion	5		5		
4		RUN	84	MODE?	Rent Payment Mode	In Lease
5	Qtrly in Advance	Q+	23	WHICH CALC.?	Element for Analysis	
6	Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	In Lease
7	21 Year Review	21		21		
8		RUN	84	OVRL.YIELD%?	Overall Yield	
9	14% Overall Yield	14		14		
10		RUN	84	GROWTH%?	Assumed Growth Rate	
11	9.3916% Growth Rate	9.3916		9.3916		
12		RUN	84	RENT RES.?	Rent Reserved	See note 10
13	£10,000Passing Rent	10000		10,000		
14		RUN	84	RACK RENT?	Rack Rent	Mkt. Rent
15	£23,000Est.Mkt.Rent	23000		23,000		
16		RUN	84	TERM?	Term to Review	
17	8 Years to Review	8		8		
18		RUN	84	NUMBER OF P?	No.of RP* Unexpired	In Lease
19	2 Unexpired RP*	2		2		
20		RUN	84	(IY%=3.5794) 279,373.2629		IY Flash RESULT- Value
21		ALPHA	-	IY%=3.5794		Recalls IY
22		ALPHA	-			Out of Alpha

* = REVIEW PERIODS

EXAMPLE 12. **THE EXTRACTION OF THE IMPLIED ANNUAL GROWTH RATE.**
(Term, Abnormal Review, and Reversion Freehold)

The example below uses the same data as in Example 11 except that the present market value is known to be £279,375, the Implied Growth Rate being the unknown factor.

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program C	C	13	MOD.REVIEW P?	Modern Rent R. P.*	Current Norm
3	5Yr.RP*on Reversion	5		5		
4		RUN	84	MODE?	Rent Payment Mode	In Lease
5	Qtrly in Advance	Q+	23	WHICH CALC.?	Element for Analysis	
6	Implied Growth	IG	33	REVIEW P?	Rent Review Period	In Lease
7	21 Year Review	21		21		
8		RUN	84	RENT RES.?	Rent Reserved	See note 10
9	£10,000Passing Rent	10000		10,000		
10		RUN	84	RACK RENT?	Rack Rent	
11	£23,000Est.Mkt.Rent	23000		23,000		
12		RUN	84	TERM?	Term to Review	
13	8 Years to Review	8		8		
14		RUN	84	NUMBER OF P?	No.of RP*Unexpired	In Lease
15	2 Unexpired RP*	2		2		
16		RUN	84	OVRL.YIELD%?	Overall Yield	
17	14% Overall Yield	14		14		
18		RUN	84	PV?	Present Value	In Lease
19	£279,375 Mkt Value	279375		279,375		
20		RUN	84	IG%=9.3917		RESULT

* = REVIEW PERIODS

The EXTRACTION OF THE OVERALL YIELD can be achieved in the same way as in Example 12 by selecting the 'OY' Key (Keycode 34) when "WHICH CALC.?" is prompted.

LEASEHOLD

LEASEHOLDS

Unless otherwise stated the Leasehold Programs ignore the rent (if any) payable under the Headlease.

Thus the programs are valid only when:- No rent, or only a nominal rent is payable; or where the rent payable under the Headlease is strictly proportionial to, i.e. geared to, the rent payable by the sub-tenant. In this latter case, only the nett rent is valued.

The situation where gearing results from a fixed Headlease rent, or one varying at different intervals to the sub-lease, is dealt with later.

When considering the risk factors involved it should be noted that the Headlease rent very often remains payable in the event of default by the sub-tenant, or if void periods occur for some other reason.

PROGRAM D.

DCF VALUATION AND ANALYSIS OF TERM AND REVERSION LEASEHOLDS ON A SINGLE RATE BASIS (GROWTH AND TAX INCLUSION OPTIONAL).

EXAMPLE **13. VALUATION AND EXTRACTION OF THE INITIAL YIELD**

Given:-	Example 13 Data:-
Rent Payment Mode	Quarterly in Advance.
Rent Review Pattern	5 yearly.
Overall Yield Required	14% p.a.
Assumed Growth Rate	9.4% p.a.
Length of term to reversion (or to rent review)	3 years.
Rent Reserved	£5.
Rack Rent	£7.
Number of whole Rent Review Periods still to run under the lease.	4 periods.

i.e. the lease has 23 years to run made up of a 3 year term + (5 year rent reviews x 4 unexpired periods).

See overleaf for the Example Listing.

EXAMPLE **13.** VALUATION OF TERM AND REVERSION LEASEHOLD.

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program D	D	14	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.4% Growth Rate	9.4		9.4		
10		RUN	84	RENT RES.?	Rent Reserved	
11	£5 Passing Rent	5		5		
12		RUN	84	RACK RENT?	Rack Rent	
13	£7 Est.Market Rent	7		7		
14		RUN	84	TERM?	Length of Term to Reversion or Review	See note 13
15	3 Years to Review	3		3		
16		RUN	84	NUMBER OF P?	No.of RP Unexpired	See note 14
17	4 Unexpired RP	4		4		
18		RUN	84	(IY%=6.0856) 82.1614		See note 15 RESULT- Value
19		ALPHA	-	IY%=6.0856		Recalls IY
20		ALPHA	-			Out of Alpha

EXAMPLE **14. THE EXTRACTION OF THE IMPLIED GROWTH RATE**
(Term and Reversion Leasehold)

This example uses the same data as in Example 13 above.

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program D	D	14	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Implied Growth	IG	33	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	RENT RES.?	Rent Reserved	
7	£5 Passing Rent	5		5		
8		RUN	84	RACK RENT?	Rack Rent	
9	£7 Est. Mkt. Rent	7		7		
10		RUN	84	TERM?	Term to Reversion	
11	3 Years to Review	3		3		
12		RUN	84	NUMBER OF P?	No.of RP Unexpired	See note 14
13	4 Unexpired RP	4		4		
14		RUN	84	OVRL.YIELD%?	Overall Yield	
15	14% Overall Yield	14		14		
16		RUN	84	PV?	Present Value	
17	£82.1614 PV	82.1614		82.1614		
18		RUN	84	IG%=9.3996		RESULT

EXAMPLE 15. THE EXTRACTION OF THE OVERALL YIELD
(Term and Reversion Leasehold)

This example uses the same data as in Examples 13 and 14 above.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program D	D	14	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	Overall Yield	OY	34	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	RENT RES.?	Rent Reserved	
7	£5 Passing Rent	5		5		
8		RUN	84	RACK RENT?	Rack Rent	
9	£7 Est. Mkt. Rent	7		7		
10		RUN	84	TERM?	Term to Reversion	
11	3 Years to Review	3		3		
12		RUN	84	NUMBER OF P?	No.of RP Unexpired	See note 14
13	4 Unexpired RP	4		4		
14		RUN	84	GROWTH%?	Assumed Growth Rate	
15	9.4% Growth Rate	9.4		9.4		
16		RUN	84	PV?	Present Value	
17	£82.1614 PV	82.1614		82.1614		
18		RUN	84	OY%=14.0002		RESULT

PROGRAM E.

DCF VALUATION AND ANALYSIS OF TERM AND REVERSION LEASEHOLDS WHERE THE SUB-LEASE PROVIDES FOR ONE OR MORE ABNORMAL RENT REVIEW PERIODS BEFORE ULTIMATE REVERSION (ON REMAINDER) TO A MODERN RENT REVIEW PATTERN. (GROWTH AND TAX INCLUSION OPTIONAL).

EXAMPLE 16. VALUATION AND EXTRACTION OF THE INITIAL YIELD

Given:-	Example 16 Data:-
Rent Payment Mode provided in the sub-lease - - - - -	Quarterly in Arrear.
Rent Review Period (or Periods) - - - -	21 years.
Overall Yield Required - - - - - - - -	14% p.a.
Assumed Growth Rate - - - - - - - - - -	9.4% p.a.
Length of term to the next Rent Review-	6 years.
Rent Reserved - - - - - - - - - - - - - -	£10,000 p.a.
Rack Rent - - - - - - - - - - - - - - - -	£120,000 p.a.
(Tax Rate - if required) - - - - - - -	Not required.
Normal Modern Rent Review Periods for this type of investment - - -	5 yearly.
Number of whole Rent Review Periods still to run under the sub-lease - -	1 period.
and The length of the remainder (in years) after the sub-lease expires - -	50 years.

N.B. It is always assumed that the rent payment mode will be quarterly in advance on reversion to modern terms for the remainder.

See overleaf for the Example Listing.

EXAMPLE **16.** VALUATION OF TERM AND REVERSION LEASEHOLD (WITH ABNORMAL RENT REVIEWS).

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program E	E	15	MODE?	Rent Payment Mode	In Sub-lease
3	Qtrly in Arrear	Q-	22	WHICH CALC?	Element for Analysis	
4	Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	In Sub-lease
5	21 Year Review	21		21		
6		RUN	84	OVRL.YIELD%?	Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.4% Growth Rate	9.4		9.4		
10		RUN	84	RENT RES.?	Rent Reserved	In Sub-lease
11	£100000Passing Rent	100000		100,000		See note 10
12		RUN	84	RACK RENT?	Rack Rent	
13	£1.2m Est.Mkt.Rent	1200000		1,200,000		
14		RUN	84	TERM?	Term to Review	
15	6 Years to Review	6		6		
16		RUN	84	NUMBER OF P?	No.of RP Unexpired	See note 14
17	1 Unexpired RP	1		1		
18		RUN	84	REMAINDER?	Rem. of Head-lease	
19	50Yr.Headlease Rem.	50		50		
20		RUN	84	MOD.REVIEW P?	Modern RP	Current Norm
21	5Yr.RP on Remainder	5		5		
22		RUN	84	(IY%=0.7197) 13,894,141.72		See note 15 RESULT
23		ALPHA	-	IY%=0.7197		Recalls IY
24		ALPHA	-			Out of Alpha

EXAMPLE 17. **THE EXTRACTION OF THE IMPLIED GROWTH RATE**
(TERM AND REVERSION LEASEHOLD WITH ABNORMAL RENT REVIEWS).

This example uses the same data as in Example 16 above.

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program E	E	15	MODE?	Rent Payment Mode	In Sub-lease
3	Qtrly in Arrear	Q-	22	WHICH CALC?	Element for Analysis	
4	Implied Growth	IG	33	REVIEW P?	Rent Review Period	In Sub-lease
5	21 Year Review	21		21		
6		RUN	84	RENT RES.?	Rent Reserved	In Sub-lease
7	£100000Passing Rent	100000		100,000		See note 10
8		RUN	84	RACK RENT?	Rack Rent	
9	£1.2m Est.Mkt.Rent	1200000		1,200,000		
10		RUN	84	TERM?	Term to Review	
11	6 Years to Review	6		6		
12		RUN	84	NUMBER OF P?	No.of RP Unexpired	
13	1 Unexpired RP	1		1		
14		RUN	84	REMAINDER?	Rem.of Head-lease	
15	50Yr.Headlease Rem.	50		50		
16		RUN	84	MOD.REVIEW P?	Modern RP	Open Market
17	5Yr.RP on Remainder	5		5		
18		RUN	84	OVRL.YIELD%?	Overall Yield	
19	14% Overall Yield	14		14		
20		RUN	84	PV?	Present Value	
21	£13,894,142 Value	13894142		13,894.142		
22		RUN	84	IG%=9.4000		RESULT

N.B. The Running time of this program can be up to two or so minutes.

EXAMPLE **18. THE EXTRACTION OF THE OVERALL YIELD**
(TERM AND REVERSION LEASEHOLD WITH ABNORMAL RENT REVIEWS).

This example uses the same data as in Example 16 and 17 above.

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program E	E	15	MODE?	Rent Payment Mode	In Sub-lease
3	Qtrly in Arrear	Q-	22	WHICH CALC?	Element for Analysis	
4	Overall Yield	OY	34	REVIEW P?	Rent Review Period	In Sub-lease
5	21 Year Review	21		21		
6		RUN	84	RENT RES.?	Rent Reserved	In Sub-lease
7	£100000Passing Rent	100000		100,000		See note 10
8		RUN	84	RACK RENT?	Rack Rent	
9	£1.2m Est.Mkt.Rent	1200000		1,200,000		
10		RUN	84	TERM?	Term to Review	
11	6 Years to Review	6		6		
12		RUN	84	NUMBER OF P?	No.of RP Unexpired	
13	1 Unexpired RP	1		1		
14		RUN	84	REMAINDER?	Rem.of Head-lease	
15	50Yr.Headlease Rem.	50		50		
16		RUN	84	MOD.REVIEW P?	Modern RP	Open Market
17	5Yr.RP on Remainder	5		5		
18		RUN	84	GROWTH%?	Assumed Growth Rate	
19	9.4% Growth Rate	9.4		9.4		
20		RUN	84	PV?	Present Value	
21	£13,894,142 Value	13894142		13,894,142		
22		RUN	84	OY%=14.0000		RESULT

N.B. The Running time of this program can be up to two or so minutes.

PROGRAM (c)

FINDS THE PRESENT VALUE OF A TERM AND REVERSION LEASEHOLD WITH A GEARING ELEMENT PRODUCED BY A FIXED GROUND RENT.
(TAX OPTIONAL)

In the examples given under Programs D and E, any ground rent has been ignored, or, the rent passing and the rack rent are taken to be nett of any rent payable under the Headlease. The latter is the most usual approach taught by traditional methodology, which does not take into account that the fact the rent is subject to increase.

The example below uses the same data as used for Examples 13 - 15 , except that a fixed ground rent of £2 is added both to the passing rent and the market rent. The ground rent is taken to be fixed over the whole term of the Headlease (the Investment Lease).

EXAMPLE 19. VALUATION

Given:-	Example 19 Data:-
Rent Payment Mode	Quarterly in Advance.
Rent Review Period	5 years.
Overall Yield Required	14% p.a.
Assumed Growth Rate	9.4% p.a.
Length of Term to Reversion (or to rent review)	3 years.
Rent Reserved	£7.
Rack Rent	£9.
Number of whole Rent Review Periods still to run under the Sub-lease	4 periods.
Headlease Rent	£2 p.a.
Length of Unexpired Headlease	23 years.

See overleaf for the Example Listing.

EXAMPLE **19.** VALUATION OF TERM AND REVERSION LEASEHOLD WITH FIXED GROUND RENT

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 7
2	Program (c)	(c)	31/13	MODE?	Rent Payment Mode	Sub&Headlease
3	Qtrly in Advance	Q+	23	REVIEW P?	Rent Review Period	
4	5 Yearly Review	5		5		
5		RUN	84	OVRL.YIELD%?	Overall Yield	
6	14%Overall Yield	14		14		
7		RUN	84	GROWTH%?	Assumed Growth Rate	
8	9.4% Growth Rate	9.4		9.4		
9		RUN	84	RENT RES.?	Rent Reserved	In Sub-lease
10	£7 Passing Rent	7		7		
11		RUN	84	RACK RENT?	Rack Rent	
12	£9 Est. Mkt. Rent	9		9		
13		RUN	84	TERM?	Term to Review	In Sub-lease
14	3 Years to RP	3		3		
15		RUN	84	HEAD RENT?	Passing Ground Rent	
16	£2 Ground Rent	2		2		
17		RUN	84	TERM?	Unexpired Length of Head-lease	
18	23Yrs.to Expiry	23		23		
19		RUN	84	(IY%=2.3621) L=92.3236	- RESULT = PV of Head-lease.	Ignore Flash

The result of this example, a Present Value of £92.32, as compared to the result of the example under Program D of £82.16, shows the difference resultant from making due DCF allowance for the gearing element.

Program (c) makes the fairly simple assumption that the Rent Payment Mode is the same for the Head and Sub leases. It also assumes that the head rent is fixed. Much more complex situations can be handled by two parallel calculations then deducting one from the other.

To find the value of an investment leasehold interest:- First value the lease-owner's interest as if it were a freehold, then deduct the value of the freeholder's interest. See overleaf for an example.

Example: Using the data above but assuming that the Headlease rent is payable quarterly in arrear, and that the Headlease provides for a rent review in 3 years and 13 years' time:-

EXAMPLE (A)

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL.YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.4000	RUN
RENT RES.?		
	7.0000	RUN
RACK RENT?		
	9.0000	RUN
TERM?		
	3.0000	RUN
	176.9944	***
IY%=3.9549		

EXAMPLE (B)

		XEQ C
MOD.REVIEW P?		
	5.0000	RUN
MODE?		
		XROM "Q-"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	10.0000	RUN
OVRL YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.4000	RUN
RENT RES.?		
	2.0000	RUN
RACK RENT?		
	9.0000	RUN
TERM?		
	3.0000	RUN
NUMBER OF P?		
	2.0000	RUN
	147.2907	***
IY%=1.3579		

ANSWER:-

176.9944 - 147.2907 = 29.7037 = The value of the Leasehold.

N.B.(1) The risk factors taken into account must be those appropriate to the leasehold interest and must be applied in both calculations.

N.B.(2) Examples (A) and (B) above are listed in the format produced by the Hewlett-Packard Printer. See the Introduction to the "Printer Listing of Examples" on Page 160.

PROGRAM (d)

EXAMPLE 20. FINDS A REDUCTION FACTOR TO CONVERT A VALUATION MADE ON THE SINGLE RATE BASIS (WITH OR WITHOUT GROWTH) TO A DUAL RATE BASIS ASSUMING CONSTANT SINKING FUND CONTRIBUTIONS.

Given:- Example 20 Data:-

Overall Yield - - - - - - - - - - - - - - 14% p.a.

Length of terminable Interest - - - - - 10 years.

Rate payable on Sinking Fund - - - - - 3% p.a.

The Reduction Factor found is used to multiply the Single Rate P.V. obtained when using Program D or E. The result is the Dual Rate P.V.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		See note 16
2	Program (d)	(d)	31/14	OVRL.YIELD%?	Investment Rate	
3	14% Investment Rate	14		14		
4		RUN	84	SF TERM?	Length of Terminable Interest	
5	10 Year Period	10		10		
6		RUN	84	SF RATE%?	Sinking Fund Accumulation Rate	
7	3%Sinking Fund Rate	3		3		
8		RUN	84	RF=0.8437		RESULT

N.B.(1) Where allowance is made for growth the initial payments to the Sinking Fund may exceed the income from the investment.

N.B.(2) The traditional Dual Rate Years Purchase and Sinking Fund Payment calculations are covered more fully in Section VIII. There are, however, two programs in the Advanced Section appertaining to Dual Rate Calculations, Program (d) which is explained above and Progrm (e). In the case of the latter, a good understanding of the traditional Dual Rate Y.P. is required before this program will be fully understood, so the explanation and examples are to be found in the Section VIII Commentary on Dual Rates. Program (e) allows for the growth of sinking fund payments in line with a growing income and also makes allowance for growth in the sum to recouped.

VALUATION AND ANALYSIS OF FREEHOLDS AND LEASEHOLDS WITH TERM REVERSION AND REMAINDER ELEMENTS and ultimate receipt (on Sale) or payment (dilapidations claim)of a Capital Sum allowing for growth of income and capital at different rates and, optionally, tax on income and Capital Gains Tax, assuming an established base value.

PROGRAM (a).

EXAMPLE 21. **VALUATION AND EXTRACTION OF THE INITIAL YIELD**

Given:-	Example 21 Data:-
Rent Payment Mode	Quarterly in Advance.
Rent Review Period	5 Years.
* Overall Yield	14% p.a.
* Assumed Growth Rate	10.32% p.a.
Passing Rent	£5.
Open Market Rent	£5.
Term to the next Rent Review	5 years.
Number of unexpired whole rent review periods (excluding Term)	4 periods.
The length of the Remainder	10 years.
Current Sale price	£50.
Growth in future (Sale) Value	10.32%.
Modern Rent Review Period	5 years.
* Present value	100 (Result).

N.B. * Finds any one of these if it is the missing element.

EXAMPLE 21.

SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1 Advanced Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2 Program (a)	(a)	31/11	MODE?	Rent Payment Mode	
3 Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4 Valuation/IY	IY/VAL	32	REVIEW P?	Rent Review Period	

Example Listing continued overleaf.

EXAMPLE 21.(Continued.)

5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	10.32% Growth Rate	10.32		10.32		
10		RUN	84	RENT RES.?	Rent Reserved	See note 10
11	£5 Passing Rent	5		5		
12		RUN	84	RACK RENT?	Rack Rent	
13	£5 Est.Mkt.Rent	5		5		
14		RUN	84	TERM?	Term to Review	
15	5 Years to Review	5		5		
16		RUN	84	NUMBER OF P?	No.of RP Unexpired	See note 14
17	4 Unexpired RP	4		4		
18		RUN	84	REMAINDER?	Rem. after Sub-lease expires	
19	10 Year Remainder	10		10		
20		RUN	84	SALE PRICE?	Future Sale Price	Current Value
21	£50 Sale Price	50		50		See note 17
22		RUN	84	FVG?	Assumed Capital Growth Rate	
23	10.32% Cap. Growth	10.32		10.32		
24		RUN	84	MOD.REVIEW P?	Modern RP	
25	5 Year RP	5		5		
26		RUN	84	99.9906		RESULT = PV
27		RUN	84	(IY%=5.0005)		IY Flash
				99.9906		
28		ALPHA	-	IY%=5.0005		Recalls IY
29		ALPHA	-			Out of Alpha

Note the different routine for recalling the IY.

This example shows that 10.32% growth (as against 9.39% shown in Example 1) is necessary to reflect the obselescence of the building at the end of thirty-five years. The sale price of 50 is taken to be the present site value less the current cost of removing the present building.

As with previous programs the Implied Growth and Overall Yield could have been initiated by the 'IG' or the 'OY' Key in Step 4 (See below).

EXAMPLE 22. **EXTRACTION OF THE AFTER-TAX OVERALL YIELD**
(TERM AND REVERSION INVESTMENT WITH ABNORMAL RENT REVIEWS AND A TERMINAL CAPITAL PAYMENT)

Given:-

The same data as in Example 21 with the following additional data items:-

a 30% Income Tax Rate.
a 30% Capital Gains Tax Rate.
a £95 Base Value for C.G.T. (i.e. the historic purchase price).

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	(UNTAXED) ADVANCED		Tax Status
2	Taxed Mode	(TAX)	31/41	TAXED		New Tax Mode
3	Advanced Section	(ADV)	31/43	(TAXED) ADVANCED		Tax Status
4	Program (a)	(a)	31/11	MODE?	Rent Payment Mode	
5	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
6	Overall Yield	OY	34	REVIEW P?	Rent Review Period	
7	5 Yearly Review	5		5		
8		RUN	84	RENT RES.?	Rent Reserved	
9	£5 Passing Rent	5		5		See note 10
10		RUN	84	INCOME TAX?	% Rate of Tax	
11	30% Income Tax	30		30		
12		RUN	84	RACK RENT?	Rack Rent	
13	£5 Est.Mkt.Rent	5		5		
14		RUN	84	TERM?	Term to Review	
15	5 Years to Review	5		5		
16		RUN	84	NUMBER OF P?	No.of Unexpired RP	
17	4 Unexpired RP	4		4		
18		RUN	84	REMAINDER?	Rem. after Sub-lease expires	

Example Listing continued overleaf.

EXAMPLE 22.(Continued.)

19	10 Year Remainder	10		10		
20		RUN	84	SALE PRICE?	Future Sale Price	See note 17
21	£50 Sale Price	50		50		
22		RUN	84	FVG?	Assumed Capital Growth Rate	
23	10.32% Cap. Growth	10.32		10.32		
24		RUN	84	COST PRICE?	Base Value for CGT	
25	£95 CGT Base Value	95		95		
26		RUN	84	CGT?	% Rate of CGT	
27	30% CGT	30		30		
28		RUN	84	MOD.REVIEW P?	Modern RP	
29	5 Yearly RP	5		5		
30		RUN	84	GROWTH%?	Assumed Rental Growth Rate	
31	10.32%Rental Growth	10.32		10.32		
32		RUN	84	PV?	Present Value	
33	£100 Capital Value	100		100		
34		RUN	84	OY%=11.8659		RESULT

Program (a) is more complicated than is required in normal circumstances, but the complexity enables the program to handle calculations from the simple to the complex. The simpler calculations can be handled by zero inputs in the appropriate places.

Zero for "TERM?" sterilises the Term Section.

Zero for "REVIEW?" and/or "NUMBER OF P?" sterilises the "Reversion" Section.

Zero for "REMAINDER?" sterilises the Remainder Section. Even though the remainder is sterilised an entry other than zero must be made after "MOD.REVIEW P?"prompt.

Thus the Implied Growth Rate can be extracted using the same data as in Example 21 utilising the remainder section only by sterilising the Term and Reversion Section with appropriate zeros. See the example below.

EXAMPLE 23. **THE EXTRACTION OF THE IMPLIED GROWTH RATE.**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2	Program (a)	(a)	31/11	MODE?	Rent Payment Mode	Irrelevant *
3	Any Mode	A-	21	WHICH CALC?	Element for Analysis	
4	Implied Growth	IG	33	REVIEW P?	Rent Review Period	
5	0 Yearly Review	0		0		
6		RUN	84	RENT RES.?	Rent Reserved	
7	£5 Passing Rent	5		5		See note 10
8		RUN	84	RACK RENT?	Rack Rent	
9	£5 Est.Mkt. Rent	5		5		
10		RUN	84	TERM?	Term	
11	0 Term	0		0		
12		RUN	84	NUMBER OF P?	No.of Unexpired RP	
13	0 Unexpired Periods	0		0		

Example Listing continued overleaf.

14		RUN	84	REMAINDER?	Remainder	
15	35 Year Remainder	35		35		
16		RUN	84	SALE PRICE?	Future Sale Price	See note 17
17	£50 Sale Price	50		50		
18		RUN	84	FVG?	Assumed Capital Growth Rate	
19	10.32% Cap. Growth	10.32		10.32		
20		RUN	84	MOD.REVIEW P?	Modern RP	
21	5 Yearly RP	5		5		
22		RUN	84	OVRL.YIELD%?	Overall Yield	
23	14% Overall Yield	14		14		
24		RUN	84	PV?	Present Value	
25	£100 Present Value	100		100		
26		RUN	84	IG%=10.3207		RESULT

N.B. * The Remainder element is always calculated on a Quarterly in Advance basis.

THE PRESENT VALUE OF FREEHOLDS AND LEASEHOLDS WITH TERM, REVERSION AND REMAINDER ELEMENTS AND ULTIMATE RECEIPT OR PAYMENT OF A CAPITAL SUM, allowing for tax on income and for Capital Gains Tax, where the PV also forms the base value for CGT purposes, i.e. where there is a current purchase under consideration and where the price to be paid will form the base value.

EXAMPLE **24. VALUATION AND EXTRACTION OF THE INITIAL YIELD**

Given:-	Example 24 Data:-
Rent Payment Mode	Quarterly in Arrear.
Overall Yield (After tax)	12%.
Assumed Growth Rate (rental)	10%.
Rent Review Period	14 years.
Passing Rent	£1,000 p.a.
Estimated Market Rent	£6,000 p.a.
Term to next Rent Review	3 years.
Rate of Income Tax	30%.
Number of whole unexpired Rent Review Periods	1 period.
Length of Remainder	20 years.
Current Sale Price	£90,000.
Assumed Groth Rate (capital)	10.5%.
Rate of Capital Gains Tax	25%.
Modern Rent Review Pattern	5 yearly.

EXAMPLE **24.**

SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1 Advanced Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2 Program (b)	(b)	31/12	MODE?	Rent Payment Mode	Tax Mode set
3 Qtrly in Arrear	Q-	22	REVIEW P?	Rent Review Period	
4 14 Year RP	14		14		
5	RUN	84	OVRL.YIELD%?	Overall Yield	

Example Listing continued overleaf.

EXAMPLE 24.(Continued.)

6	12% "After Tax" OY	12		12			
7		RUN	84	GROWTH%?	Assumed Growth Rate		
8	10% Growth Rate	10		10			
9		RUN	84	RENT RES.?	Rent Reserved	See note 10	
10	£1,000 Passing Rent	1000		1,000			
11		RUN	84	INCOME TAX?	Rate of Income Tax		
12	30% Income Tax	30		30			
13		RUN	84	RACK RENT?	Rack Rent		
14	£6,000 Est.Mkt.Rent	6000		6,000			
15		RUN	84	TERM?	Term to Review		
16	3 Years to Review	3		3			
17		RUN	84	NUMBER OF P?	No.of RP Unexpired	See note 14	
18	1 Unexpired RP	1		1			
19		RUN	84	REMAINDER?	Rem. after Sub-lease expires		
20	20 Year Remainder	20		20			
21		RUN	84	SALE PRICE?	Future Sale Price	Current Value	
22	£90,000 Sale Price	90000		90,000		See note 17	
23		RUN	84	FVG?	Assumed Capital Growth Rate		
24	10.5% Cap. Growth	10.5		10.5			
25		RUN	84	CGT?	% Rate of CGT		
26	25% CGT	25		25			
27		RUN	84	MOD.REVIEW P?	Modern RP		
28	5 Year RP	5		5			
29		RUN	84	112,737.9008		RESULT = PV	
30		RUN	84	(IY%=0.6209)		IY Flash	
				112,737.9008			
31		ALPHA	-	IY%=0.6209		"After Tax"IY	
32		ALPHA	-				

N.B. This program is always run in the 'Taxed' Mode, and pressing Key '(b)' (Keycode 31/12) changes the tax status of the calculator automatically. It can be returned to an Untaxed status by pressing the 'Tax on/off' Key (Keycode 31/41) after the calculation has been completed.

THE CONSTANT RENT FACTOR

THE EQUIVALENCE FACTOR

PROGRAM **A (EQF)**.

The factor is calculated by comparing, in terms of their Initial Yields, two investments with different rent review periods. The factor shows the proportion by which the rent of the investment with the longer review period must exceed that of the base or normal investment to put the two in DCF equilibrium.

The same data inputs are required as shown in Example 2 above when extracting the Initial Yield. The data inputs are entered twice, first for the base investment (the norm) and then for the investment for comparison (the abnormal review period).

See overleaf for an Example Listing.

EXAMPLE 25. EXTRACTING A CONSTANT RENT FACTOR

Using the same data as in Example 2 namely:- Rent Quarterly in Advance, a 9.3916% Growth Rate and a 14% Overall Yield. What is the factor appropriate for a 5 year base review period compared to a 21 year review period ?

N.B. when entering the data for the second time it is not essential to enter the Growth Rate and the Overall Yield again. If these are to stay the same just press 'R/S' (Keycode 84) when the "OVRL. YIELD%?" and "GROWTH%?" prompts are displayed for the second time, the previous entry will remain in situ.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advanced Section	(ADV)	31/43	ADVANCED		
2	Program A	A	11	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC.?	(EQF) Key	See note 6(b)
4	Equivalence Factor	(EQF)	31/42	REVIEW P?	Base RP	See note 6(a)
5	5 Yearly Review	5		5		Modern RP
6		RUN	84	OVRL.YIELD%?	Base Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Base Growth Rate	
9	9.3916 Growth Rate	9.3916		9.3916		
10		RUN	84	(19.9999) (IY%=5.0000) REVIEW P?	 2nd.Review Period	Base YP Flash Base IY Flash
11	21 Yearly Review	21		21		Abnormal RP
12		RUN	84	OVRL.YIELD%?	2nd.Overall Yield	
13	14% Overall Yield	14		14		See note 6(c)
14		RUN	84	GROWTH%?	2nd. Growth Rate	
15	9.3916% Growth Rate	9.3916		9.3916		See note 6(c)
16		RUN	84	(12.5301) (IY%=7.9808 EQF=1.5961		2nd. YP Flash 2nd. IY Flash RESULT

ADVANCED SECTION CALCULATIONS IN COMBINATION

The complicated nature of some investments will mean that they cannot be encompassed by any one program within this section. A solution can always be found by resort to the more laborious NPV and IRR Programs, however a little bit of ingenuity in using two calculations in combination may provide an answer in some cases, without the necessity of entering every cash flow.

These combinations may take the form of two parallel calculations with subsequent addition or subtraction, or they may take the form of succeeding slice calculations added together.

a) Parallel Calculations

An example of parallel calculations added together would be the valuation of let premises where the lease terms in respect of rent reviews provide for reviews of only one-third of the building at a time. Three valuations would be required, one for each segment of the building with the results being combined to produce one overall value.

An example of parallel calculations producing a solution by subtraction was set out in Examples (A) and (B) in the explanation of Program (c), see Page 45. This shows a means of calculating the value of a leasehold interest where the head rent produces a gearing element. A similar situation may occur where the rent payable to the freeholder is reviewable not to a rack rent but to a proportion thereof. Example: What is the value of a leasehold investment where the sublease provides for a rent of £300 p.a. reviewable in 3 years and 5 yearly thereafter with the sublease having 28 years to run? The current market rental value is £500 p.a. and the Head Lease provides for the fixing of the head rent at 25% of the market rent with reviews every 10 years. The head lease has 28 years to run, and a review will take place in 8 years' time. The sublease provides for rent to be payable quarterly in advance and the head lease quarterly in arrear.

The formula is:- The value of the sublease (ignoring the head rent) less the value of the head-lease.

See example overleaf.

EXAMPLE (C) SUB-LEASE

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ D
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL.YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	300.0000	RUN
RACK RENT?		
	500.0000	RUN
TERM?		
	3.0000	RUN
NUMBER OF P?		
	5.0000	RUN
	6442.7251	***
IY%=4.6564		

EXAMPLE (D) HEAD-LEASE

		XEQ D
MODE?		
		XROM "Q-"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	10.0000	RUN
OVRL.YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	75.0000	RUN N.B.*
RACK RENT?		
	125.0000	RUN N.B.*
TERM?		
	8.0000	RUN
NUMBER OF P?		
	2.0000	RUN
	1184.3826	***
IY%=6.3324		
		CHS
	-1184.383	***
	6442.7251	+
	5258.3425	***

N.B.* i.e. 25% of total rent.

6,442.7251 - 1,184.3826 = 5,258.3425

It is possible to find an OY or IG using these parallel calculations by guessing the unknown until the known value and the result are within tolerable limits of comparability.

See the Introduction to the Schedule of Printer Listings on Page 160 for an explanation of the printer listing.

b) Slice Calculations

An example of a slice calculation might be where it was desired to evaluate the effect of a void period at a given time in the future. The standard Advanced Section programs cannot quantify this void in the middle of the investment time span, but a solution can be found by breaking down the problem into its two component parts - the investment before the void, and the investment after the void.

Example: In the case of a freehold find its value, allowing for a one year void at the end of 10 years.

EXAMPLE (E) 0-10 Years.
i.e. 1st. Slice.

		XROM "*ADV"
UNTAXED		
ADVANCED		
		XEQ D
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL.YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	5.0000	RUN
RACK RENT?		
	5.0000	RUN
TERM?		
	5.0000	RUN
NUMBER OF P?		
	1.0000	RUN
	33.8100	***
IY%=14.7885		

EXAMPLE (F) From Year 11 in Perpetuity.
i.e. 2nd. Slice.

		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL.YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	0.0000	RUN
RACK RENT?		
	5.0000	RUN
TERM?		
	11.0000	RUN
	63.5183	***
IY%=0.0000		
	33.8100	+
	97.3238	***

33.8100 + 63.5138 = 97.3238

Whilst the Advanced Programs have made explicit one factor contained in the All Risk Rate, namely growth, there are a number of other less important factors still left implicit in the Overall Yield or in the Growth Rate used. The likelihood of voids is one of these factors left implicit when market data is used to extract I.G. and O.Y. figures. Thus the 9.3916% used for growth might already recognise the risk of a void, either completely or to some degree.

Subject to the comment above, it is possible to find an average I.G. which reflects the void, if this has not already been taken into account.

		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IG"
REVIEW P?		
	5.0000	RUN
RENT RES.?		
	5.0000	RUN
RACK RENT?		
	5.0000	RUN
TERM?		
	5.0000	RUN
OVRL.YIELD?		
	14.0000	RUN
PV?		
	97.3243	RUN
IG%=9.2534		

Further thought is given to the treatment of implicit risks in the section below entitled "Possible Future Trends in DCF Applications".

ADVANCED SECTION NOTES

1(a). When the '(ADV)' Key is pressed the calculator will display for one second the current tax status. This has no effect when using Program A and can be ignored.

(b) The selection of the Advanced Section automatically sets the calculator to display four places of decimals. If it is desired to display further places of decimals, follow the procedure set out below:-

STEP	KEYS	KEY CODE	DISPLAY	COMMENTS
1	(FIX)	31/72	FIX-	Prompts for numeral entry.
2	6		9.391623	6 Places of Decimals set.

If accuracy of the order of one thousandth part of one percent is important to the user, then the section at the rear of the book entitled "Calculator and Program Limits" should be read.

(c) It is unnecessary to press the '(ADV)' Key every time, as long as the preceding calculation utilised one of the Advanced Section Programs, i.e. once in the Advanced Section the calculator remains in that section until a key is used to initiate a program in another section, e.g. The Basic Section Key or the Tax Mode Key.

(d) The display of "ADVANCED" prompts for one of the programs designated A - E or (a) - (e). The top row keys are automatically assigned to these designations when in 'USER' Mode.

2. Once a program is selected under the Advanced Section, the calculator remains set to that program and also set to the current Rent Payment Mode. Thus data changes can be made, starting from step 4 (where the element for analysis is selected) or if a 'Mode' change is required commence at Step 3.

3. The 'MODE?' display prompts for the selection of the Rental Payment Mode and selection is then made by using one of the five second row keys marked 'A-', 'Q-', 'Q+', 'M+' and 'H-'. The choice, however, is not limited to anyone of these five, if say weekly in arrear is the appropriate mode, then follow the routine below after the "MODE?"prompt:-

STEPS	KEYS AND DATA	KEY CODE	DISPLAY	COMMENTS
			MODE?	
1	A-	21	WHICH CALC?	Press any second row key with the appropriate '+' or '-' symbol.
2	USER	-		Ignore"WHICH CALC?" prompt.Out of 'USER'.
3	52		52	Selects the number of payment periods per annum.
4	STO	33	STO —	
5	06		52	Stores 52 in Storage register 06.
6	USER	-		Puts calculator back into 'USER'.
7	IG	33		Proceed as before as if "WHICH CALC.?" were being displayed.

4. The various conventions in the quotation of interest rate percentages can at best be confusing, and at worst downright misleading. Quoted interest rates are not always what they seem, as anyone will be aware who has been taking note of the competition currently taking place over house loans and similarly with 'Bank Card' Loans. The Quotations of interest rates are subject to the vagaries of individual market conventions.

The initial yield is no more than the reciprocal of the years purchase multiple, and is necessarily a nominal rate. In simple terms the initial yield is the current income of an investment expressed as a percentage of its current capital value . The Overall Yield throughout this book is taken to be the effective annual yield i.e. the rate reflects the receipt of income more frequently than annually in arrear where appropriate. The effective rate is perhaps more commonly referred to as the Annual Percentage Rate (APR) in the mortgage and house loan environment. The only way of making comparisons between investments with different income receipt schedules is by means of their effective rates. When overall rates of return are being extracted from alternative investment situations, the quirks of the individual markets must be borne in mind. The market for Gilt-Edged Securities, for instance, calculates the gross redemption yield (GRY) on a half-yearly basis and then doubles the result to arrive at the nominal annual rate shown in the published quotation lists. The effective rate for a Gilt-Edged Stock can be found by using the Program for Nominal/Effective Conversions or by means of this simple routine on the calculator:-

E.G. A Quoted G.R.Y. is 14%p.a.

Keys		Display		
14	-	14	=	Nominal Rate
Enter	-	14		
200	-	200		
÷	-	.07		
1	-	1		
+	-	1.07		
Enter	-	1.07		
X	-	1.1449		
1	-	1		
-	-	.1449		
100	-	100		
X	-	14.4900	=	Effective Rate

Many Building Societies quote a rate which is neither truly nominal nor effective, but is incidentally the most advantageous to themselves. They calculate the amount due on an annual basis, but actually charge it on a monthly basis.The APR is calculated by the Mortgage Program (See Section V) if required.

5. A Years Purchase multiple of 20 would have been shown had the more accurate figure of 9.391623 been used for the Assumed Growth Rate input.

6(a). The Constant Rent exercise is normally carried out for limited leasehold periods as in the case of the Example 25 which compares a 5 year pattern with a term of 21 years. The Equivalence Factor calculation has a wider application, enabling comparisons to be made between many freehold situations, but there is implicit in this exercise the assumption that the rent review pattern continues in perpetuity. This assumption means that the same constant rent factor is produced whether the calculation be done

for a limited period i.e. 21 years, or in perpetuity with permanent 21 year rent review periods. The assumption in a freehold situation must be that another constant rent is fixed at the next review date.

(b). It has been normal in the past to calculate the Constant Rent on the basis that rent is received annually in arrear, even though this may not represent the situation in reality. However, the most important aspect is to ensure that the calculation is carried out on the same basis as that used for extracting data (the implied growth rate) from market statistics. The program assumes that the rent payment mode is the same for the base investment and for the investment in comparison, but if it is desired to reflect a difference of Rent Payment Mode between the two investments, this can be achieved by the following routine:-
(N.B. The second row 'Q+', 'A-' , etc. Keys cannot be used).

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
			Review P?	When "REVIEW P?" is displayed for the SECOND time.
1	(SF)	31/52	SF—	SF10.Sets "In Arrear" Mode.)
2	10			CF10 (31/53)).Sets"In Advance") -Ignore if no change.
3	USER	-		Out of 'User'.
4	12		12	Monthly rental payments.
5	STO	33	STO—	
6	06			STORES the no. of payments p.a. in storage Register 06
7	USER	-	12	Back into 'User'.
				Now continue as if "REVIEW P?" prompt were still being displayed, i.e. enter data for the second investment. The second part of the calculation will now be carried out on the basis of Rent Receipts being Monthly in arrear .The Base will be calculated in accordance with the program initialisation procedure.

6(c) When entering data for the second investment during a Constant Rent calculation the entries for Overall Yield and Growth Rate would be the same as for the Base investment. It is not necessary to enter the data again, as pressing the 'R/S' Key when "OVRL YIELD%?" or "GROWTH%?" is prompted, will cause the previous entry to be retained, provided no other key has been used.

Provision for data changes in the OVERALL YIELD and the GROWTH RATE has been retained as risk analysis of the base investment's 5 year reviews, and the investment with a 21 year rent review might require a change in either one or the other, or even both , to reflect the different risk factors.

7. Tax allowance in the Advanced Section takes the form of a specific deduction from each income cash flow, thereby differing from the grossing up exercise traditionally applied to Sinking Fund payments, and from the traditional reduction of the discounting rate in the PV of Reversion to £1 and the PV of Reversion to a Perpetuity Tables allowing for Tax. The tax status remains set even though the calculator is switched off, it will therefore wake up in the same tax mode (either Tax on or off) as it was when last used. Pressing the '(ADV)' Key will display for one second the current tax mode.
If it is wished to change the tax mode, this is achieved by pressing the '(Tax on/off)'Key (Key code 31/41). This toggles the calculator between tax "on" and tax "off".
After a tax mode change it is necessary to start the calculation **again** at the beginning with the selection of the Advanced Section by the use of the '(ADV)' Key (Keycode 31/43).

8. Program B calculates a value rather than just a Y.P.multiple as in Program A. However Program B can be used (when the investment constitutes a lease just commencing or where there has just been a rent review) to produce a valuation in place of Program A. This can be achieved by either using Zero for the Term and the Reserved Rent; or, by using the full standard review period for the Term. The Rent Reserved and the Rack Rent will be the same figure. Program B can be used in the same analytical way to calculate IG or OY figures as with Program A by using percentages instead of rent inputs and 100 for the PV input.

9. The selection of an appropriate after tax Overall Yield is not a simple task as little work has been done on this subject, and in any event the selection will be more subjective, the individual's tax rate and availability of other investment opportunities being critical. AFTER TAX OVERALL YIELDS are of most use to the individual seeking to analyse his investment decisions, though they might become important at the market level if one type of taxpayer (or non-taxpayer) is the dominant force.

It is not appropriate to choose an AFTER TAX OVERALL YIELD by taking the highest gross O.Y. levels available in the market and then deducting the tax, say 14% becoming 9.8% at a 30% tax rate (14 x .70) The deferment in the receipt of income inherent in the 'with growth' property investment favours the taxpayer when compared with an investment by him in the high yielding fixed interest gilt-edged type of investment. The whole issue is further complicated by the low coupon stocks standing at a high discount to their redemption price, not to mention Index Linked Stocks.

It would be necessary to do all investment calculations on an after tax basis to get the feel of the market, and to assess the maximum after tax returns available in the investment world at large. This having been done, the best available after tax return can be applied to specific investments and markets by way of comparison. There might be a transitional phase when the market values change to reflect this after tax approach, if this has not already happened. The gilt market, certainly, is sufficiently sophisticated in this respect to already discount the effect of taxation.

Example 5 utilises the figure found for the O.Y. (After tax) in Example 7.

10. Programs C, E, (a) and (b) calculate the effect of abnormal rent reviews WHERE NO CONSTANT RENT adjustment has been allowed to reflect these abnormal reviews. If full allowance is made for the abnormality then Program B or D with normal Rent Reviews can be used i.e. ignoring the abnormal reviews as the freehold or leasehold owner is in theory supposed to have been compensated by the adjusted rent.

11. The Reserved or Passing rent is the rent actually being paid by the tenant as provided in the lease document or under the terms of a subsequent rent review.

12. The Rack Rent is the estimated market rent for the premises at the date that the valuation exercise takes place on a letting on modern terms, i.e the rent should not reflect unusual terms in the lease, having regard to the Rent Review Pattern or Rental Payment Mode.

13. The "Term" is the period in years and fractions of a year over which a rent is static, i.e. not being subject to a rent review or to reversion to the landlord. If the term ends in a reversion to the landlord, the premises are assumed to be relet immediately with no void. The question of voids at reversion is dealt with elsewhere.

When ,in the Example Headings, the words "Term and Reversion" are used "Reversion" is not used in its legal connext but in the sense of a reversion to a market rent; implying only a "reversionary" element in the rental, i.e. the rent reserved in the lease is not a current market rent.

14. Program D values the benefit of a lease to a landlord (a terminable interest) and assumes that under the terms of that lease there is a period to run before the next rent review date (the term); and thereafter until the lease terminates, that there will be one or more subsequent rent reviews. "NUMBER OF P?" prompts for the number of these periods after the term. (Where the lease is just commencing or where there has just been a rent review and a whole rent review period has been specified as the term input, this review must be deducted from the number used for the "NUMBER OF P?" input. Alternatively Zero can be used for the term input, in which case all the review periods must be included in the "NUMBER OF P?" input. This applies only to the Valuation Calculation and is not permissible in IG or OY calculations, because a zero term upsets the reiterative process).

15. The Initial Yield is merely the Passing Rent divided by the capital value and should not be confused with the Capitalisation Rate which takes into account the provision of a sinking fund.

16. Program (d) can be operated in the tax mode if required, and the adjustment factor produced will reflect the traditional grossing-up exercise to allow for the fact that sinking fund payments have to be made out of after-tax income. If the leasehold interest has been valued on an after-tax basis using one of the preceding programs which deducts the tax from each cash flow, it is not then appropriate to use Program (d) in the tax mode.

17. This sum may represent ,either a sale figure or, by entering a minus sum (using the 'CHS' Key-42) can reflect a dilapidations payment at the end of the investment tenure.The data input may be at today's prices with an inflation/growth rate applied by means of the FUTURE VALUE GROWTH ("FVG?") input or an estimate of the future value <u>including</u> inflation can be made, in which case zero must be entered in response to "FVG?".

SECTION II

NOMINAL/EFFECTIVE RATE CONVERSION. PROGRAM (E/N)

The difference between Nominal and Effective rates is important and despite the discrepancies that occur in valuation results, this difference is often ignored.

Note 4 of the Advanced Section Notes gives a summary of the situation in relation to Initial and Overall Yields.

The Nominal Rate is a rate related to a specific compounding period, if the Nominal Rate is applied on an annual basis for an income stream receivable on an annual in arrear basis, there is no problem. The nominal and the effective rate will be the same. If, as is often the case (e.g. Gilt-Edged), the compounding period is less than a year (half yearly for Gilt Edged) to allow for more frequent receipts of income than annually in arrear, then dividing the rate quoted for the year by the number of compounding periods produces a nominal rate for that compounding period.

For example a quoted rate of 14% in the Gilt-Edged Market will actually be applied in the price calculation, as 7% for half-yearly compounding periods. Thus reflecting the half-yearly payments of interest.

This does not reflect the advantage to the investor of compounding at half-yearly intervals, i.e it does not recognise the fact that the 7% received halfway through a year can be invested for the remaining six months to the end of the year, to give him in effect a higher return than 7% x 2. What he will get is 7% with 7% interest plus 7% :-

i.e. (7 x 1.07) + 7 = 14.49%
This then is the Effective Annual Yield!

The E/N Program allows conversion from Effective to Nominal or Nominal to Effective, allowing for any number of compounding periods per annum and whether payments are made in advance or in arrear.

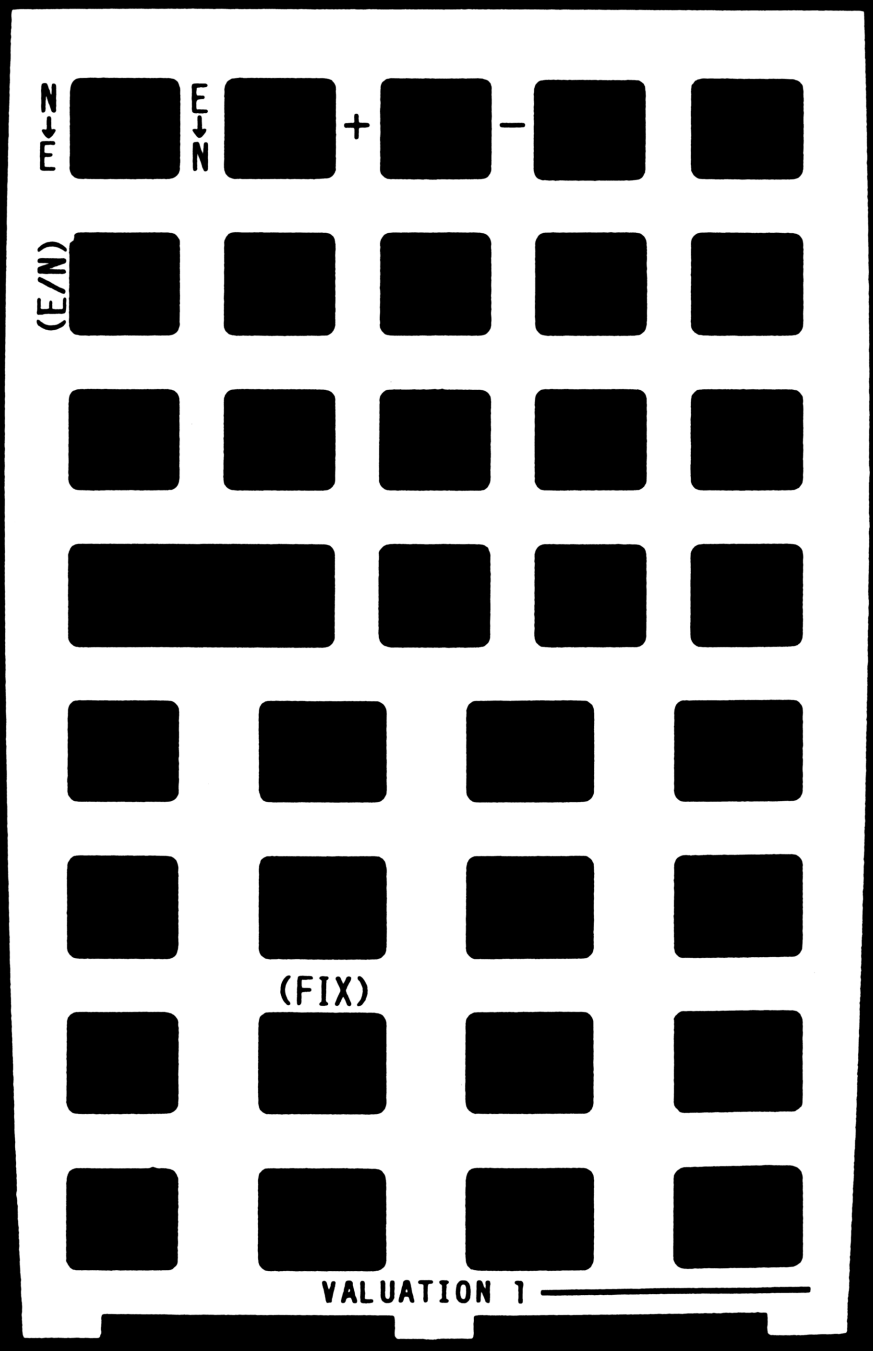
EXAMPLE **26**

Given:-	Example 26 & (27) Data:-	
Nominal to Effective(or Eff. to Nom.) - - - -	N to E.	(E to N)
Number of Payments p.a. - - - - - - - - - - - -	4	(4)
In Advance or In Arrear. - - - - - - - - - - - -	In Advance.	(In Advance)
Annual Nominal Rate (Effective Annual Rate)- -	14%.	(15.316313)

Example **27** data is given above in brackets. Example 27 reconverts the Effective Annual Rate back into an Annual Nominal Rate, using the same data as in Example 26. (See Page 68 for the calculation of Examples 26 & 27.)

N.B. In the Top Row Keys (See diagram over page) the plus ('+') sign symbolises 'in advance' mode and the minus ('-') sign 'in arrear'.

NOMINAL/EFFECTIVE RATE CONVERSION KEYS
(IN SILVER)



EXAMPLE **26. NOMINAL TO EFFECTIVE RATE CONVERSION.**

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Conversion Program	(E/N)	31/21	NOM↔EFF?	N to E or E to N	
2	Nom. to Eff.	N→E	11	NO.PMTS P.A.?	No.of Compounding Periods p.a.	
3	4 Payments p.a.	4		4		
4		RUN	84	ADV OR ARR?	Payments in Advance or Arrear.	
5	In Advance.	+	13	NOM%=?		
6	14% Annual Nom.Rate	14		14		
7		RUN	84	EFF%15.316313		RESULT

EXAMPLE **27. EFFECTIVE TO NOMINAL RATE CONVERSION.**

1	Conversion Program	(E/N)	31/21	NOM↔EFF?	N to E or E to N	
2	Eff. to Nom.	E→N	12	NO.PMTS P.A.?	No.of Compounding Periods p.a.	
3	4 Payments p.a.	4		4		
4		RUN	84	ADV OR ARR?	Payments in Advance or Arrear.	
5	In Advance.	+	13	EFF%=?		
6	15.316313% Ann.Eff	15.316313		15.316313		
7		RUN	84	NOM%14.000000		RESULT
8		RUN	84	3.500000		

3.500000=The Nominal Rate for the Input Compounding Period (i.e. Quarterly)

N.B.Once the Conversion Program (E/N) has been selected subsequent conversions can commence at Step 2.

SECTION III

THE "BASIC" SECTION

Introduction:

The 'Financial Keys' of the Basic Program will be familiar to those who have used one of the pre-programmed Financial Calculators that have been on the market since the early 1970s. The top row keys marked N, I, PV, PMT and FV allow the calculation of solutions to the basic compound interest problems. However these Financial Keys may not be familiar to all those educated in the traditions of the Surveying and Valuation professions, therefore a special section is devoted below to relating the Financial Keys to the tables and terminology familiar to the property profession. The Financial Keys will encompass nearly all the tables found in books such as Parry's and Rose's Valuation Tables, with the obvious exception of the tables involving life expectancy. Those tables which are not covered by the Financial Keys are dealt with separately. The Financial Keys, in fact, cover many more situations than are contained in the standard tables, and generally allow operation in a much more flexible way.

The diagram on the next page shows the key assignments, as printed in gold on the keyboard overlay, for operation with the Basic Programs.

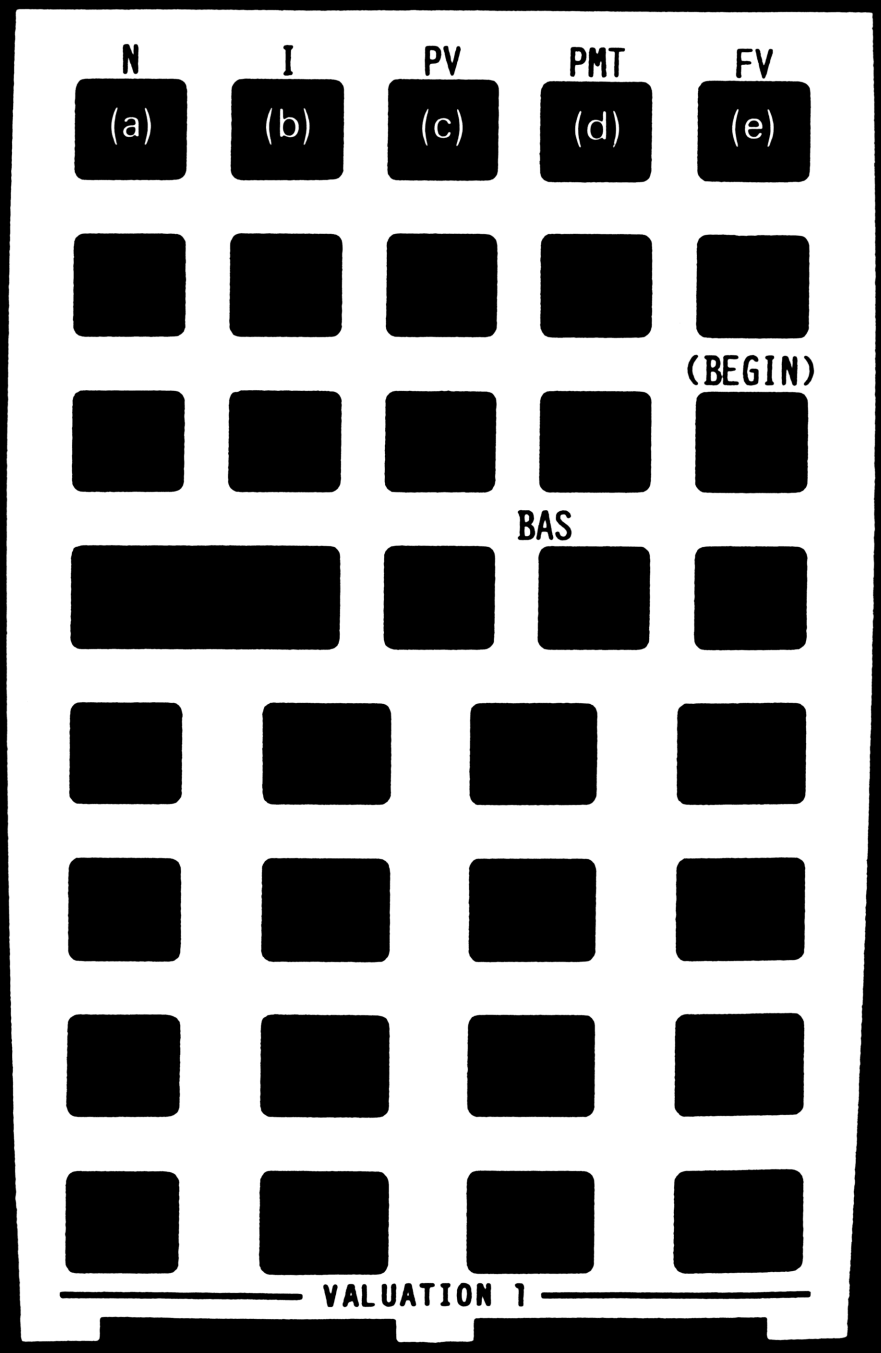
KEY 'BAS' - initiates the Basic Program and clears the five financial registers.

KEY '(BEGIN)' - sets the calculator to the assumption that periodical payments are received at the beginning of the compounding period rather than at the end. When set, Flag 0 will be displayed in the Flag annunciator.

The Top Row Financial Keys are dealt with below on Page 71.

See overleaf for the Basic Section Key Diagram.

BASIC SECTION KEYS
(IN GOLD)



CONTENTS OF THE BASIC SECTION

In addition to the Financial Keys there are five other sub-programs in the Basic Section which are initiated by the 'BAS' Key followed by a top row key preceded by the yellow shift key (Keycode 31).

These five sub-programs calculate:-

(a) An **Adjustment Factor** to reflect income receipts more frequent than annual and whether they be in advance or arrear.
(b) The **Years Purchase of a Reversion to a Perpetuity**, making traditional allowance for Income Tax and Capital Gains Tax.
(c) The **Present Value of a Reversion to £1**, making traditional allowance for Income Tax and Capital Gains Tax.
(d) A **Dual Rate Years Purchase** for terminable interests (with annual sinking fund payments) optionally making traditional allowance for Income Tax by way of grossing up the sinking fund payments. See Section VIII on Page 127.
(e) An **Equivalent Single Rate** for given Dual Rate data.

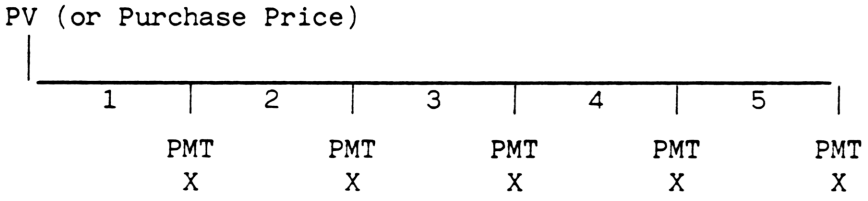
The explanation for (d) and (e) can be found in the special section covering Dual Rate Calculations. See Section VIII on Page 127.

THE FINANCIAL KEYS

The Financial Keys and the Programs covering Nett Present Value, Internal Rate of Return, and Modified Internal Rate of Return calculations, work to what is called a **Cash Flow Sign Convention** to distinquish between receipts and payments. Cash receipts are positive figures and cash outgoings are negative figures when taking the user's view. The logic becomes slightly more difficult to follow when an existing investment is being valued; it is, in this case, necessary to take the position of a potential purchaser.

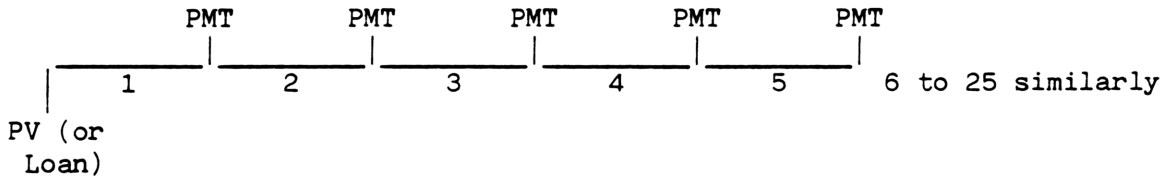
The Cash Flow Sign Convention is best understood by a diagram. The example shown below is the present value of X per annum receivable for 5 years. The line(s) extending upward show the negative cash flow(s) and the line(s) extending downwards show the positive cash flow(s).

Example **28.**



Example 29.

A 25 year Repayment Mortgage would be represented as:-

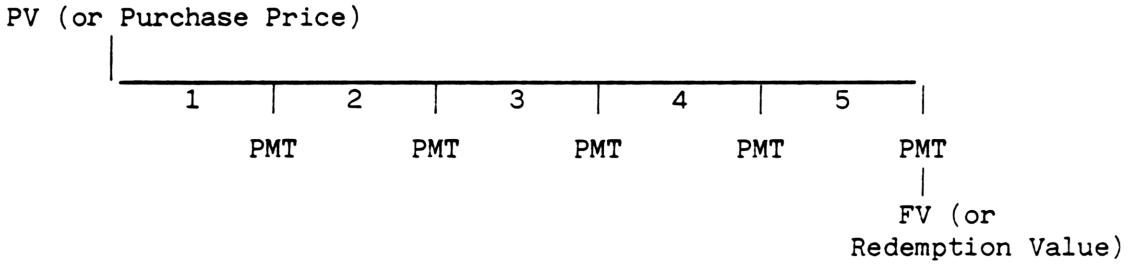


In both cases, the horizontal line represents the time span of the investment and the numbers underneath represent the compounding periods.

In all cases when using the financial keys, a compounding period and an interest rate must form part of the calculation, either as one of the data inputs or as the solution sought. There must also always be at least one positive and one negative cash flow.

So far only 'four' key calculations have been referred to, but there is no reason why all five keys should not be brought into play, e.g. in a redemption yield type calculation. These would be represented in diagramatic form as:-

Example 30.



KEY DESCRIPTION

The 5 Financial Keys can be defined as follows:-

N - The number of compounding periods
I - The Interest Rate (as a percentage) appropriate to the compounding period. See Secion II on Nominal/Effective Rates if compounding periods are less than annual.
PV - The Present Value, i.e. the Initial cash flow.
PMT - The Periodic Payment or receipt appropriate to the compounding period.
FV - The final cash-flow or Future Value.

OPERATION

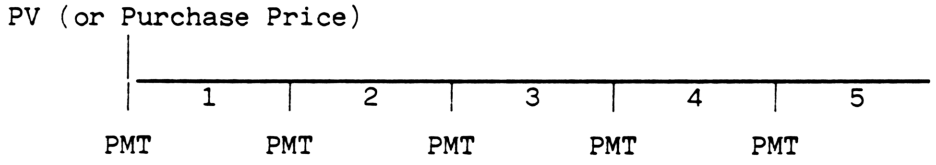
The operation of the Financial Keys is different to the fully prompted process of the Advanced Section. Data entries are made unprompted by first keying in the numeral and then pressing the key with the appropriate symbol for that entry. Data can be entered using the keys in any order. The calculation is started after entering data by pressing the appropriate key without a preceding numeral. Once entries have been made they may be checked by first going out of 'User' mode, pressing Key 'RCL' (Keycode 34) then pressing the top row key with the symbol of the data to be recalled.

Every operation of the Financial Key Calculations must be preceded by pressing the 'BAS' Key (Keycode 43) to clear the financial registers of previous entries.

The various combinations of these five keys allow solutions to be found for a vast number of problems, so large that it is not practical to cover all the possibilities in this book.

The examples set out below show the method for calculating the problems represented by the three cashflow diagrams set out above. The fourth example shows Example 28 calculated on the basis of the income being received in advance, which would be diagramatically represented as:-

Example **31.** Payments at the beginning of the compounding period.



Whilest the examples below are calculated to find the Present Value, the calculation could equally as well have been undertaken to find any other element had that been the missing factor. The result shown may vary slightly from results obtained by using Valuation Tables. The calculator's solution is the more accurate owing to the use of ten significant digits plus a two digit exponent in the calculations.

EXAMPLE **28.** THE PRESENT VALUE OF £7 p.a.(RECEIPT) FOR 5 YEARS AT 13%.

	KEYS & DATA	**KEY CODE**	**DISPLAY**	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	5		5	Selects Number of Compounding Periods,i.e.5 Annual
3	N	11	N=5.0000	Enters Number of Compounding Periods.
4	13		13	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=13.0000	Enters " " " " " .
6	7		7	Selects Periodic Payment,i.e.Annual Income in Arr.
7	PMT	14	PMT=7.0000	Enters " " " " " " "
8	PV	13	PV=-24.6206	RESULT

EXAMPLE **31(b).**

9	(BEGIN)	31/35	BEGIN	Alterative to Example 31 below.
10	PV	13	PV=-27.8213	RESULT. Where receipts are annual in advance.

EXAMPLE **29.** THE PRESENT VALUE OF £7 p.a. (PAYMENT) FOR 25 YEARS AT 13%.

	KEYS & DATA	**KEY CODE**	**DISPLAY**	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	25		25	Selects Number of Compounding Periods,-25 Annual.
3	N	11	N=25.0000	Enters Number of Compounding Periods.
4	13		13	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=13.0000	Enters " " " " " .
6	7		7	Selects Periodic Payment,i.e.Annual Income in Arr.
7	CHS	42	-7	Changes input to a negative figure (outgoing).
8	PMT	14	PMT=-7.0000	Enters Payment.
9	PV	13	PV=51.3099	RESULT i.e.the Amount of the Loan.

N.B. The Results in the Basic Section are all displayed to four decimal places. This can be overridden by the '(FIX)' Key (Keycode 31/72).

EXAMPLE 30(a). THE PRESENT VALUE OF AN INTEREST BEARING BOND.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	5		5	Selects Number of Compounding Periods,- 5 Annual.
3	N	11	N=5.0000	Enters Number of Compounding Periods.
4	13		13	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=13.0000	Enters " " " " " .
6	7		7	Selects Periodic Payment,i.e.Annual Income in Arr.
7	PMT	14	PMT=7.0000	Enters Payment .(Receipt)
8	100		100	Selects the Redemption Value.(Receipt)
9	FV	15	FV=100.0000	Enters " " " .
10	PV	13	PV=-78.8966	RESULT = The Present Value.

N.B.Pressing any Top Row Key will demonstrate that anyone of the five could have been the unknown factor.

EXAMPLE 30(b). Applying the same facts as above using the bi-annual Gilt-Edged Market Convention.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	10		10	Selects No.of Compounding Periods,-10 Bi-Annual.
3	N	11	N=10.0000	Enters Number of Compounding Periods.
4	6.5		6.5	Selects Interest Rate, i.e. Rate for half year.
5	I	12	I=6.5000	Enters " " " " " " " .
6	3.5		3.5	Selects Periodic Payment.Bi-Annual Income in Arr.
7	PMT	14	PMT=3.5000	Enters Payment .(Receipt)
8	100		100	Selects the Redemption Value.(Receipt)
9	FV	15	FV=100.0000	Enters " " " .
10	PV	13	PV=-78.4335	RESULT = The Present Value.

N.B. The advantage of bi-annual income has been out-weighed by discounting the redemption value bi-annually.

EXAMPLE 31. THE PRESENT VALUE OF AN INCOME STREAM - PAYMENTS IN ADVANCE.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	(BEGIN)	31/35	BEGIN	Selects Payments in Advance Mode.
3	5		5	Selects 5 Annual Compounding Periods.
4	N	11	N=5.0000	Enters " " " " .
5	13		13	Selects Annual Interest Rate.
6	I	12	I=13.0000	Enters " " " .
7	7		7	Selects Annual Income.(Receipt)
8	PMT	14	PMT= 7.0000	Enters Payment.
9	PV	13	PV=-27.8213	RESULT = The Present Value.

N.B. Pressing 'BAS' Key resets the Payment Mode back to the Annual in Arrear Basis, therefore every time 'BAS' is pressed it must be followed by the Shift Key and '(BEGIN)' (Keycode 31/35) if the "In Advance" mode of payment is required.

FINANCIAL KEYS - 5 KEY OPERATION

Using all five keys allows the user to cover, inter alia, the following calculations:-

1) The PV or price payable for the receipt of an income and a terminal capital payment (e.g. Bonds, Bills, Fixed Interest Stocks and non-repayment mortgages etc.) - 'PV'.

2) Redemption Yield - 'I'.

3) Finds the coupon necessary to achieve a given Redemption or Overall Yield. - 'PMT'.

4) The number of years required to pay off a given proportion of a Mortgage. - 'N'.

BANK CARD LOANS

A useful attribute of the financial keys is the ability to calculate the effective rates charged on loans or the Annual Percentage Rate (APR) as they are more commonly known.

As an example:-

> What is the APR of a Bank Card Loan of £1,000 which provides for the repayment of the loan with interest by monthly instalments of £30.83 over a four year period?

```
Enter . . 48      in  N
  "   . . 1000    in  PV
  "   . . -30.83  in  PMT

Press . . . . 'I'

  Result:-  I  =  1.7290
```

Then either multply by 12 and use the Nominal to Effective Conversion Program; or divide by 100, add 1, to the power of 12, subtract 1, and multiply by 100, i.e

$$100\left[\left(\frac{1.7290}{100}+1\right)^{12}-1\right] = \text{APR } 22.84\%$$

THE FINANCIAL KEYS RELATED TO

THE PROPERTY VALUATION TABLES

The Financial Keys will cover, inter alia, the following basic Tables and also all data elements in those Tables.

1) The **Amount of £1** (The FV of £1). - - - - - - - - - Examples 32 & 33

2) The **Present Value of £1.** - - - - - - - - - - - - - " 34 & 35

3) **Years Purchase** - Single Rate.
(i.e. The Present Value of £1 p.a.). - - - - - - - " 42 & 43

4) The **Amount of £1 p.a.** (The F.V of £ 1 p.a.). - - " 36 & 37

5) The **Annual Sinking Fund Payment to Provide £1.** - " 38 & 39

6) The **Annuity £1 will Purchase.**
(i.e. The Annual Payment to redeem a Mortgage).- " 40 & 41

All the Tables above can be calculated, starting with the following sequence:-

STEP	KEY	KEYCODE
1	BAS	43
2	Data-N	----------Number of Years
3	N	11
4	Data-I	----------Rate of Interest
5	I	12
6	1	---------- 1 (Unity)

then the following keys are used:-

STEP	AMOUNT OF £1		PV OF £1		YP(Single Rate)		AMOUNT OF £1 p.a.		ANNUAL SINKING FUND		ANNUAL PAYMENT TO REDEEM A MORTGAGE	
7	PV	13	FV	15	PMT	14	PMT	14	FV	15	PV	13
8	FV	15	PV	13	PV	13	FV	15	PMT	14	PMT	14

It should be noted that an immediate answer can be obtained if Unity is substituted by the actual amount. See the examples that follow.

THE AMOUNT OF £1 (UNTAXED).

EXAMPLE 32. Finds the **AMOUNT OF £1**, When:-
Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	1		1	Selects Present Value,i.e. Unity = £1.
7	PV	13	PV=1.0000	Enters " " " " ".
8	FV	15	FV=-2.7590	RESULT

EXAMPLE 33. Finds the **AMOUNT OF £140**, When:-
Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	140		140	Selects Present Value,i.e. £140.
7	PV	13	PV=140.0000	Enters " " " " .
8	FV	15	FV=-386.2644	RESULT

N.B.Changing the PV to a negative i.e. a purchase price with the 'CHS' Key (Keycode 42) will produce a positive FV.

THE PRESENT VALUE OF £1 (UNTAXED).

EXAMPLE 34. Finds the **PRESENT VALUE OF £1.**
When:- Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	1		1	Selects Future Value,i.e. Unity = £1.
7	FV	15	FV=1.0000	Enters " " " " ".
8	PV	13	PV=-0.3624	RESULT

EXAMPLE 35. Finds the **PRESENT VALUE OF £1,500.**
When:- Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	1500		1,500	Selects Future Value,i.e. = £1,500.
7	FV	15	FV=1,500.0000	Enters " " " " .
8	PV	13	PV=-543.6690	RESULT

THE AMOUNT OF £1 PER ANNUM.(UNTAXED).

ANNUALLY IN ARREAR.

EXAMPLE 36. Finds the **AMOUNT OF £1 P.A.** When:-
Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	1		1	Selects Annual Payment, i.e. Unity = £1.
7	PMT	14	PMT=1.0000	Enters " " " " ".
8	FV	15	FV=-25.1290	RESULT

EXAMPLE 37. Finds the **AMOUNT OF £40 P.A.** When:-
Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	40		40	Selects Annual Payment, i.e. = £40.
7	PMT	14	PMT=40.0000	Enters " " " " .
8	FV	15	FV=-1005.1605	RESULT

ANNUAL SINKING FUND TO PROVIDE £1.

EXAMPLE **38.** Finds the **ANNUAL SINKING FUND TO PROVIDE £1.** When:- Number of Years = 15
Interest Rate = 4%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	4		4	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=4.0000	Enters " " " " " .
6	1		1	Selects Future Value, i.e. Unity = £1.
7	FV	15	FV=1.0000	Enters " " " " ".
8	PMT	14	PMT=-0.0499	RESULT

EXAMPLE **39.** Finds the **ANNUAL SINKING FUND TO PROVIDE £550.** When:- Number of Years = 15
Interest Rate = 4%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	4		4	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=4.0000	Enters " " " " " .
6	550		550	Selects Future Value, i.e. = £550.
7	FV	15	FV=550.0000	Enters " " " " .
8	PMT	14	PMT=-27.4676	RESULT

THE ANNUITY £1 WILL PURCHASE.

(MORTGAGE REDEMPTION)

EXAMPLE **40.** Finds the **ANNUITY £1 WILL PURCHASE.**
When:- Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	1		1	Selects Present Value, i.e. Unity = £1.
7	CHS	42	-1	Changes PV to a negative i.e. an outgoing.
8	PV	13	PV=-1.0000	Enters Negative Present Value.
9	PMT	14	PMT=-0.1098	RESULT

EXAMPLE **41.** Finds the **ANNUITY £10,000 WILL PURCHASE.** When:- Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	10000		10,000	Selects Present Value, i.e. = £10,000.
7	CHS	42	-10,000	Changes PV to a negative i.e. an outgoing.
8	PV	13	PV=-10,000.00	Enters Negative Present Value.
9	PMT	14	PMT=-1097.9462	RESULT

N.B. In the Mortgage Redemption Calculation Step 7 '(CHS)' should be left out as the Present Value represents the loan i.e. a receipt.

THE PRESENT VALUE OF £1 PER ANNUM (UNTAXED).

ANNUALLY IN ARREAR.

YEARS PURCHASE.

EXAMPLE **42.** Finds the **PRESENT VALUE OF £1 P.A.**
When:- Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	1		1	Selects Annual Payment,i.e. Unity = £1.
7	PMT	14	PMT=1.0000	Enters " " " " ".
8	PV	13	PV=-9.1079	RESULT

EXAMPLE **43.** Finds the **PRESENT VALUE OF £140 P.A.**
When:- Number of Years = 15
Interest Rate = 7%

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	15		15	Selects Number of Compounding Periods, - 15 Annual
3	N	11	N=15.0000	Enters Number of Compounding Periods.
4	7		7	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=7.0000	Enters " " " " " .
6	140		140	Selects Annual Payment,i.e. = £140.
7	PMT	14	PMT=140.0000	Enters " " " " .
8	PV	13	PV=-1275.1080	RESULT

VALUATION TABLE APPLICATIONS NOT COVERED BY THE FINANCIAL KEYS

AND OTHER BASIC PROGRAMS

The following programs are fully prompted and data must be entered using the 'R/S' Key (Keycode 84).

(a) **AN ADJUSTMENT FACTOR TO REFLECT INCOME RECEIPTS MORE FREQUENT THAN ANNUAL AND WHETHER THEY BE IN ADVANCE OR ARREAR.**

This program can be used alone to find an adjustment factor or in combination with the Financial Keys.

The factor can be used for adjusting the following by multiplication:-
1) Years Purchase Single Rate.
2) Years Purchase of a Reversion to a Perpetuity.
3) The Amount of £1 p.a.
4) Years Purchase of a Rising Income.

or the following by division :-
1) Annual Sinking Fund payent.
2) The Annuity £1 will purchase.
3) The Rising Annuity £1 will purchase.
4) Mortgage instalments.

The program is initiated by the 'BAS' Key (Keycode 43) followed by the Shift Key and Key '(a)'(Keycode 31/11). This last operation toggles the calculator between the 'In Advance' Mode and the 'In Arrear' Mode, press 'R/S'(Keycode 84) when the desired mode is displayed. The program will then prompt for the data to be input, using the symbol "I=?" for the interest rate and "NO. PMTS P.A?" for the number of income receipts or payments per annum.

Example 44 below demonstrates the program being used alone, to find a factor to reflect Quarterly in Advance Payment and a 15% interest rate.

Example 45 shows the program being used in combination with the Financial Keys which have been used first to determine an appropriate Years Purchase for a term of 10 years disccunted at 13% on an annual in arrears basis. The adjustment is again to reflect Quarterly in Advance Payments.

N.B. It is inappropriate to use the '(Begin)' Key and then use this program.

EXAMPLE **44.** ADJUSTMENT FACTOR.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	(a)	31/11	IN ARREAR	Toggles between "IN ADVANCE" and "IN ARREAR".
3	(a)	31/11	IN ADVANCE	Selects "IN ADVANCE" Mode.
4	R/S	84	NO.PMTS P.A?	Prompts for the number of payments per annum.
5	4		4	Selects 4 payments per annum.
6	R/S	84	I=?	Prompts for the Interest Rate.
7	15		15	Selects 15% p.a.
8	R/S	84	AF=1.0921	RESULT = The Adjustment Factor.

EXAMPLE **45.** ADJUSTMENT FACTOR APPLIED TO A PRESENT VALUE.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	10		10	Selects Number of Compounding Periods, - 10 Annual
3	N	11	N=10.0000	Enters Number of Compounding Periods.
4	13		13	Selects Interest Rate, i.e. Rate p.a.
5	I	12	I=13.0000	Enters " " " " " .
6	1		1	Selects Annual Payment,i.e. Unity = £1.
7	PMT	14	PMT=1.0000	Enters " " " " ".
8	PV	13	PV=-5.4262	Intermediate Result.
9	(a)	31/11	IN ARREAR	
10	(a)	31/11	IN ADVANCE	Selects "In Advance" Mode.
11	R/S	84	NO.PMTS P.A?	
12	4		4	Selects Quarterly Payments.
13	R/S	84	I=?	
14	13		13	Selects 13% p.a.
15	R/S	84	AF=1.0800	Displays the Adjustment Factor.
16	R/S	84	-5.8604	RESULT = The Adjusted Value, a YP in this case.

N.B.The multiplication of the YP (Annual in Arrear Basis) by the Adjustment Factor is automatic on pressing the 'R/S' Key in Step 16.

(b) THE **YEARS PURCHASE OF A REVERSION TO A PERPETUITY.**

and

(c) THE **PRESENT VALUE OF A REVERSION TO £1.**

In both cases allowance can be made for Capital Gains Tax and also the traditional allowance for Income Tax. This latter allowance reduces the rate of discount rate by the tax rate to reflect that in other income producing investments the return would be taxed. The tax mode is permanent for these two sub-programs.

Examples 46 and 47 show the two programs in operation with full prompting, using the terminology of the Financial Keys.

The data for both examples being:-

I = 13%.
Income Tax = 45%.
N = 10 years.
CGT = 30%.

EXAMPLE **46. THE YEARS PURCHASE OF A REVERSION TO A PERPETUITY.**

	KEYS & DATA	**KEY CODE**	**DISPLAY**	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	(b)	31/12	I=?	Prompts for the Interest Rate.
3	13		13	Selects Interest Rate.
4	R/S	84	INCOME TAX?	Prompts for Percentage Rate of Income Tax.
5	45		45	
6	R/S	84	N=?	Prompts for the Number of Years.
7	10		10	
8	R/S	84	CGT?	Prompts for the rate of Capital Gains Tax.
9	30		30	
10	R/S	84	PV=3.1769	RESULT = YP.

EXAMPLE 47. **THE PRESENT VALUE OF A REVERSION TO £1.**

	KEYS & DATA	**KEY CODE**	**DISPLAY**	COMMENTS
1	BAS	43	BASIC	Selects Basic Program & Clears Registers.
2	(c)	31/13	I=?	Prompts for the Interest Rate.
3	13		13	Selects Interest Rate.
4	R/S	84	INCOME TAX?	Prompts for Percentage Rate of Income Tax.
5	45		45	
6	R/S	84	N=?	Prompts for the Number of Years.
7	10		10	
8	R/S	84	CGT?	Prompts for the rate of Capital Gains Tax.
9	30		30	
10	R/S	84	PV=0.4130	RESULT = PV.

(d) **DUAL RATE YEARS PURCHASE** AND **ANNUAL SINKING FUND PAYMENT.**

This calculation is shown below, but a fuller explanation is to be found in the special Dual Rate Section VIII see Page 127. The 'Tax' Key is operative on this program (Keycode 31/41) and if tax is to be taken into account, the Flag Annunciator 4 should be displayed.

Step	Key (Keycode)	Data Entry.
1	BAS (43)	
2	(d) (31/14)	
3	- - - - - - - -	Income Tax Rate
4	R/S (84)	
5	- - - - - - - -	Remunerative Rate
6	R/S (84)	
7	- - - - - - - -	Number of Years
8	R/S (84)	
9	- - - - - - - -	Sinking Fund Rate
10	R/S (84)	

The YP will be shown.

11	R/S (84)	

The Annual Sinking Fund to recoup £1 will be shown.

12	X (71)	

The Annual Sinking Fund to recoup the YP will be shown.

(e) THE **EQUIVALENT SINGLE RATE FOR GIVEN DUAL RATE DATA.**

This also is dealt with more fully under the Dual Rate Section VIII Page 127. The Equivalent Single Rate is found by repeating the whole process shown above from Steps 1 to 10 inclusive, the YP will be displayed, then Key '(e)' (Keycode 31/15) should be pressed. The solution will be labelled "ESR = -------".

SECTION IV

NETT PRESENT VALUE (NPV), INTERNAL RATE OF RETURN (IRR) and MODIFIED INTERNAL RATE OF RETURN (MIRR) CALCULATIONS.

Introduction:

The first two of these three calculations will be familiar to anyone who has previously concerned themselves with DCF. Many may even consider the term DCF synonymous with NPV and IRR. We hope we have shown in the Advanced Section that there are some short cuts to the necessity of having to enter every single cash flow as required by these NPV, IRR and MIRR calculations.

The basic principle of reducing all future cash flows to their present value, is the same for all DCF calculation, and is described in the Introduction to the Advanced Section under the heading "The Role of DCF Calculations in Property Valuations".

The Advanced Section covers a wide range of calculations but nonetheless there will be times when an investment situation cannot be covered by the programs contained in that Section. This will occur where the cash flows are eccentric, in which case the only solution is to enter each cash flow individually or in even groups.

The number of individual cash flows that can be entered is determined by the number of storage registers available. This is determined by the "SIZE" function described earlier on Page 6, and ultimately by the capacity of the calculator.

The standard HP41C has a maximum capacity of 63 Data Storage registers, which can be expanded by the insertion of memory modules in units of 64 Storage Registers, up to a maximum of 4 or by one Quad Expanded Memory Module giving an additional 256 storage registers. The HP 41 CV has the capacity of a fully expanded HP 41C, namely a maximum of 319 storage registers.

When running the NPV, IRR and MIRR Programs and where all but 9 registers are allocated to data storage, the standard 41C capacity is taken up as follows:-

9	Program Registers for Automatic Key Assignments.
25	Storage Registers to run the program.
29	Storage Registers for cash flow entries.
63	

The HP41CV capacity is taken up as follows:-

9	Program Registers for Automatic Key Assignment.
25	Storage Registers to run the program.
285	Storage Registers for cash flow entries.
319	

The figures of 29 and 285 represent the number of individual cash flows that can be entered. The maximum number of even groups possible are these numbers divided by two, namely 14 and 142 respectively.

The number of registers available can be expanded by 9 by de-assigning the keys, this is achieved by initiating the 'CLKEYS' function as follows:-

Out of "User"	KEYCODE
XEQ - - - - - - - -	32
ALPHA (in to)	
C - - - - - - - -	13
L - - - - - - - -	33
K - - - - - - - -	32
E - - - - - - - -	15
Y - - - - - - - -	71
S - - - - - - - -	53
ALPHA (out of)	

After this operation the SIZE function must be used to allocate all the calculator memory capacity to Data Storage (Maximum 63 - HP41C and 319 - HP41CV).

N.B. Switching the calculator off then on with the module in place restores the key assignments.

When the keys have been de-assigned the programs have to be initiated in the same way as any other off keyboard function.

E.G. Key: - XEQ
- ALPHA
- N
- P ---- alternatively IRR or MIRR.
- V
- ALPHA

It may well be that the user will wish to allocate some of the spare storage capacity for program registers to contain his own programs. In this case the SIZE function must be used to juggle the data storage and program registers in accordance with individual need. An attempt to run any of the Module Programs with insufficient data stores will result in the calculator displaying "NONEXISTENT". Thus if 28 Data stores are specified by the SIZE Function NONEXISTENT will be displayed on attempting to input the fourth cash flow, i.e 28 less the 25 basic requirement for running any of these three programs leaves only 3 data registers available for storing cash flows.

The same cash-flow sign convention applies to these three programs as was described for use with the Basic Financial Keys, i.e receipts are represented by positive figures and payments by negative figures, taking the position of the user.

An important facility with these programs is the ability to make changes in one or more of the cash flows and/or the discounting rate after a calculation has been completed so that the sensitivity of an investment to different requirements or assumptions can be readily assessed.

The term 'Discounting Rate' is used in the NPV Program , and 'Internal Rate of Return' is used in the IRR and MIRR programs, for all material purposes these expressions mean the same as 'Overall Yield' rate used in the Advanced Section.

GLOSSARY OF ABBREVIATIONS USED IN THE IRR, MIRR and NPV PROGRAMS.

* Denotes a variable numerical entry in the display.

PROMPTS

Prompts with an equals sign ('=') before the question mark ('?') are prompting for numerical entries.
Prompts without equals sign are prompting for the answer NO or YES to the question. The answer NO is given by entering 'N' and the answer YES is given by pressing the 'R/S' key (Keycode 84).

Abbreviations:-

GROUPS?	-	Prompts for 'N' where individual cash flows are to be calculated. If Groups of cash flows are to be calculated press 'R/S'.
CF *=?	-	This prompts for the amount of the cash flow.
CF CHANGES?	-	'N' for NO Changes to entered cash flows. 'R/S' for YES.
CF NO=?	-	Number of the cash flow to be changed.
CF*=*.**?	-	Displays previously entered amount and prompts for revised input. If none press 'R/S'.
NO.CFS *=?	-	Number of cash flows in a group.
GROUP NO.=?	-	Prompts for the number of the group after 'R/S' response to "CF CHANGES?" where groups have been specified.
GROUP*=*.**?	-	Displays the amount previously entered for a given cash flow group and prompts for revision.
NO.CFS*=*.**?	-	Displays the number of cash flows in that group and prompts for revision.
SAFE RATE=?	-	Prompts for the discount rate applicable to negative cash flows, e.g. possibly a deposit interest rate on unused money until called upon for a future outgoing commitment.
RISK RATE=?	-	The accumulation rate to be applied to cash flows received ,until the end of the investment term. A rate possibly drawn from comparable investment situations.
DSCNT RATE=?	-	The rate of interest to be applied when calculating a Nett Present Value.

RESULT INDICATORS

IRR=	-	Displays the result of the Internal Rate of Return Calculation.
MIRR=	-	Displays the result of the Modified Internal Rate of Return Calculation.
NPV=	-	Displays the result of the Nett Present Value Calculation.

NETT PRESENT VALUE

This program finds the discounted value at the present time of a series of cash flows receivable at given times in the future.

The program accepts the input of individual cash flows or, alternatively, groups of equal cash flows. The selection of the latter option, in appropriate circumstances, will cut down the time taken to enter the data considerably.

The cash flow entries can be made for any regular time intervals, as long as the Discount Rate is appropriate for that period. If the period is shorter than annual, regard must be had to Nominal and Effective Rates see Section II.

The program can be used, either; to test the profitability of an investment where the purchase price and other outgoings are entered as a negative figures - a positive NPV shows profitability and a negativ NPV shows unprofitability; or, to find an appropriate purchase price for a given discounting rate where zero is entered for the initial cash flow. The value in this last situation, contrary to the normal sign convention, is positive.

Once the NPV program has been selected the entries are fully prompted, so rather than spend too much time looking through the glossary above it is as easy to work through an example.

Example **48.**

What is the NPV or price that an investor can afford to pay for an office investment where the rent is £10,000 p.a for the first five years and thereafter it is estimated the rent will be £20,000 p.a. for the next five years? A final sale after ten years is estimated to realise £250,000. A Discount Rate of 13% is used assuming receipts are annual in arrears?

See over the page for the example listing.

EXAMPLE **48.**

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	NPV Program	(NPV)	31/24	GROUPS?	Single CFs /Groups	See note 1.
2	Group Basis	R/S	84	CF 0=?	Amount of CF 0	See note 2.
3	Nil Initial Outlay	0		0		
4		R/S	84	NO.CFS 0=?	NO.of CFs in Group 0	See note 3.
5	No.of CFs in Group0	1		1		
6		R/S	84	CF 1=?	Amount of CF 1	
7	£10,000	10000		10,000		
8		R/S	84	NO.CFS 1=?	NO.of CFs in Group1	
9	5 Cash Flows	5		5		
10		R/S	84	CF 2=?	Amount 2nd CF series	
11	£20,000	20000		20,000		
12		R/S	84	NO.CFS 2=?	NO.of CFs in Group2	
13	4 Cash Flows	4		4		See note 4.
14		R/S	84	CF 3=?	Amount of CF	
15	£270.000	270000		270,000		
16		R/S	84	NO.CFS 3=?	NO.of CFs in Group3	
17	1 Cash Flow	1		1		
18		R/S	84	CF 4=?	Amount of CF	See note 5.
19	No more Cash Flows	R/S	84	CF CHANGES?	Any Cash Flow Changes	
20	N for No Changes	N	41	N		See note 6.
21		R/S	84	DSCNT RATE=?	Discount Rate	
22	13% Discount Rate	13		13		
23		R/S	84	NPV=146,999.64		RESULT See note 7.

The same problem can be reworked on a slightly different basis, say, where two payments of £50,000 to cover building costs have to be made, one at the beginning of the investment time scale and the other after one year, at which time the letting commences. There is no need to re-enter all the data again.

Example **49.** (continues on from where Example 48. left off.)

24	Data Change Routine	R/S	84	GROUP NO.=?	CFs to be altered	See note 8.
25	Cash Flow 0	0		0		
26		R/S	84	GROUP 0=0.00?	Amount of CFs in Group0	
27	£50,000	50000		50,000		
28	Outgoing	CHS	42	-50,000		
29		R/S	84	NO.CFS 0=1.00	No.of CFs in Group	
30	2 Cash Flows	2		2		
31		R/S	84	GROUP NO.=?	CFs to be altered	
32	No more Alterations	R/S	84	DSCNT RATE=13.00?	Alteration	See note 8.
33	No Alteration	R/S	84	NPV=35,840.39		RESULT

If it is desired to re-calculate the problem using a different discounting rate, this can readily be done ,and again without re-entering all the data.

Example **50.**

34		R/S	84	GROUP NO.=?	CFs to be altered	
31	No CF Alterations	R/S	84	DSCNT RATE=13.00?	Alteration	
32	Alter Rate to 12%	12		12		See note 8.
33		R/S	84	NPV=45,937.51		RESULT

Examples 51 and 52 illustrate the NPV program being used in the traditional Nett Present Value manner to test the profitability of an investment. In these examples the option to enter every individual cash flow is selected.

Example **51.**

An investor is offered a property for £70,000 , from which he will receive an income of £1,000 for the first year, £3,000 p.a. for the 2nd and third years, at the end of the third year he intends to sell the property and he estimates the sale price will be £100,000. Will the investment be profitable if he requires a 15% rate of return?
The cash flow will be as follows:-

Year 0	£70,000 (outgoing)
Year 1	£ 1,000
Year 2	£ 3,000
Year 3	£103,000

EXAMPLE **51.**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	NPV Program	(NPV)	31/24	GROUPS?	Single CFs /Groups	See note 1.
2	Individual CFs	N		N		
3		R/S	84	CF 0=?	Amount of CF 0	See note 2.
4	£70,000	70000		70,000		
5	Outgoing	CHS	42	-70,000		
6		R/S	84	CF 1=?	Amount of CF 1	
7	£1,000	1000		1,000		
8		R/S	84	CF 2=?	Amount of CF 2	
9	£3,000	3000		3,000		
10		R/S	84	CF 3=?	Amount of CF 3	
11	£103,000	103000		103,000		
12		R/S	84	CF 4=?	Amount of CF 4	
13	No more Cash Flows	R/S	84	CF CHANGES?	CF Alterations	
14	N for No Changes	N		N		
15		R/S	84	DSCNT RATE=?	Discount Rate	
16	15% Discount Rate	15		15		
17		R/S	84	NPV=862.17		RESULT See note 7.

The NPV = £862.17, so the investment is worthwhile.

Example **52.**

What would be the position if, in year 2, only half the rent was paid (£1,500) following a 6 month void period before reletting the property?

Example **52.** contiues from where Example 51. left off.

18	Data Change Routine	R/S	84	CF NO.=?	CF to be altered	See note 8.
19	Cash Flow 2	2		2		
20		R/S	84	CF2=3,000.00?	New Entery for CF2	
21	£1,500	1500		1,500		
22		R/S	84	CF NO.=?	CF to be altered	
23		R/S	84	DSCNT RATE=15	Alteration if any	
24	No Change	R/S	84	NPV=-272.05		RESULT

The NPV = - £272.05 : the minus sign indicating that the investment is not worthwhile.

INTERNAL RATE OF RETURN

The I.R.R. Program finds the discount rate which reduces all present and future cash flows to a Nett Present Value of zero. This is a very useful tool, as by this means all investments can be compared by way of their rate of return. It is particularly useful in a development situation to calculate the return on an investment, e.g.:-

What is the rate of return to a developer in the following circumstances?

He pays :-	Year 0	£100,000 for Land Purchase.
" "	Year 1	£ 50,000 for Building Costs.
" "	Year 2	£ 25,000 " " " .
He receives	Year 3	£ 10,000 as Rent.
" "	Year 4	£ 10,000 as Rent.
" "	Year 5	£ 12,500 As Rent after review.
" "	Year 6	£362,500 as Rent and £350,000 sale price.

Solution: IRR = 16.67

Changing the facts to test a £300,000 Sale Price produces:-

Solution: IRR = 13.79

See Examples 53 and 54 which are listed over the page.

N.B. In the series of cash-flows set out above, it can be seen that the cash-flow sign convention described in the introduction has been employed. Each time the cash-flow changes from a positive value to a negative value or vice versa, it is called a sign change. It is necessary to have a least one sign change in every cash-flow series for there to be an IRR Solution. However, cash-flows with more than one sign change in the series can lead to more than one answer. Multiple cash flow sign changes should not be used with this program. While the program may find one of the answers, it has no means of finding or indicating other possibilities. Where there are multiple sign changes the MIRR Program can be used.

EXAMPLE 53.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	IRR Program	(IRR)	31/22	GROUPS?	Single CFs /Groups	See note 1.
2	Individual CFs	N		N		
3		R/S	84	CF 0=?	Amount of CF 0	See note 2.
4	£100,000 Land Cost	100000		100,000		
5	Outgoing	CHS	42	-100,000		
6		R/S	84	CF 1=?	Amount of CF 1	
7	£50,000Building Cost	50000		50,000		
8	Outgoing	CHS	42	-50,000		
9		R/S	84	CF 2=?	Amount of CF 2	
10	£25,000Building Cost	25000		25,000		
11	Outgoing	CHS	42	-25,000		
12		R/S	84	CF 3=?	Amount of CF 3	
13	£10,000 Rent	10000		10,000		
14		R/S	84	CF 4=?	Amount of CF 4	
15	£10,000	10000		10,000		
16		R/S	84	CF 5=?	Amount of CF 5	
17	£12,500	12500		12,500		
18		R/S	84	CF 6=?	Amount of CF 6	
19	£362,500 Final CF	362500		362,500		
20		R/S	84	CF 7	Amount of CF 7	See note 5.
21	No more CFs	R/S	84	CF CHANGES?	Alterations	See note 6.
22	N for No Changese	N	41	N		
23		R/S	84	IRR=16.67		RESULT See note 7.

EXAMPLE **54.** - Continuing from where Example 53 left off, and changing the sale proceeds from £350,000 to £300,000.

24	Data Change Routine	R/S	84	CF NO.=?	CF to be altered	See note 8.
25	Cash Flow 6	6		6		
26		R/S	84	CF6=362,500.00?	New Entry for CF6	
27	Change to £312,500	312500		312,500		
28		R/S	84	CF NO.=?	CF to be altered	
29	No more changes	R/S	84	IRR=13.79		RESULT

MODIFIED INTERNAL RATE OF RETURN

The traditional IRR technique is, in practical terms, limited to the situation where there is only one sign change, as multiple sign changes can produce multiple answers. In other words the IRR Program only works where there is one outgoing or a series of outgoings followed by one receipt or a series of receipts; or vice versa.

The MIRR program overcomes this difficulty, by allowing the user to select a "Safe Rate" for discounting the negative cash-flows. This Safe Rate would normally be the amount of interest obtainable on short term deposit, i.e. the sums set aside for, for example, building costs, would be discounted at the rate at which they would receive interest if put on deposit, rather than assuming that the sums could be invested at the IRR.

An other problem arises when two or more investments are compared using the traditional IRR technique or using most other yield assessment techniques, namely the reinvestment of income is alternatively disregarded, or, there is an implicit assumption that the income is reinvested at (and then discounted at) the IRR. This problem can be simply demonstrated by two investments having the same IRR, but with different cash-flow schedules. The problem is sometimes known as the reinvestment dilemma.

(a)		(b)	
Year 0	£-100	Year 0	£-100
Year 1	£ 1	" 1	£13.31
Year 2	£ 1	Year 2	£13.31
Year 3	£ 1	" 3	£13.31
Year 4	£ 161	" 4	£113.31

Both have an IRR of 13.31%

But if we assume that the income received can only be reinvested at 10% , then the investments are not equally beneficial to the investor who wishes to accummulate all receipts.

The MIRR program allows the selection of an accumulation 'Risk Rate' for application to the positive cash-flows from the moment of their receipt. See Examples 55 and 56 below, which show their respective MIRRs to be 13.28 and 12.78% , i.e there is a half percent difference.

The term 'Risk Rate' is used, as it is likely that most investors will use a rate that has been extracted from market data, having regard to the market average rate for investments of a similar kind. This may well be very different from the IRR of an investment bought on particularly advantageous terms.

In Example 55 the Safe Rate input is immaterial, as there is only one negative cash-flow, and that at the commencement of the investment time scale, i.e there will be no discount applied.

Example 57 shows multiple sign changes, and the use of Safe and Risk Rates of 8% and 10% respectively, the following cash-flow schedule is used.

Year 0	£-100,000	Purchase of Land
Year 1	£ 50,000	Sale of Part of Land
Year 2	£- 30,000	Building costs
Year 3	£- 20,000	Building costs
Next 5 years	£ 6,000	Rent
Next 5 years	£ 10,000	"
Next 5 years	£ 15,000	"
Next 100 years	£ 50,000	"

EXAMPLE 55.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	MIRR Program	(MIRR)	31/23	GROUPS?	Single CFs /Groups	See note 1.
2	Individual CFs	N		N		
3		R/S	84	CF 0=?	Amount of CF 0	See note 2.
4	£100 Initial Outlay	100		100		
5	Outgoing	CHS	42	-100		
6		R/S	84	CF 1=?	Amount of CF 1	
7	£1 Income Receipt	1		1		
8		R/S	84	CF 2=?	Amount of CF 2	
9	£1 Income Receipt	1		1		
10		R/S	84	CF 3=?	Amount of CF 3	
11	£1 Income Receipt	1		1		
12		R/S	84	CF 4=?	Amount of CF 4	
13	£161 Receipt	161		161		
14		R/S	84	CF 5=?	Amount of CF 5	See note 5.
15	No more CFs	R/S	84	CF CHANGES?	Alterations	
16	N for No Changes	N	41	N		See note 6.
17		R/S	84	SAFE RATE=?	Rate for Negative CFs	
18	Nil(or any Figure)	0		0		
19		R/S	84	RISK RATE=?	Return on CFs received	
20	10% Risk Rate	10		10		
21		R/S	84	MIRR=13.28		RESULT See note 7.

EXAMPLE **56.** As in Example 55 with data changes in Steps 7,9,11, and 13.

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	MIRR Program	(MIRR)	31/23	GROUPS?	Single CFs /Groups	See note 1.
2	Individual CFs	N		N		
3		R/S	84	CF 0=?	Amount of CF 0	See note 2.
4	£100 Initial Outlay	100		100		
5	Outgoing	CHS	42	-100		
6		R/S	84	CF 1=?	Amount of CF 1	
7	£13.31 Receipt	13.31		13.31		
8		R/S	84	CF 2=?	Amount of CF 2	
9	£13.31 Receipt	13.31		13.31		
10		R/S	84	CF 3=?	Amount of CF 3	
11	£13.31 Receipt	13.31		13.31		
12		R/S	84	CF 4=?	Amount of CF 4	
13	£113.31 Receipt	113.31		113.31		
14		R/S	84	CF 5=?	Amount of CF 5	See note 5.
15	No more CFs	R/S	84	CF CHANGES?	Alterations	
16	N for No Changes	N	41	N		See note 6.
17		R/S	84	SAFE RATE=?	Rate for Negative CFs	
18	Nil(or any Figure)	0		0		
19		R/S	84	RISK RATE=?	Return on CFs received	
20	10% Risk Rate	10		10		
21		R/S	84	MIRR=12.78		RESULT See note 7.

Example **57.**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	MIRR Program	(MIRR)	31/23	GROUPS?	Single CFs /Groups	See note 1.
2	Group CFs	R/S	84	CF 0=?	Amount of CF 0	See note 2.
3	£100,000 Land Cost	100000		100,000		
4	Outgoing	CHS	42	-100,000		
5		R/S	84	NO. CFS 0=?	No.of CFs in Group	
6	1 Cash Flow	1		1		
7		R/S	84	CF 1=?	Amount of CF 1	
8	£50,000 Part Sale	50000		50,000		
9		R/S	84	NO. CFS 1=?	No.of CFs in Group	
10	1 Cash Flow	1		1		
11		R/S	84	CF 2=?	Amount of CF 2	
12	£30,000-Building	30000		30,000		
13	Outgoing	CHS	42	-30,000		
14		R/S	84	NO. CFS 2=?	No.of CFs in Group	
15	1 Cash Flow	1		1		
16		R/S	84	CF 3=?	Amount of CF 3	
17	£20,000-Building	20000		20,000		
18	Outgoing	CHS	42	-20,000		
19		R/S	84	NO. CFS 3=?	No.of CFs in Group	
20	1 Cash Flow	1		1		
21		R/S	84	CF 4=?	Amount of CF 4	
22	£6,000 Rent	6000		6,000		
23		R/S	84	NO. CFS 4=?	No.of CFs in Group	
24	5 Cash Flows	5		5		
25		R/S	84	CF 5=?		

Continued overleaf.

EXAMPLE 57. (Continued)

26	£10,000 Rent	10000			10,000		
27			R/S	84	NO. CFS 5=?	No.of CFs in Group	
28			5		5		
29			R/S	84	CF 6=?	Amount of CF 6	
30	£15,000 Rent	15000			15,000		
31			R/S	84	NO. CFS 6=?		
32			5		5		
33			R/S	84	CF 7=?		
34	£50,000 Rent	50000			50,000		
35			R/S	84	NO. CFS 7=?		
36			100		100		
37			R/S	84	CF 8=?		See note 5.
38	No more CFs		R/S	84	CF CHANGES?	Alterations	
39	N for No Changes		N	41	N		See note 6.
40			R/S	84	SAFE RATE=?	Rate for Negative CFs	
41	8% Safe Rate		8		8		
42			R/S	84	RISK RATE=?	Return on CFs received	
43	10% Risk Rate		10		10		
44			R/S	84	MIRR=10.26		RESULT See note 7.

NOTES ON SECTION IV (NPV, IRR & MIRR)

1. The first question to which an answer is sought is:-
   Does the user wish to enter the cash-flows individually or in groups?
   In the programs under this Section, there are three types of questions which can be asked, i.e. questions:-
   (a) Seeking an numerical input for the first time, these are signified by an equals sign followed by a query e.g. "CF1=?"
   or (b) Seeking a change to an existing numerical input these are signified by an equals sign followed by the existing numerical entry and then a query, e.g "CF1=1234.00?"
   or (c) Seeking the answers 'yes' or 'no'. These questions can be identified by the absence of an equals sign, e.g "CF CHANGES?"
   The "GROUPS?" prompt falls into this last category.
   If the answer 'yes' is required press Key 'R/S' (84)
   If the answer 'no' is required, press Key 'N' (41) followed by Key 'R/S' (84).
   N.B the calculator automatically sets and clears the Alpha Mode when prompting for yes/no answers.

2. The calculator will prompt in turn for each cash flow or series of cash flows in numerical sequence. Cash Flow 0 represents a cash flow at the beginning of the investment time scale and will most commonly represent expenditure on purchasing the investment, i.e. it will usually be a negative figure.

3. Where it is intended to input a nil figure for CF 0 and where the Groups option has been selected, 1 is the appropriate entry for the 'Number of cash flows in Group 0' prompt. If the user wishes to reflect a payment at the start of the investment time scale and a similar size payment at the end of the 1st year, the appropriate entry is 2 . This has the effect of moving Cash flow 1 one year into the future.

4. As in the NPV Example 48 where income is receivable annually in arrear and where there is a terminal capital payment, the last receipt of income and the receipt of capital will both be received together. Hence in this example the prior series of cash flows has to be reduced by one.

5. When all the cash flows have been entered, pressing 'R/S' (84) with no numeral entry preceding it, e.g. when "CF4=?" is prompted, causes the program to go on to the next phase.

6. This prompt gives the opportunity to make any changes in the cash flows entered. See Note 1. for how to answer yes or no.

7. This program automatically sets the calculator to display the result to two decimal places. This can be extended by using the 'FIX' function described in the Owner's Handbook.

8. If, after a calculation has been completed, the user wishes to repeat the calculation with modified entries, pressing 'R/S' (84) will produce the prompt requesting the number of the cash flow to be changed. A numerical input following the display of the current entry for a given cash flow number followed by 'R/S' will result in a new entry being made. If 'R/S' is pressed with no preceding numerical entry the existing entry shown in the prompt will remain. The calculator will then display the "CF NO.=?" or the "GROUP NO.=?" prompt, and any further changes can be made, or if none press 'R/S' (84). Then the calculator prompts to see if the user wants to change the discount rate. A numeral entry then 'R/S' changes the rate. 'R/S' alone does not change the rate.

SECTION V

MORTGAGES, GRADUATED MORTGAGES AND LOANS AT A DISCOUNT

MORTGAGES

Introduction

At first sight Mortgage calculations would appear quite simple but closer examination proves otherwise. There are interest only mortgages which may be repaid by an endowment insurance policy, and there are the repayment mortgages which are repaid over the mortgage term. In the case of the latter the capital repayments start very small in relation to the interest element, but increase over the term of the mortgage.

Taxation and the quirks of individual markets and even of individual Building Societies add to the general complexity of the mortgage environment.

The purpose of this section is merely to throw some light on the calculations involved and not to be a definitive guide to the mortgage business.

Basic Section - Financial Keys

These keys will cover a considerable range of Repayment Mortgage calculations.

A) On the assumption of annual in arrear instalments, an annual instalment can be calculated as follows:-

1) 'Basic' Key ('BAS' Keycode 43)
2) Then using the Financial Keys as described under the Basic Section (Page 71) to enter the following data inputs:-
   25 year Mortgage term.
   14% p.a interest rate.
   10,000 Amount of the Mortgage Advance.

   i.e:- N = 25, I = 15, PV = 10,000

3) Pressing Key "PMT" will produce the result PMT = - 1,546.99 The minus sign signifies that this is the annual payment required to support a £10,000 borrowing.

B) If the instalment is known (i.e where borrower wants to know the maximum mortgage for a given instalment) and the term and interest rate also, the amount of that loan can be calculated. Using the same data as above:-

1) 'Basic' Key. This must be pressed every time as it clears the financial registers.

2) N = 25, I = 15, PMT = - 1,546.99

3) Pressing key 'PV' will produce the result PV = 9,999.97 a small discrepancy resulting fom rounding up to pence. A similar juggling of entries would produce the number of years a mortgage would have to run if I, PV and PMT are known elements or the appropriate interest rate if N, PV and PMT are the known elements.

C) If the instalments are paid annually but in advance, the same calculation as above can be carried out, except that after the Basic Key has been pressed, the 'Begin' Mode must be selected by pressing the '(Begin)' Key (Key Code 31/35).

N = 25, I = 15, PV = 10,000
Result: PMT = - 1,345.22

N.B. This assumes that the lender gives credit for advance payments, and they do not all, as we will see later.

D) Payment of the instalments may not be on an annual basis and the input for N will become the number of compounding periods, making up the whole term of the mortgage, i.e in the above example if the instalments were monthly:-

N = 25 x 12 = 300.

It must be remembered that the interest rate and the payment must correspond with the compounding period.

The interest rate used must also correspond with the appropriate market custom, bearing in mind the difference between nominal and effective rates of interest. A rate used on a monthly nominal basis will represent a much higher annual effective rate. The Nominal/Effective Conversion Program can be used for changing from one to the other.

THE MORTGAGE PROGRAM (MTGE)

The most common approach used by Building Societies is to calculate the instalments on an annual in arrear basis, but actually to demand the instalments on a monthly in arrear basis without giving the borrower any credit for these early payments. The effect of this is to push up the effective cost or the annual percentage rate (A.P.R. as it is usually called in this context) to the borrower quite considerably.

The 'MTGE' Program calculates the monthly instalment on the normal Building Society basis and the effective rate of interest, (the APR).

EXAMPLE **58.**

Given:- Example 58 Data:-

Mortgage Term - - - - - - - - - - - - - - - 25 Years.
Quoted Interest Rate - - - - - - - - - - 10% p.a.
Amount of the Loan - - - - - - - - - - - £10,000.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	(MTGE)	31/25	MTGE TERM=?	Prompts for the Mortgage Term.
2	25		25	Selects " " " .
3	RUN	84	RATE%=?	Prompts for the Mortgage Interest Rate.
4	10		10	Selects " " " " .
5	RUN	84	LOAN=?	Prompts for the Amount of the Loan.
6	10000		10,000	Selects " " " " " .
7	RUN	84	MON.PMT=91.81	RESULT
8	RUN	84	EFF%=10.62	Displays the APR or Annual Effective Rate.

The effect of mortgage interest relief at source can be reflected in the calculation by adjusting the interest rate to an 'after tax' rate by multiplying by the following :- $\frac{100-T}{100}$. 'T' being the rate of tax expressed as a percentage.
See Example **58** (b) below which assumes a 30% tax rate.

EXAMPLE **58** (b). MORTGAGE INTEREST RELIEF AT SOURCE (MIRAS).

	KEYS & DATA	**KEY CODE**	**DISPLAY**	COMMENTS
1	(MTGE)	31/25	MTGE TERM=?	Prompts for the Mortgage Term.
2	25		25	Selects " " " .
3	RUN	84	RATE%=?	Prompts for the Mortgage Interest Rate.
4	10		10	Selects Gross Mortgage Interest Rate .
	ENTER	41	10	
	100		100	
	ENTER	41	100	
	30		30	
	-	51	70	Subtract
	100		100	
	÷	81	0.70	Divide
	x	71	7.00	Multiplying produces the 'After Tax' Interest Rate
5	RUN	84	LOAN=?	Prompts for the Amount of the Loan.
6	10000		10,000	Selects " " " " " " .
7	RUN	84	MON.PMT=71.51	RESULT
8	RUN	84	EFF%=7.37	Displays the APR or Annual Effective Rate.

GRADUATED MORTGAGES (Program GM)

There has been much discussion about helping first-time house buyers, but little of significance has been done to assist them. The problem of many newly wedded couples is that the marriage takes place at a time of relatively low family income. A possible solution might be to graduate the mortgage payments allowing annual increases at a given rate over the initial years of the mortgage term. If in the example above under the Mortgage Program, the mortgage instalments were allowed to increase annually at an 8% growth rate over the first 5 years: What would be the first yearly instalment?

A special program in the Advanced Section finds the answer.

Example **59.**

Given:-	Example 59 Data:-
The Growth Rate for graduating the instalments.	8%p.a
Mortgage Interest Rate.	15% p.a.
Mortgage Term.	25 years
Period over which graduation is to take place.	5 years
Amount of the Loan.	£10,000

The 1st annual instalment is shown to be £1,187.32

EXAMPLE **59.**

	SELECT:-	**KEYS & DATA**	**KEY CODE**	**DISPLAY**	PROMPTS FOR:-	COMMENTS
1	Advance Section	(ADV)	31/43	ADVANCED		Ignore 'Tax'
2	GM Program	RUN	84	GROWTH%?	Graduation Increase	
3	8% Increase p.a.	8		8		
4		RUN	84	OVRL.YIELD%?	Mortgage Interest Rate	
5	15% Interest Rate	15		15		
6		RUN	84	TERM?	Mortgage Term	
7	25 Years	25		25		
8		RUN	84	GR P?	Period of Graduation	
9	5 Year Graduation	5		5		
10		RUN	84	LOAN?	Amount of Loan	Ignore IY Flash
11	£10,000 Loan	10000		10,000		
12		RUN	84	PMT1=1,187.32	—Displays 1st.Annual Instalment	
13		RUN	84	1,282.31	" 2nd. " "	
14		RUN	84	1,384.89	" 3rd. " "	
15		RUN	84	1,495.68	" 4th. " "	
16		RUN	84	1,615.34	" 5th. & subsequent years.	

On the Building Society basis (i.e. dividing by 12) the monthly instalment will be £98.94 as compared to £128.92 on an ungraduated basis. The difference between the two figures is reduced if allowance is made for tax relief. The two nett of tax figures , allowing for tax at 30% p.a. , are £70.16 and £91 42 respectively. However the percentage difference is the same whether or not an 'after tax' comparison is made.

The schedule of annual payments in the example shows that the earlier payments are lower, but the deficit is made up by higher payments later in the term.

From a security point of view, it should be noted that the amount of the loan actually increases over the early years, but then so also may the value of the underlying security.

If the amounts payable under a graduated mortgage are known and it is wished to calculate the interest rate the IRR Program can be used.

The G.M. Program automatically sets the calcuator to the 'Untaxed Mode'. Keys 31/43 can be used to return the calculator to the Tax Mode after the calcuation has been finished, if required.

MORTGAGE INTEREST RELIEF AT SOURCE (MIRAS)

With effect from April 1983 lenders, including Building Societies, are required to switch to a nett of tax basis for mortgage interest payments. The practise prior to this date was to charge a gross sum and then tax was recovered by a borrower from the Revenue, most usually by means of an adjustment to the P.A.Y.E. Code. In the normal repayment type mortgage typified by Example 58(a) the after tax cost to the borrower will increase from year to year as the interest element decreases and the capital repayment element increases, tax relief will diminish year by year.

The monthly after-tax cost of a Pre-April 1983 mortgage can be calculated as follows using the following formula:-

$$\left[A - B\left(\frac{C}{12}\right)\right] + B\left[\frac{C(1-T)}{12}\right]$$

A = Monthly Mortgage Instalment.
B = Mortgage Interest Rate expressed as a decimal.
C = Outstanding Loan Amount.
T = Tax Rate expressed as a decimal.

i.e. The Gross Monthly payment less the interest element equals the capital repayment instalment;
then the capital repayment plus interest after tax allowance equals the 'after tax' Monthly Payment.

Example using the data from Example 58(a) above:-

$$\left[91.81 - .10\left(\frac{10,000}{12}\right)\right] + .10\left[\frac{10,000(1 - .30)}{12}\right] = 66.81$$

From the point of view of the lender the previous system was relatively simple, as the gross repayment could be readily calculated because it stayed the same throughout the term of the mortgage, assuming no change in interest rates. The Revenue calculation was much more complex. The Finance Act 1982 now reverses the position!

The Building Societies have reacted by offering a number of alternatives:-

1) A transfer from a repayment mortgage to a interest only endowment mortgage repaid by an insurance policy.

2) A "Constant Nett" repayment mortgage. See Example (58) (b). This has the effect of increasing the initial nett sum payable, because capital repayments will be weighted to nearer the beginning when compared to the gross payment method.

3) The 1982 Act allows borrowers to opt for continuation of the same 'after tax' monthly payment as applied under the previous system namely £66.81 per month (See the illustration above). The Option offered to borrowers in these circumstances is the "Extended Term" Mortgage which allows even payments over a longer term. The length of the revised term can be calculated using the Basic Financial Keys. See the example in print-out form below:-

		XROM "BASIC"
BASIC		
	7.0000	XEQ B - - - - - - - I
I=7.0000		
	10,000.0000	XEQ C - - - - - - - PV
PV=10.000.0000		
	66.8100	ENTER
	12.0000	*
	801.7200	***
		CHS
	-801.7200	***
		XEQ D - - - - - - - PMT
PMT=-801.72		
		XEQ A - - - - - - - N
N=30.5140		

This can be cross-checked using the Program 'MTGE' as in Example 58(b) substituting 30.5 years for 25:-

		XROM "MTGE"
MTGE TERM=?		
	30.50	RUN
RATE%=?		
	7.00	RUN
LOAN?		
	10,000.00	RUN
MON.PMT=66.82		

4) The last option and one which is not popular with Building Societies is the "Gross Profile" mortgage which is in effect the same as recalculating the after tax rate every year. This might be referred to as an Increasing Mortgage Payment.

A Short Program is listed with two examples following. This program can be entered into the calculator if space is available; reference should be made to the Owner's Handbook and Section IX on Page 149 below on points of programming.

'IMP' PROGRAM LISTING

```
01#LBL "IMP"        |14 PROMPT          |27 1 E2            |40 X<->Y
02 CF00             |15 STO 01          |28 ÷               |41 "NMP="
03 FIX 2            |16 1               |29 x               |42 ARCL X
04 0                |17 "TAX RATE%=?"   |30 -               |43 AVIEW
05 STO 04           |18 PROMPT          |31 ST-03           |44 PSE      ) Replace
06 STO 05           |19 1 E2            |32 LASTX           |45 CLD      ) with
07 "GROSS INT%=?"   |20 ÷               |33 RCL 20          |46 RCL 03   ) "STOP"
08 PROMPT           |21 -               |34 x               |47 FS? 55   ) when no
09 STO 02           |22 STO 20          |35 +               |48 PRX      ) printer
10 "LOAN=?"         |23#LBL 01          |36 12              |49 PSE      ) attached.
11 PROMPT           |24 XEQ "PMT"       |37 ÷               |50 GTO 01
12 STO 03           |25 RCL 03          |38 1               |51 END
13 "MTGE TERM=?"    |26 RCL 02          |39 ST-01
```

Printer Listing of an Example using the Full Program.
(i.e. including Steps 44 to 49)

```
                |          |XROM "IMP"
GROSS INT%=?    |          |
                |    10.00 |RUN
LOAN=?          |          |
                |10,000.00 |RUN
MTGE TERM=?     |          |
                |    25.00 |RUN
TAX RATE%=?     |          |
                |    30.00 |RUN
NMP=66.81  -    |- - - - - |- - - - - - Displays 1st.Year's Nett Monthly Payment.
                | 9,898.32 |- - - - - -     "     "    "    Outstanding Balance.
NMP=67.06  -    |- - - - - |- - - - - -     "    2nd.  "    Nett Monthly Payment.
                | 9,786.47 |- - - - - -     "     "    "    Outstanding Balance.
and so on for Years 3 to 23, then:-
NMP=87.03  -    |- - - - - |- - - - - -     "   24th.  "    Nett Monthly Payment.
                | 1,001.53 |- - - - - -     "     "    "    Outstanding Balance.
NMP=89.30  -    |- - - - - |- - - - - -     "   25th.  "    Nett Monthly Payment.
                |     0.00 |- - - - - - Final Nil Balance.
```

N.B. If a printer is not used the 'R/S' Key (Keycode 84) stops the calculator when the result is displayed for one second and then starts it again.

Printer Listing of an Example using the Short Program.
(i.e. where "STOP" replaces Steps 44 to 49)

```
                    |          |XROM "IMP"
GROSS INT%=?        |          |
                    |    10.00 |RUN
LOAN=?              |          |
                    |10,000.00 |RUN
MTGE TERM=?         |          |
                    |    25.00 |RUN
TAX RATE%=?         |          |
                    |    30.00 |RUN
NMP=66.81           |          |
                    |          |RCL 03 - - - Recalls Balance.
                    | 9,898.32 |***
                    |          |RCL 01 - - - Recalls Remaining Years.
                    |    24.00 |***
                    |          |RUN
NMP=67.06           |          |
                    |          |RUN
NMP=67.34           |          |
                    |          |RUN
NMP=67.65           |          |
                    |          |RUN
            and so on to Year 25.
```

LOANS AT A DISCOUNT

(The value to the borrower of Cheap Loans)

Where mortgages and loans are on an interest only basis, i.e where the whole loan only becomes repayable at the end of the term, and where the interest is fixed for the whole term of the loan, any subsequent changes in market interest rates will make the loan or mortgage more valuable or less valuable to the lender and the borrower. This is obviously dependent on whose point of view is taken and whether market rates go up or down.

Many property companies have historic loans at fixed rates of interest well below current market rates and these loans have a substantial value to the companies concerned. These loans would also have to be sold at a substantial discount if the lender wished to dispose of them.

The Basic Section - Financial Keys can be used to assess the borrower's situation or the lender's situation as required.

What is the value to a company which has the benefit of a loan with twenty years to run, the amountof the principal payable on expiry is £100,000 and the interest payable is £6,000 per annum (i.e 6%) The current market borrowing rate is, say, 14%.

First calculate the interest payment which would have been payable by the borrower if current interest rates were applicable, i.e. 100,000 x $\frac{14}{100}$ = £14.000 p.a then deduct the actual payment of £6,000 which leaves a balance of £8,000. This represents the annual advantage to the borrower of the cheap loan, this can then be capitalised as follows:-

1) Press Basic Key - 'BAS' (Keycode 43)

2) Using the Financial Keys as described in the Basic Section N = 20 , I = 14, PMT = 8,000,

3) Pressing 'PV' without a data entry preceding it produces the result:- PV = -52,985.04 - representing the value of this cheap loan to the borrower, i.e. what he would have to pay out to gain a similar advantage.

alternatively,

1) Press Basic Key - Keycode 43

2) Using Financial Keys enter :- N = 20, I = 14 , PMT = 6,000, FV = 100,000,

3) Then press 'PV' (Keycode 13), USER, RCL (Keycode 33), 'E' (Keycode 15) , '+' (Keycode 61).

The other side of the coin is the value the lender might expect to get on sale, obviously he would have to sell at a discount on the redemption value.

N = 20, 1 = 14, PMT = 6,000 , FV = 100,000
PV= -47,014.96 This figure represents the price a potential purchaser could pay on the data given.

N.B. The minus sign convention is explained at the beginning of the Basic Section. Minus signs i.e. negative numbers, represent cash out flows and positive numbers represent cash receipts (actual or notional). Where no actual purchase or sale is contemplated , e.g. when a valuation of an existing investment is undertaken, the valuation must be done from the stand-point of a potential purchaser.

SECTION VI

THE EVOLUTION OF THE 'VALPAC' MODULE

The development of the VALPAC Module has taken place in a vacuum in as much as many of the programs were developed for the use of one individual and perhaps this represents too narrow a standpoint. It is hoped that VALPAC will elicit comments and suggestions from the valuation professions at large and that these can then be used to formulate improvements to the Module to make it broader based. The authors would like to hear from anyone who wishes to comment on the usefulness of the module in its present form, and also from anyone with suggestions for additions to be included in any updated version.

The most novel of the material contained in the module is that covered by the Advanced Section, and as such this Section represents that rationale for producing the module. The Basic Section is novel in parts, in that it brings together many of the more esoteric valuation tables under one umbrella, nevertheless the Basic Section is primarily concerned with the 5 Financial Key Functions. The more common financial functions have been covered by pre-programmed calculators for many years now.

The other programs (E/N, IRR, MIRR, NPV, and MTGE) can be found elsewhere in various forms in the computer and calculator world. The purpose behind the inclusion of these programs is to help complete what the authors believe to be a very powerful all-round valuation tool.

The evolution of the Advaced Section deserves closer attention, as it will help the user to understand more fully the programs contained therein.

Evolution of the Advanced Section.

The element common to all the programs in this section is growth. This aspect has become increasingly important with the onset of dramatic demand and monetary inflation and has in turn undermined the validity of many traditional valuation techniques. The programs in the Advanced Section are labelled in the sequence A to E and (a) to (e), each program can be thought of as progressive steps to solving the problems that growth has thrown up, albeit at the expense of further complexity.

Program A is designed to analyse traditional Freehold YP Valuation in the light of growth expectation. The growth expectation is implicit in any purchase at a lower initial yield than the higher rate of return that might reasonably be expected from an alternative investment.

This analysis tends towards the hypothetical, as there is a built-in assumption that the occupational lease is just commencing or that there has been a contemporaneous rent review.

Program B works in the same way as Program A, except that it allows for a term input to reflect the fact that a rent review period may be part expired and that the passing rent is to some extent historic. As Proram B uses data of a very specific nature, it seemed appropriate to change from I.Y./YP analysis to specific valuation.

Program B will value and analyse situations in which there is a term followed by a cycle of even rent review periods continuing in perpetuity. Where the rent reviews specified in the occupational lease are the same as would be sought by a

landlord in the open market at the present time, this is correct. However the situation often arises where the reviews specified in a lease are unfashionaly long.

Program C allows (assuming no Constant Rent uplift) for one or more abnormal rent review periods between the term and the reversion to a modern rent review pattern. In this program the term and the abnormal review periods have their rent payment mode controlled by the Mode Keys (Q+ etc) whilst the reversion (to modern terms) automatially assumes these terms include quarterly in advance rental payment. So far all three programs relate to freehold investments.

Program D relates to Investment Leaseholds where the occupational lease is co-terminus with the head-lease. In effect, this program is the same as C. but without the reversion to modern terms.

When the occupational Lease ends leaving a remainder to run of the head lease and where a new occupational lease can be granted for the remainder on modern terms then, Program E allows for the inclusion of this remainder. In this exercise it is also assumed that no Constant Rent uplift is allowed.

Taxation is an option available when using the above programs, but many an unsuspecting user will be disturbed by the way nett of tax valuations and analysis can upset investment thinking and criteria.

Whether the investment be freehold or leasehold, the normal prospect is that it will be sold at some time before the investment depreciates to nil. The acceleration of the tax consequences brought about by sale and the incidence of tax on capital gains can substantially affect the arithmetic.

Program (a) is th same program as E but with allowance for the receipt of a capital sum at the end of a given period of time. The sum can be received as a result of selling either a freehold or a leasehold.

Program (a) when operated in the "Taxed" mode provides for the valuation of an investment that has been owned for a number of years. It is therefore assumed that the base value for Capital Gains Tax purposes is known.

Program (b) always operates in the "TAXED" Mode and its only function is to value, (taking tax into account) where the assessed value represents a potential purchase price which will itself form the base value for capital gains tax purposes.

Program (c) has been included to demonstrate the gearing effect that the payment of a fixed ground-rent can have on the valuation of a leasehold investment. This program is merely the extension of Program D to allow for the payment of ground rent to the freeholder.

Program (d) again applies to leasehold investments and specifically to the application of the Dual Rate philosophy. Where the investor in a leasehold is not satisfied that he will be able to recoup his capital outlay at the overall rate of return, he can choose a separate rate for application in the recoupment exercise. Program (d) produced a Reduction Factor for application (by multiplication) to the valuatons obtained using Programs D & E to convert them into Dual Rate valuations. It should be noted that tax should not be taken into account twice. The choice is a fully nett of tax valuation using the Tax mode when using Programs D & E and then Program (d) without tax allowance OR a without tax valuation using D & E followed by Program (d) in the Taxed Mode. The latter procedure produces a result in line with traditional Taxed Dual Rate techniques which gross up the sums paid to the sinking fund to reflect the incidence of tax on the supporting income.

There are many points of debate about the validity of the traditional Dual Rate procedure including those appertaining to growth in relation to both the sum to be recouped and the payments to the sinking fund. Program (e) attempts to provide solutions for some of these problems.

It can be said in general terms that the Basic section covers the more simple problems and the Advanced section the more complicated. Where a problem is not susceptible to solution by either of these sections, the more laborious Programs NPV, IRR and MIRR can be called upon.

In the past mathematicl complexity has prevented proper examination of the problems that 'growth' has brought in its wake. These programs will solve such problems without a great input of labour.

The module contains a program covering Effective/Nominal rate conversions. It could be said that the lynch-pin of DCF is the Overall Rate selected, so it is vital to know and understand exactly what this rate purports to be. A particular rate of interest quotation can mean many different things, depending on the market that uses it. The MTGE program demonstrates this as in addition to finding the normal monthly payment under a "normal" Building Society mortgage, it <u>also</u> finds the Effective Annual Rate of interest. The normally qoted rate is not truly nominal and certainly is not effective and therefore a separate program is required to find the effective rate. A mortgage program is also included in the Advanced Section to demonstrate that growth allowance might become important in this area also. If the concern for first time borrowers is sincere, then, instead of the lender participating in the house equity an alternative would be mortgages that provide for graduated increases in repayment instalments over the initial few years. For example, a 25 year mortgage where the instalments increase at 10% p.a. over the first five years and from the sixth year onwards the instalments become fixed. However, it should be noted that in the early years the outstanding principal sum increases.

Various additional calculations have been included in the Mortgage Section to cover the "Mortgage Interest Relief At Source" problems.

POSSIBLE FUTURE TRENDS IN DCF APPLICATION

In the earlier explanation of the Combination Calculations at the end of the Advanced Section, the problem of voids was raised in the context of some risks still being implicit in the data chosen (or extracted from market transactions) for the Overall Yield or the Implied Growth Rate. This aspect deserves further consideration.

The traditional Years Purchase method of valuation is based upon the assessment of an appropriate interest rate for capitalising the initial income. This rate is commonly known as the All Risks Rate, to reflect the fact that every risk is supposedly implicitly allowed for in the rate chosen. Every facet of an individual investment must be reflected in this All Risks Rate. The most significant of these facets is the susceptibility of the income to growth and linked with growth must be the terms of the lease with regard to rent reviews. The main function of the Advanced Section Programs is to weigh and analyse the growth element in relation to the provisions of a lease. The object has been to build a mathematical model resembling the facts as closely as possible.

Whilst growth may be the most important, there are many other facets which have to be taken into account in the All Risks Rate, or alternatively allowance can be made by a reduction of the income to be valued . The DCF approach and to some extent the All Risks Rate approach requires that the income to be valued is the nett income after all outgoings have been deducted. By making appropriate provision against the income for known outgoings and by estimated annual provisions, many quasi-risks can be specifically allowed for at the income end of any calculation.

There are, however, a number of facets and risks that cannot be dealt with in this way. There are those matters that require the experience of the market place, for instance locational trends, but most of this experience can be analysed in terms of expected growth rates by analysing market comparables.

Finally, there are those risks which can be mathematically assessed but tend not to be, for instance, tenant default or the risk of a void period at the end of a lease and before a letting to another tenant. The problem in both cases is to assess the likelihood of the event and the duration. The application of Risk Analysis to these problems would add to the scientific validity of the DCF process though rarely altering the precision of the value calculations significantly. Once the average date of occurrence and the average duration have been assessed, the risk can be reflected in the Implied Growth Rate or the Overall Yield. See the Slice Calculation examples on Pages 57 to 60.

It is left to be decided which element should be selected to implicitly allow for the facets which have been explicitly analysed. The authors' choice would be the Implied Growth rate which might more properly be renamed the Risk Factor. The growth rate has already been shown to be influenced by such elements as location and it must reflect this and other risks. It would seem an unnecessary additional complication to turn the Overall Yield into an All Risks Rate excepting growth, (and one or two other minor risks), and thereby creating two variable elements. The Overall Yield should be the rate of return actually received over the investment time span. When an investment is valued any certain interruptions to the cash-flows should be specifically taken into account in the calculation, and potential risks to the cash flow should be evaluated and similarly be included with due weighting. Ideally every investment should be compared in terms of its Present Value by using the same Overall Yield for each and every investment, having allowed for every risk actual and potential in the calculation.

Risk Analysis has been greatly assisted by the advent of the computer with their vast capacity for storing data. Their potential is only being exploited in the property business of late and then only by the larger firms of surveyors on a fragmented basis for performance measurement. In due course the establishment of various data bases, and the analysis of performance statistics will help considerably in evaluating the risk aspect in property.

Another way in which computers have assisted in the making of business decisions is in the analysis of specific investments in the terms of their sensitivity to changes in input assumptions, for instance in relation to growth. Sensitivity Analysis is outside the scope of this book, in essence it boils down to carrying out a number of calculations using a range of data inputs for a given variable (e.g growth) covering the likely range of possibilities.A short routine for repeat calculations is described in the next section on Page 125, this avoids the necessity of having to repeat all the inputs for a repeat calculation where there is just one item of variable data.

SECTION VII

FORMULAE DESCRIPTION AND PROGRAM AND CALCULATOR OPERATIONAL LIMITS

FORMULAE DESCRIPTION

It would not be practical to set out all the formulae in full, so only the main formulae are given and then only if they are not readily available elsewhere.

The two formulae covering Freeholds and Leaseholds which form the basis of the Advanced Programs are set out below. The more complicated formulae used in the Advanced Section are a combination of these two formulae, linked by various combinations of the simple formulae covering:- the Amount of £1, to allow for growth; the Present Value of £1, for discounting; and the Present Value of £1 per annum, to allow for fixed term income.

(A) FREEHOLD: YEARS PURCHASE ALLOWING FOR GROWTH.

$$\frac{1}{R}\left[\frac{(1+R)^{Z}-1}{(1+R)^{Z}-(1+G)^{Z}}\right]$$

Notation:-

R = Overall Yield expressed as a decimal i.e. 5% = 0.05.
Z = Interval between rent reviews in years.
G = Anticipated Growth Rate expressed as a decimal.

(B) LEASEHOLD: YEARS PURCHASE ALLOWING FOR GROWTH.

$$\frac{1}{R}\left[\frac{(1+R)^{Z}-1}{(1+R)^{Z}-(1+G)^{Z}} \times \frac{(1+R)^{N}-(1+G)^{N}}{(1+R)^{N}-1} \times \left(1-\frac{1}{(1+R)^{N}}\right)\right]$$

Notation:-

N = Total Length of the lease in years.

(C) NOMINAL and EFFECTIVE RATE CONVERSIONS.

NOMINAL TO EFFECTIVE WITH PAYMENTS IN ARREAR.

$$Y = \left(1 + \frac{X}{M}\right)^{M} - 1$$

NOMINAL TO EFFECTIVE WITH PAYMENTS IN ADVANCE.

$$Y = \left(1 - \frac{X}{M}\right)^{-M} - 1$$

EFFECTIVE TO NOMINAL WITH PAYMENTS IN ARREAR.

$$X = M\left[(1 + Y)^{\frac{1}{M}} - 1\right]$$

EFFECTIVE TO NOMINAL WITH PAYMENTS IN ADVANCE.

$$X = M\left[1 - (1 + Y)^{-\frac{1}{M}}\right]$$

Notation:-

X = The Nominal Annual Rate expressed as a decimal.
Y = The Effective Annual Rate expressed as a decimal.
M = The number of income payments per annum.

(D) The Formula for the COMPOUND INTEREST SOLUTIONS when using the Financial Keys is:-

$$0 = PV + (1 + Is)PMT\left[\frac{1 - (1 + I)^{-N}}{I}\right] + FV(1 + I)^{-N}$$

Note:-
(1) The symbols above match the Financial Keys of the Top Row of the Calculator except 'I' which is the discounting rate expressed as a decimal i.e. 6% = .06.
(2) s = 1 when the payments (PMT) are in advance
s = 0 when the payments (PMT) are in arrear.

(E) The Formula for the MODIFIED INTERNAL RATE of RETURN Calculation is:-

$$MIRR = 100\left[\left(\frac{NFV(\text{Positive CFs})}{-NPV(\text{Negative CFs})}\right)^{\frac{1}{N}} - 1\right]$$

NFV (Positive CFs) = The Nett Future Value of the positive cash flows compounded at the 'Risk' Rate.

NPV (Negative CFs) = The Nett Present Value of the negative cash flows discounted at the 'Safe' Rate.

(F) The STOCK MARKET Formula for calculating the price of a Long-dated GILT-EDGED STOCK:

$$\text{Gross Price} = \frac{\frac{\text{Coupon}}{2}\left[1 + \frac{1 - (1 + i)^{-N}}{i}\right] + 100(1 + i)^{-N}}{1 + \left(\frac{d}{365} \times 2i\right)}$$

given:-

Coupon = The denomination or coupon of the stock expressed as a percentage.

i = The Nominal half-yearly discounting rate expressed as a decimal, i.e. half the generally quoted Gross Redemption Yield divided by 100.

N = The number of whole discounting periods (i.e half years) from the date of the next dividend due to the purchaser.

d = The number of days from Settlement Day to the next dividend payment due to the purchaser.

(G) The INITIAL ANNUAL SINKING FUND PAYMENT necessary to recoup £1 in the future, allowing for growth of payments at given intervals:-

Initial Annual Sinking Fund Payment =

$$\frac{SFR}{(1 + SFR)^{N} - (1 + G)^{N}} \times \frac{(1 + SFR)^{Z} - (1 + G)^{Z}}{(1 + SFR)^{Z} - 1}$$

where:-

SFR = The Sinking Fund Accumulation Rate expressed as a decimal.

N = Term in years of the Sinking Fund.

Z = Interval between growth adjustments in years.

G = The Growth Rate expressed as a decimal.

PROGRAM AND CALCULATOR OPERATIONAL LIMITS

Whatever the number of decimal places shown by the calculator's display, the calculator will always calculate using the 10 available digits and a two digit exponent of 10, see page 31 of the Owner's Handbook. This specification determines the ultimate limit of accuracy, however it is more likely that accuracy will be determined by the precision of the User's data having regard both to the science applied in choosing the data and the number of decimal places used when making the data entries.

The calculator's accuracy is indisputably sufficient for the needs of property valuation. It is likely that in practise a further rounding up of figures will become normal over and above the rounding up of the data in the examples given in this book.

The programs themselves are as accurate as the data and the calculator's specification will allow, with the exception of those programs which have to find a solution by way of trial and error, or reiteration. This involves the calculation of an answer for an unknown element in a formula, using an intial guess for the unknown data element followed by improved guesses until the required degree of similarity is obtained to the known answer for the formula solution. For instance, all the Advanced Programs with the facility to analyse an investment in terms of Initial Yield, Implied Growth Rate and Overall Yield, rely on one formula which finds a solution for the Initial Yield. The Overall Yield and Implied Growth Rate are found by reiteration. The reasons for this are, necessity in the case of the former, and economy of program space in the latter.

The accuracy of these reiterative solutions is variable, but subject to the comments below, they are accurate to one ten thousandths of one percent at least.

The property sector can produce some extremes in the world of investment not found anywhere else. The short leasehold represents one end of the spectrum, and the long term reversionary freehold the other, and finding a formula producing converging reiterations for both types of investments is not easy. When judged in terms of their respective capital values and in particular in relation to the equivalent percentage changes in their initial yields short leaseholds are extremely volatile and long term reversions are extremely placid. In other words the intial yield is much more significant in the short leasehold calculation, than in the long term reversionary freehold calculation. In extreme cases, the reiterations may take 3 to 4 minutes before a solution is achieved.

In the preceding Examples in the Advanced Section, the use of zero rent is permissible although in theory reiterations should not be possible with a nil reserved rent which gives rise to a nil initial yield. In this instance, and also where the calculator attempts to divide by zero in some other programs, zero is replaced by a minute fraction. This nominal figure will marginally affect the accuracy of the calculation. The ability to use zero entries for data does, however, greatly extend the flexibility of the various programs. Example 10 given under Advanced Program B shows the use of zero rent being used to reflect a development situation. The calculation in this case finds the present capital value, but had this been known the implied growth rate or the overall yield could have been calculated. If the example had been calculated using entries of 6 decimal places, the PV would be 88.356323. If this PV is used to calculate the I.G, the answer shown is 9.380731% (9.391623) or alternatively the O.Y. is 14.010490% (14%). The figures in brackets are the accurate data. The discrepancy is not very significant, but if the user is troubled by this inaccuracy, he can always use the I.Y. calculation to check accuracy by comparing the capital value

found against the known value. This last calculation does not depend on reiteration and is, therefore, accurate to within the limits of the calculator and the data provided.

A zero input for the "MOD.REVIEW P?" prompt in Programs (a) and (b) can produce problems if very small initial yields are used. It is better practise to use 1 or any other numeral; Zero in response to the 'REMAINDER' prompt still nullifies the remainder element if required.

Whilst on the subject of numerical accuracy, it should be noted that where a fraction of a year is used as a data input, the discounting rate applied will be the appropriate nominal rate for that fraction of a year which would give the effective end of year rate specified, on the assumption that a proportion of the year's income will be due at the end of the fractional period.

Finally there is one important disadvantage to the Advanced Section Programs, namely that all the data entries have to be re-entered every time that changes of assumptions (e.g. as to growth rates) are tested in repeat calculations. There are two possible short cuts:-

i) It has been shown in the Equivalence Factor calculation that it is not necessary to enter data for IG or the OY on the second prompts. It is only necessary to press Key R/S (84) and the previous entries will remain in place, providing no numeral key has been pressed in advance. This facility exists for the IG and OY prompts alone in all the other Advanced Section Programs also.

ii) Programs B, C, D, E and (a) can be recalculated by using the 'XEQ 15' function. This is achieved by going out of USER Mode. Pressing key 'XEQ' (Keycode 32) following by the numerals '1' and '5'. Some data entries can be changed by placing the revised figure(s) in the appropriate store(s). A list of stores is given below, with the appropriate storage configuration:-

STORE
NUMBER

01 - 1 + Overall Yield (expressed as a decimal).
02 - Review Period.
03 - 1 + Growth Rate (expressed as a decimal) i.e. 8% Growth would be entered as 1.08.
05 - 1 + Initial Yield (expressed as a decimal).
07 - Rack Rent (After Tax if appropriate).
08 - Term to rent review or reversion.
16 - Rent Reserved (After tax if appropriate).

Alterations can be made to the entries listed above, by storing revised figures as follows:- Out of User Mode, Data entry, Pressing 'STO' (Keycode 33) followed by the two digit store code number, and then 'XEQ' 15. See overleaf for an example.

By way of example, Advanced Program B Example 10 could have been recalculated using 4 years instead of 3 for completing the developement without re-entering the other data, as follows:-

Step	Key
17	USER
18	4
19	STO 08
20	XEQ 15

Result = 84.7841

N.B. A PV input is never stored. It is prompted and then used to find the I.Y.

Intial Rent ÷ PV = I.Y. expressed as a decimal.
1 + I.Y. is then stored in Store 05.

SECTION VIII

A COMMENTARY ON DUAL RATE AND SINKING FUND THEORY WITH SELECTED CALCULATIONS

The philosophy of this chapter is to analyse, and then suggest the means to solve problems arising out of the application of the Dual Rate method of valuing terminable interests in property.

In providing the programs, the authors wish in no way to apply an editorial process to their selection and the individual valuer must decide whether or not the programs are valid and whether or not to use them.

The valuation of terminable interests (e.g leaseholds) in comparison with freeholds has always presented problems of a special nature. The chief of these problems is that the investor in a terminable interest, being a wasting asset, has to recoup his original investment outlay over the term of the investment, whilst the freeholder can in theory get all his money back at any time by reselling the investment.

The so-called Single Rate Years Purchase multiple is the primary method of valuing terminable interests and is no more or less than the Present Value of £1 per annum for a given period capitalised at a given interest rate. This Single Rate basis assumes that the capital outlay is recouped by the accumulation of income, usually thought of as equal annual amounts, plus the accretion of interest at a rate equal to the capitalisation rate. Where the accretion rate equals the remunerative rate, any accumulation schedule is valid within the confines of the total income without affecting the Y.P. figure; this is not true where Dual Rates are used.

Dual Rate theory,on the other hand, allows one rate for the remunerative return on the investment and another rate for the accretion of interest on the accumulation fund, thereby reflecting the position where the amounts set aside for accumulation cannot be reinvested at the remunerative rate. A problem arises in fixing an appropriate interest rate for accretion, as the future returns available in the market will vary from one year to the next.

This problem was thought to be solved when an investor took out a Sinking Fund Policy with an insurance company. The policy provided for the payment of a fixed capital sum at an agreed future date in exchange for equal fixed payments throughout the term of the policy. The payments to the Sinking Fund were assessed allowing a notional annual return to the investor. In view of the uncertainties over the future rates of interest available, the guaranteed return on the Sinking Fund payments would be relatively small and appeared even smaller as it was the practice to quote a 'nett of tax' rate.

Although tax had been taken into account in the accretion rate, it was also felt in the past that to put a leaseholder on the same footing as a freeholder, it was necessary to reflect the fact that payments to the Sinking Fund had to be found out of 'after tax' income. Therefore an adaption to gross up the Sinking Fund payments was added to the Dual Rate formula to reflect this defect.

BASIC SECTION, Program (d) covers the Traditional Dual Rate calculation with optional allowance for tax. See Example 60 below.

In the present day and age it would be extremely rare for an investor to actually take out a Sinking Fund Policy; however, the Dual Rate technique founded on the Sinking Fund Policy assumption still lingers on in valuation theory and methodology. All would probably now agree that the calculation of a Dual Rate

Years Purchase figure is a theoretical exercise. The Pocket Oxford Dictionary defines "theoretical" as:-

> "of or in or of the nature of theory, not based on or concerned with practice, merely supposed to be true or exist, unpractical".

In the view of many valuers, this definition could not be more appropriate, when applied to the Dual Rate concept.

The use of traditional Dual Rate (with tax) calculations has come in for some recent criticism, and even their validity challenged. The questions to be decided are:-

1. Are Dual Rates valid on first principles?

and if so

2. Can they be adapted to modern conditions and valuation techniques?

The criticisms:-

(a) The traditional capitalisation rate does not represent the anticipated return to an investor if rent reviews and rental growth are taken into account.

This criticism is valid when aimed at any attempt to value leaseholds by means of an All Risks Capitalisation Rate. The deficiencies of the All Rsks Rate have been discussed earlier. An added deficiency inherent in the traditional Dual Rate theory is that in many cases the income supporting the Sinking Fund payments will be subject to growth. This has the effect of producing a gearing element that goes unrecognised in traditional Dual Rate calculations. The Advanced Section programs substitute an Overall Yield in place of the All Risks Rate in more complicated formulae and make specific allowance for rent reviews and growth. This Overall Yield can be used in place of the traditional capitalisation rate in the Dual Rate formula. Advanced Section Program (d) gives an adjustment factor to convert Single Rate valuations (with or without growth allowance) into the Dual Rate equivalent. See Example 61.

(b) Taxation affects the whole of the income and not just the Sinking Fund payments element and the accretion interest rate. Also the very nature of certain terminable interests limits potential investors to a non-tax paying category.

In the case of this criticism, it is clearly illogical to value an investment taking tax into account, if the particular market for it is dominated by tax-exempt investors. In the Advanced Section we have seen that fully nett of tax valuations can readily be made, if need be, and thereby making the traditional grossing up exercise on the Sinking Fund payments redundant.

(c) The accretion interest rate assumed in a Sinking Fund Policy does not represent the most effective way of recouping capital.

This is patently true, or more people would be taking out policies. If it is thought that recoupment can be achieved at the Overall Yield, then Dual Rates are obsolete. However, it is postulated that circumstances may still exist where an investor may wish to assess recoupment at a different rate. In many recent treatises on DCF it has been suggested that the Overall Yield should be fixed by reference to the undated Gilt-Edged Stocks plus an addition of 2% to reflect the increased risk inherent in a property investment (assuming erroneously that risks are

similar between individual properties). There is inherent in this approach an assumption that the Overall Rate will not be achieved. Extending this argument, it can be seen that a safe investment rate for interest accretion on the recoupment fund can never be the same as the Overall Yield if an abitrary addition is made.

Therefore it seems that Dual Rates may have a place, but returning to first principles clouds the issue, as will be seen below. From a DCF standpoint, it seems unfortunate, having so recently escaped from the tyranny of the All Risks rate, to turn the Overall Yield into an All Risks (except growth) Rate. The logical approach should be to weigh up every risk and then specifically take them into account. This argument, even if accepted, might still leave a material difference, though much reduced, between the Overall Rate and the accretion rate, and therefore justifying the use of Dual Rates.

In considering first principles, the opening statements in this introduction should be recalled, namely that when comparing leaseholds with freeholds the recoupment of capital is the problem.

In the event of rational valuation establishing different categories of appropriate purchasers for freeholds and for leaseholds, should the two interests be compared?. Are freeholds a homogeneous group? The first question must be answered by individual investors, and the second is answered in the subsequent paragraphs.

In essence, the concept of recoupment refects an investor's concern about reinvesting income (or part of it) on its receipt. This concept is a departure from normal valuation practice which makes no allowance for what happens to cash flows after their receipt by the investor. When any two investments are compared, using a DCF approach, exact comparability in terms of Nett Present Value or Internal Rate of Return must be examined against the investor's requirements vis-a-vis cash flow timing. Differing cash flow schedules should be tested against the investor's reinvestment assumptions, if any, for cash flow receipts, i.e. if he does not have a requirement for income, comparability between investments must take into account the reinvestment of that income.

Is it reasonable to single out the reinvestment dilemma that may exist in respect of the part of the income receipts from leaseholds used for recoupment, when reinvestment may be a problem relevant to all income from every type of investment?

As an interesting exercise, 4 investments are set out below, all valued at a Present Value of £100 using an Overall Yield of 20% as the capitalisation rate; future growth is assumed to be non-existent. The yield on these investments is then reassessed, assuming cash flows can be reinvested at only 14% per annum. This approach assesses an investment on the basis that cash flows are kept, reinvested and accounted for until the end of the investment term.

The investments below have the same value, run for the same period and yield the same return, but the cash flow profiles are very different.

The investments are valued using a 20% Capitalisation Rate:-

(a) A leasehold of 10 years (Single Rate) -	£23.85 p.a.	PV = 100
(b) A leasehold of 10 years (Dual Rate 20/14)* -	£25.17 p.a.	PV = 100
(c) Rack Rental freehold sold after 10 years -	£20 p.a.	PV = 100
(d) Reversionary Freehold sold on a 5 Y.P. after 10 years (Review at 6th year). - Passing Rent	£5 p.a.	
- Rent at Review	£42.32 p.a.	PV = 100

* Overall Yield rate used with a realistic accretion rate.

This is a simplistic exercise to demonstrate a point and requires the belief that the capitalisation rate is fixed in a period where there are no risks and no growth expectations. The next part of the exercise uses Program MIRR to assess the actual return over the investment period on the assumption that income received is re-invested at 14%.

(a) Modified Return = 16.52% - Single Rate
(b) -do- = 17.15% - Dual Rate
(c) -do- = 17.15% - Freehold
(d) -do- = 18.69% - Reversionary Freehold

This exercise demonstrates the fact that the dual rate calculation can successfully produce equality, in this environment, between the Dual Rate leasehold and the rack rented freehold; but has not reflected the broader reinvestment dilemma and has not made a leasehold comparable with a reversionary freehold. The advantage of deferred cash flow receipts inherent in reversionary situations, or in situations where growth is taken into account specifically, is increased when allowance is made for tax.

A look at the investments recalculated to show their 'after-tax' return is interesting. A 50% rate of tax has been selected.

(a). After Tax Return = 3.34%.

(b). (a) above demonstrates that leaseholds of this nature are not an appropriate investment for a 50% taxpayer. If a Sinking Fund accretion rate is higher than the remunerative rate, the investor ought to be in the business of granting Sinking Fund Policies and not in property investment.

(c) After Tax Return = 10%.

(d) After Tax Return = 12.74% if held in perpetuity.
14.44% if sold in 10 years NIL CGT.
13.22% -do- 30% CGT.
12.32% -do- 50% CGT.

Two further examples show the extra dimension that explicit growth allowance produces:-

Example:-

Rack Rented Freehold valued @	£100.
Passing Rent and Market Rent	£11.80 p.a.
Rent Review Pattern	5 years.
Annual Growth Rate	10%.
Overall Yield	20%.
After Tax Return (50% Tax)	14.96%

(if held in perpetuity or sold in 10 years and nil CGT)

Example:-

Reversionay Freehold value at	£100.
Passing Rent	£2 p.a.
Reversion to full rental value after	£17.14 p.a. 5 years.
Rent Review Pattern thereafter	5 yearly.
Annual Growth Rate	10%.
Overall Yield	20%.
After Tax Return (50% Tax) (if held in perpetuity)	15.78%
After TAX Return (50% Tax) (if sold in 10 years with nil CGT)	17.21%

If Dual Rate theory is thought to be valid, then there are a number of complications which can be included. See over.

One complication relatively recently introduced has been to recalculate the standard Dual Rate tables to reflect the fact that income is received quarterly in advance and that likewise payments to the Sinking Fund are paid quarterly in advance. This exercise has not been included in the calculator programs. Is it valid in any case?

The standard Dual Rate Formula on an Annually in Arrear basis allowing for tax is:-

$$\frac{1}{i + ASF\left(\frac{100}{100 - T}\right)}$$

The formula allowing for payments Quarterly in Advance is:-

$$\frac{1}{\frac{i}{A} + \frac{ASF}{B}\left(\frac{100}{100 - T}\right)}$$

where:-

i = The Capitalisation or Remunerative Rate expressed as a percentage. In traditional Dual Rate application, this figure is the All Risks Rate and surely one of the aspects implicitly taken into account is the rent payment mode. In the DCF techniques described in the Advanced Section, allowance is made elsewhere specifically for the appropriate rent payment mode and the Overall Yield is the effective annual rate.

ASF = The annual Sinking Fund payment to recoup £1.

A = The adjustment factor (calculated using the Basic Section, Program (a)) to reflect quarterly in advance payments at the remunerative rate.

B = The adjustment factor to reflect quarter in advance payments at the Sinking Fund accretion rate. Do insurance companies give credit for advance payments , if so, they are more generous than the Building Societies?

Even if they do, the adapted formula is suspect, as this adjustment to the Sinking Fund payment reduces it and thereby increases the Years Purchase figure.

Can it really be an advantage to have to pay Sinking Fund payments earlier than previously assumed?

The adapted formula has failed to take note that the Sinking Fund payments have to be found out of money which would otherwise earn the remunerative rate.

A further adaptation to the formula to reflect this last point might be:-

$$\frac{1}{\frac{i}{A} + \frac{ASF \times A}{B}}$$

It is left to the user to make calculations to determine the significance of the variations in results between the formulae, although in fairness it must be stated that the variations will usually be quite small.

There are a number of other complications which are dealt with by program applications and the notes that follow. They are best dealt with by example and only a brief outline is given in the next pargraphs.

The question of rental growth is dealt with under the Advanced Section and the adaption of the Advanced Programs covering the leasehold interests to Dual Rate principles is covered by Advanced Section Program (d), an example is also given in this section. It should be noted that the ratio of the initial income to the Sinking Fund payment will be very different when rental growth is taken into account. Normally, Sinking Fund payments are assumed to be fixed equal annual amounts throughout the length of the investment and in extreme cases the Sinking Fund payment may exceed the initial income when the initial income is low.

As the actual purchase of a Sinking Fund Policy is not now very common, there seems to be no reason why an investor should not plan the recoupment of his capital by payments to his imaginary Sinking Fund graduated to suit his own growth assumption. Growth can take two forms, firstly, if, as in the traditional Dual Rate calculation, the remunerative rate is taken to be an All Risks Rate (i.e. a rate in which growth is implicit), the income supporting the Sinking Fund payments must also be subject to growth. This fact goes unrecognised in the traditional Dual Rate calculation. Advanced Section Program (e) covers this situation by calculating a revised Y.P figure, assuming that the growing income relating to the Sinking Fund payment is actually contributed to the Sinking Fund. The second form of graduated Sinking Fund payment would be where an Overall Yield (as explained previously) is applied in the Dual Rate calculation and growth of income is taken specifically into account. This aspect is covered in the appendix to this section Growth allowance in the latter case serving only to weight the Sinking Fund Payments towards the end of the investment time scale in place of the traditional fixed even payments.

Advanced Section Program (e) also has the facility to allow for growth of the amount to be recouped using a rate of increase separate from the growth rate applied to the income. This facility has been included to cover the argument which has been put forward that for leaseholds and freeholds to be compared the target for recoupment is the value to which a freehold would have appreciated and not the original purchase price. This growth allowance will further increase the risk of the Sinking Fund payments exceeding the initial income.

INDEX OF BASIC AND ADVANCED DUAL RATE AND SINKING FUND EXAMPLES

EXAMPLE **60.**

(a) **TRADITIONAL DUAL RATE YEARS PURCHASE MULTIPLE**
with optional grossing up of the Sinking Fund
Payment to reflect income tax at a given rate.
Basic Section Program (d).

Given:- Example 60 Data:-

Income Tax Rate - - - - - - - - - - - - - - - - 30% p.a.
Overall Yield/Capitalisation Rate - - - - - 14% p.a.
Term of Sinking Fund/Terminable Interest - - 15 years.
Sinking Fund Accretion Rate - - - - - - - - 8% p.a.

Following the normal Dual Rate convention, the Sinking Fund Accretion Rate is a nett of tax figure, i.e. 8% implies a before tax yield of $\frac{8}{0.7}$ = 11.43% at the tax rate of 30%.

The tax rate does not affect the normal income cash flows after deducting the Sinking Fund element; this income is valued gross in accordance with traditional practice.

See the introduction for comments on the Overall Yield used in 'Advanced' calculations and, on the tradtional All Risks Capitalisation Rate.

(b) Finds the **ANNUAL SINKING FUND PAYMENT** to recoup £1 at a given time in the future, and the amount necessary to recoup the Y.P. calculated.

See overleaf for the Example Listing.

EXAMPLE **61.**

Finds **THE EQUIVALENT SINGLE RATE FOR GIVEN DUAL RATE DATA.**

Given:- Example 61 Data:-

Income Tax Rate - - - - - - - - - - - - - - - - 30% p.a.
Overall Yield - - - - - - - - - - - - - - - - 14% p.a.
Term of Sinking Fund - - - - - - - - - - - - 15 years.
Sinking Fund Accretion Rate - - - - - - - - 8% p.a.

The steps are the same as in Example 60 up until the Dual Rate Y.P. is displayed after Step 13. Step 14 will be to key '(e)' (Keycode 31/15), which will result in a display of the equivalent rate of interest which will produce the same Present Value of £1 p.a. on a Single Rate basis as was calculated previously on a Dual Rate basis.

See overleaf for the Example Listing.

EXAMPLE 60. TRADITIONAL DUAL RATE Y.P.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Basic Section	BAS	43	BASIC		
2	Program (d)	(d)	31/14	(UNTAXED) OVRL.YIELD%?	 OY/Capitalisation Rate	Tax Status
3	Tax On/Off	(TAX)	31/41	TAXED		Taxed Mode
4	Basic Section	BAS	43	BASIC		
5	Program (d)	(d)	31/14	(TAXED) INCOME TAX?	 Income Tax Rate for Grossing Up.	Tax Status
6	30% Income Tax	30		30		
7		RUN	84	OVRL.YIELD%?	OY/Capitalisation Rate	
8	14% Overall Yield	14		14		
9		RUN	84	SF TERM?	Period of Investment	
10	15 Year Term	15		15		
11		RUN	84	SF RATE?	Sinking Fund Rate	
12	8% Accretion Rate	8		8		
13		RUN	84	YP=5.1917	- RESULT = Y.P.	
14		RUN	84	ASF=0.0368	- to recoup £1.	
15		X	71	0.1912	- to recoup Y.P.	

EXAMPLE 61. EQUIVALENT SINGLE RATE.

13		RUN	84	YP=5.1917		YP Displayed.
14	Program (e)	(e)	31/15	ESR=17.5600	- RESULT=Equivalent Single Rate	

EXAMPLE **62**

Finds **A REDUCTION FACTOR** to convert a Single Rate valuation (with or without rental growth allowance) into a Dual Rate basis valuation, assuming even payments to the Sinking Fund.

Any Leasehold valuation can be converted from Single to Dual Rate by multiplying the Single Rate valuation by the Reduction Factor. This is particularly useful where valuations have been carried out using the Advanced Section Programs with explicit allowance for rental growth.

The Reduction Factor Program assumes that the Sinking Fund payments remain the same throughout the life of the investment, thereby following current traditional practice. As mentioned earlier, it can result in the Sinking Fund payments initially exceeding the current income from the property, e.g. where the property is highly reversionary and/or where there are high growth expectations.

Example 62, Part 1. Single Rate Valuation.

Given:-	Data:-
Head Lease Term	17 years.
Ground Rent	nil.
Passing Rent	£1 p.a.
Sub-lease Term to Review	2 years.
Current Market Rental Value	£7 p.a.
Rent Review Pattern in Reversion	5 yearly.
Annual Growth Rate	9.4%.
Overall Yield Requirement	14%.
Rent Payment Mode	Q+.

RESULT:- Value = £61.3087

See the Example Listing overleaf.

To find the value on a Dual Rate basis, first value on the Single Rate basis as above and secondly find the Reduction Factor.

Example 62, Part 2. Finds the Reduction Factor.
Given that the desired Sinking Fund Accretion Rate is 10%,

The Reduction Factor = 0.9529

See the Example Listing on Page 139.

then, multiply the single rate valuation by the Reduction Factor i.e.
£61.3087 x0.9529 = £58.4237 to find the value on a Dual Rate basis.

It will be noted that tax has not been taken into account in calculating the Single Rate value, or in calculating the Reduction Factor. Tax could have been taken into account in one or the other, but not both. If tax is to be deducted from all the income, allowance should be made when valuing, i.e. using the tax mode in the Advanced Section, or if tax is only to be taken into account for the purpose of grossing up the Sinking Fund payment, then calculate the Reduction Factor in the Tax Mode.

Returning to the example, the Sinking Fund payments necessary to recoup the adjusted value can be checked using the Basic Section Financial Keys. See Example 62, Part 3 on Page 139. In the example above there is a deficit of initial income in relation to the Sinking Fund payment.

EXAMPLE 62, Part 1. SINGLE RATE VALUATION.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advance Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2	Program D	D	14	MODE?	Rent Payment Mode	
3	Qtrly in Advance	Q+	23	WHICH CALC?	Element for Analysis	
4	IY/Valuation	IY/VAL	32	REVIEW P?	Rent Review Period	
5	5 Yearly Review	5		5		
6		RUN	84	OVRL.YIELD%?	Overall Yield	
7	14% Overall Yield	14		14		
8		RUN	84	GROWTH%?	Assumed Growth Rate	
9	9.4% Growth Rate	9.4		9.4		
10		RUN	84	RENT RES.?	Rent Reserved	
11	£1 Passing Rent	1		1		
12		RUN	84	RACK RENT?	Rack Rent	
13	£7 Est. Mkt. Rent	7		7		
14		RUN	84	TERM?	Term to Review	
15	2 Years to Review	2		2		
16		RUN	84	NUMBER OF P?	No.of RP Unexpired	
17	3 Unexpired RP	3		3		
18		RUN	84	(IY%=1.6311) 61.3087	- RESULT = VALUE	Flashes IY

EXAMPLE 62, Part 2. REDUCTION FACTOR TO CONVERT FROM A SINGLE TO DUAL RATE BASIS VALUATION.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advance Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2	Program (d)	(d)	31/14	OVRL.YIELD%?	Overall Yield	
3	14% Overall Yield	14		14		
4		RUN	84	SF TERM?	Period of Investment	
5	17 Year Period	17		17		
6		RUN	84	SF RATE%?	Sinking Fund Rate	Accretion %.
7	10% Accretion Rate	10		10		
8		RUN	84	RF=0.9529	- REDUCTION FACTOR.	
9		61.3087		61.3087	- ENTERS SINGLE RATE VALUE.	
10		X	71	58.4237	- RESULT = THE ADJUSTED VALUE.	

EXAMPLE 62, Part 3. ANNUAL SINKING FUND PAYMENT.

1	Basic Section	BAS	43	BASIC		
2		17		17		
3		N	11	N=17.0000		
4		10		10		
5		I	12	I=10.0000		
6		58.4327		58.4327		
7		FV	15	FV=58.4237		
8		PMT	14	PMT=1.4410	- RESULT = SINKING FUND PAYMENT	

Note that the SFP of £1.4410 compares with an Initial Yield of £1 i.e. the Sinking Fund Payment exceeds the initial income.

EXAMPLE **63.**

(a) Finds a **DUAL RATE YEARS PURCHASE MULTIPLE ALLOWING FOR THE GROWTH OF THE SINKING FUND PAYMENTS** (SFP) in line with the rental growth expectations implicit where the capitalisation rate is an All Risks Rate. (Optional grossing up of the SFP to reflect income tax).

Advanced Section, Program (e).

Given:- Example 63 Data:-

Capitalisation Rate - - - - - - - - - - - - - - - 8%.
Term of Sinking Fund/Terminable Interest - - 15 years.
Sinking Fund Accretion Rate - - - - - - - - - 3½%.
SFP Growth Rate - - - - - - - - - - - - - - - - 9.4%.
Period between the Growth Adjustment dates - 5 years.

(b) Finds the first annual SFP to recoup £1 at a given date in the future, and the payment necessary to recoup the Y.P. figure calculated.

See overleaf for the Example Listing.

N.B. (i) The calculation in Part (b) of this example finds the SFP for the first year, which will remain fixed until the next growth adjustment date in five years time. The second and third five year tranches can be calculated by using the Basic Section Financial Keys in the following sequence:-

STEP	SFP AFTER 5 YEARS	SFP AFTER 10 YEARS
1	'BAS' Key	'BAS' Key
2	5	10
3	N	N
4	9.4	9.4
5	I	I
6	-.2893	-.2893
7	PV	PV
8	FV	FV
RESULT	FV= .4534	FV= .7104

N.B. (ii) The growth allowance in respect of SFP permitted by Advanced Section Program (e) is only valid if the capitalisation rate has implicitly allowed for the growth of rental income. This allowance for SFP growth circumvents the defect in traditional Dual Rate methodology which ignores growth in the income supporting the SFP, by allowing the SFP to increase at the implied or implicit growth rate. If the user baulks at the idea of graduated SFP, the gearing element can be assessed by valuing on a Single Rate basis, allowing for growth and the applying a Reduction Factor as described in Example 62 above.

EXAMPLE 63. DUAL RATE YP ALLOWING FOR THE GROWTH OF THE SFPs.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advance Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2	Program (e)	(e)	31/15	FVG??		
3		0		0		0 Sterilises
4		RUN	84	OVRL.YIELD%?	Capitalisation Rate	
5	8% All Risks Rate	8		8		
6		RUN	84	SF TERM?	Period of Investment	
7	15 Years	15		15		
8		RUN	84	SF RATE%?	Sinkind Fund Rate	Accretion %.
9	3.5% Accretion Rate	3.5		3.5		
10		RUN	84	GROWTH%?	Growth Rate of SFPs	
11	9.4% Growth Rate	9.4		9.4		
12		RUN	84	REVIEW P?	Period between Growth Adjustments	
13	5 Years	5		5		
14		RUN	84	YP=8.8842	- RESULT = YEARS PURCHASE.	
15		RUN	84	ASF=0.0326	- Annual S F P to recoup £1.	
16		X	71	0.2893	- Annual S F P to recoup the YP	

EXAMPLE **64.**

(a) Finds a **DUAL RATE YEARS PURCHASE MULTIPLE ALLOWING FOR THE GROWTH OF THE SINKING FUND PAYMENTS** (SFP) in line with the rental growth expectations implicit where the capitalisation rate is an All Risks Rate **AND ALLOWING FOR THE INCREASE OF THE SUM TO BE RECOUPED** at a differing rate of appreciate (optional grossing up of SFP to reflect income tax). Advanced Section Program (e).

Given:- Example 64 Data:-

The estimated annual appreciation
of the sum to be recouped - - - - - 8.5% p.a.

Otherwise the same data as in Exampled 63 above.

(b) Finds the first annual SFP to recoup £1 plus the growth factor at a given date in the future, and the payment required to recoup the Y.P. calculated plus the growth factor.

N.B. (i) The allowance for growth in the sum to be recouped has been said to be necessary if leaseholds and freeholds are to be truly comparable. Traditional Dual Rate theory, formulated before the onset of inflation, has only sought to recoup the original cash outlay in purchasing the investment and not the sum to which this outlay might have appreciated if a freehold had been purchased in preference to a leasehold.

There are some pitfalls in this exercise, namely the appreciation of the freehold investment stems from rental growth, whereas in the traditional Dual Rate method of valuing leaseholds rental growth may have been ignored or incompletely understood and incomplete allowance made.

It might reasonably be thought that the Advanced Section Programs B,C,D, and E used in the Taxed Mode, without allowing for Dual Rates, produce a better comparison between freeholds and leaseholds than the traditional Dual Rate technique.

Perhaps the leasehold reinvestment dilemma inherent in finding a home for income cash-flow receipts needs to be re-examined in a broader context, the dilemma not being confined to leaseholds alone.

N.B. (ii) Advanced Section, Program (e) can be used to calculate a Dual Rate Y.P. allowing for just the growth of the sum to be recouped, where the capitalisation rate is either an All Risks Rate or an Overall Yield and where no growth in the SFP is assumed. This is achieved as in Example 64 above, but with zero input after the "GROWTH%?" and "REVIEW P?" prompts. This Y.P. divided by the appropriate Single Rate Y.P. produces a Reduction Factor for application to Advanced Section Leasehold Valuations, using Programs D and E. (See the Appendix, Page 145).

EXAMPLE 64. DUAL RATE YP ALLOWING FOR THE GROWTH OF THE SFPs AND THE SUM TO BE RECOUPED.

	SELECT:-	KEYS & DATA	KEY CODE	DISPLAY	PROMPTS FOR:-	COMMENTS
1	Advance Section	(ADV)	31/43	ADVANCED		(UNTAXED)
2	Program (e)	(e)	31/15	FVG??	Future Value Growth	Recoupment
3	8.5%p.a.Appretiation	8.5		8.5		
4		RUN	84	OVRL.YIELD%?	Capitalisation Rate	
5	8% All Risks Rate	8		8		
6		RUN	84	SF TERM?	Period of Investment	
7	15 Years	15		15		
8		RUN	84	SF RATE%?	Sinking Fund Rate	Accretion %.
9	3.5% Accretion Rate	3.5		3.5		
10		RUN	84	GROWTH%?	Growth Rate of SFPs	
11	9.4% Growth Rate	9.4		9.4		
12		RUN	84	REVIEW P?	Period between Growth Adjustments	
13	5 Years	5		5		
14		RUN	84	YP=5.2440	- RESULT = YEARS PURCHASE.	
15		RUN	84	ASF=0.1107	- Annual S F P to recoup £1.	
16		X	71	0.5805	- Annual S F P to recoup the YP	

APPENDIX TO SECTION VIII

Growth allowance in relation to Sinking Fund payments can take two forms. An example of a calculation allowing for the growth of the Sinking Fund Payments using an All Risks Remunerative Rate has been shown above. This exercise assumed that the Sinking Fund payments increase from a given base, i.e. the Sinking Fund payments increase because the supporting income is subject to growth. The other form of growth allowance is where the growth in the payments is assessed to provide a substitute Sinking Fund payment schedule for a given fixed base payment schedule. i.e. the supporting income is not subject to growth or growth has been taken into account specifically. This latter allowance reflects the advantage of deferring the larger Sinking Fund payments until the end of the investment time-scale, rather than their being spread evenly over the whole period.

To calculate a Dual Rate Years Purchase figure using an Overall Yield Remunerative Rate and reflecting this deferment element complete the steps below:-

Example:-

Remunerative Rate	=	14%.
Sinking Fund Rate	=	3%.
Term	=	10 years.
Growth Rate	=	10%.
Rent Review Pattern	=	5 yearly.

STEP 1

Calculate the initial Sinking Fund payment allowing for growth, using the Advanced Section, Program (e).

FVG?	=	0
OVRL.YIELD%?	=	14
SF TERM?	=	10
SF RATE%?	=	3
GROWTH%?	=	10
REVIEW P?	=	5
RESULT	=	"YP=4.8076"
Then, Key 'R/S'		
RESULT	=	"ASF=.0680"

STEP 2

Calculate the Present Value of the Sinking Fund payments at 14% using Advanced Section, Program D.

MODE?	=	A-
WHICH CALC.?	=	IY/VAL
REVIEW P?	=	5
OVRL. YIELD%?	=	14
GROWTH%?	=	10
RENT RES.?	=	.0680
RACK RENT?	=	.0680
TERM?	=	5
NUMBER OF P?	=	1
RESULT	=	".4287"

STEP 3

Calculate the average annual payment at 14% for this Present Value, using the Basic Section Financial Keys as follows:-

'BAS' Key (Keycode 43)
10
N
14
I
-.4287
'CHS' (Keycode 42)
PV
PMT

RESULT : "PMT=.0822"

STEP 4

Apply the result to the Dual Rate formula namely:-

$$\frac{1}{.14 + .0822} = \text{YP} = 4.5007$$

N.B. This compares with a Y.P. of 4.4008 for the Traditional Dual Rate Calculation which assumes even payments to the Sinking Fund. The difference is not very substantial, despite the rates chosen being more diverse than is likely in practice. A separate program to cover this deferment element does not seem justified.

STEP 5

If a Single Rate calculation (with or without growth) has been undertaken using the Advanced Section, Programs D or E, they can be adjusted by mutiplying by a factor, as explained in Program (d) of the same Section. The factor to reflect Dual Rates plus the deferment element is found by dividing the Y.P. found in Step 4 above by the equivalent Single Rate Y.P., which can be found by using the Basic Section, Financial Keys:-

'BAS' Key (Keycode 43)
10
N
14
I
1
PMT
PV

RESULT : "PV= 5.2161"

$$\text{FACTOR} = \frac{4.5007}{5.2161} = .8628$$

SUMMARY OF YEARS PURCHASE MULTIPLES AND INITIAL PAYMENTS TO A SINKING FUND, assuming a 10 year leasehold investment on 5 different bases:-

1.	Single Rate at 14%.	Y.P. = 5.2161	SFP = .2697
*2 .	Single Rate at 14% allowing for Growth in Sinking Fund Payments.	Y.P. = 5.4709	1st SFP = .2341
3.	Traditional Dual Rate 14%/3%.	Y.P. = 4.4008	SFP = .3839
*4.	Dual Rate 14%/3% allowing for growth in SFPs.	Y.P. = 4.8076	1st SFP = .3269
5.	Dual Rate 14%/3% allowing for deferment in SFPs due to growth allowance.	Y.P. = 4.5007	1st SFP = .3060

* Nos. 2. and 4. are only valid where an All Risks Remuneration Rate is chosen. 14% may appear too high, but the purpose of this table is to demonstrate mathematical relationships rather than to justify the yields in relation to the market.

N.B. In 5. the rate of increase applied to the Sinking Fund is the arbitrary choice of the investor and need not be in any way linked to the rate of rental growth. However the growth rate of 10% p.a. has been used in 2,4 and 5 together with a 5 yearly review pattern in each case.

PROOF

1. $\frac{1 - .2697}{5.2161} = .14$ i.e. 14% p.a.

2. $\frac{1 - .2341}{5.4709} = .14$ i.e. 14% p.a.

3. $\frac{1 - .3839}{4.4008} = .14$ i.e. 14% p.a.

4. $\frac{1 - .3269}{4.8076} = .14$ i.e. 14% p.a.

5. The factor to reflect 10% growth in Sinking Fund payments over 5 years:-

$$1.10^5 = 1.6105$$

then:-

$$\frac{1 - .3060}{4.5001} = .1542$$ i.e. 15.42% over the first 5 years.

and:-

$$\frac{1 - .3060(1.6105)}{4.5001} = .1127$$ i.e. 11.27% over the second 5 years.

IRR (Average Return) = 14%.

CALCULATION AND PROOF OF DUAL RATE ADJUSTMENT FACTORS AS APPLIED TO SINGLE RATE VALUATIONS

A) A Single Rate valuation with allowance for rental growth, adjusted to reflect dual rates with even Sinking Fund payments.

STEP 1

Calculate the Single Rate value using the Advanced Section, Program D:-

MODE?	=	A-
WHICH CALC.?	=	IY/VAL
REVIEW P?	=	5
OVRL. YIELD%?	=	14
GROWTH%?	=	10
RENT RES.?	=	1
RACK RENT?	=	1
TERM?	=	5
NUMBER OF P?	=	1
RESULT:	=	6.3047

STEP 2

Calculate the Reduction Factor using the Advanced Section, Program (d):-

RF = .8437 for a 3% Sinking Fund Rate,

i.e. $\frac{4.4008}{5.2161}$ = .8437 (See the Y.P. Summary above)

STEP 3

Adjusted Value = 6.3047 x .8437 = 5.3193

PROOF

Sinking Fund Payment to recoup £1 in 10 years at 10% = .0872

Total SFP = .0872 x 5.3193 = .4638

$\frac{1 - .4638}{5.3193}$ = .1008 i.e. 10.08% p.a. over the first 5 years.

$\frac{1(1.6105) - .4638}{5.3193}$ = .2156 i.e. 21.56% p.a. over the second 5 years.

IRR (Average Return) = 14%.

B) A Single Rate valuation with allowance for growth adjusted to reflect Dual Rates and the deferment element inherent where the Sinking Fund payments increase at a given rate.

The Single Rate value has been calculated in Step 1 above. The Reduction Factor has been calculated in Step 5 on Page 145. The two multiplied produce the adjusted value.

$$6.3047 \times .8628 = \underline{5.4397}$$

PROOF

The first Sinking Fund payment to recoup £1 in 10 years at 3%, allowing for increases at 10% p.a. at 5 yearly intervals = .0680.

Total SFP = .0680 x 5.4397 = .3699.

$$\frac{1 - .3699}{5.4397} = .1158$$ i.e. 11.58% p.a. for the first 5 years.

$$\frac{1(1.6105) - .3699(1.6105)}{5.4397} = .1866$$ i.e. 18.66% p.a. for the second 5 years

IRR (Average Return) = 14%.

SECTION IX

NORMAL AND INDEX LINKED GILT EDGED STOCK WITH A SAMPLE PROGRAM

Introduction

The purpose of this section is to introduce those who are interested to an actual program. Rather than duplicate those programs contained in the VALPAC Module a new program covering the Index Linked Gilt Edged Stock is set out at the rear of this Section. The Index Linked Gilt is often quoted as a rival to property investment, so it would seem that those involved in either market ought to understand the other.

The IL Program demonstrates some of the techniques used in the Advanced Section Programs without involving the user in the myriad of options available in those programs. The IL program uses a formula which calculates the Initial Yield and current price when the Redemption Yield, Annual Growth Rate, the period of the investment and the Initial Coupon are known elements. The same formula also finds the growth rate or the redemption yield by a reiterative process, in the same way as the Advanced Programs, if either one of these is the unknown element.

The popular belief is that IL stocks can be valued by discounting at a so-called 'real' rate of return i.e. if 15% is available in a normal gilt situation and the growth (inflation) rate is 10% then the "real" return is 5% per annum, (i.e. 15 minus 10) and when discounting therefore:- $\frac{1}{1.05} = \frac{1 \times 1.10}{1.15}$ which of course it does not. A further confusion often arises in connection with 'real' rates of return in that Gilt's Redemption Yields are normally quoted as a Nominal Half Yearly Rate multiplied by two; and the rate of inflation is usually, and necessarily by its nature, quoted as an Effective Annual Rate.

Any one interesed will no doubt program their calculator with the program that follows as this shows the effect of proper inflation allowance and allows for one other deviation from the 'real' rate approach, namely the first half yearly interest payment is not Index Linked. This program is illustrative only and as such does not allow for accrued interest, nor does it allow for the time shift between the payments and the Indexing, and in any event is only valid on the day of issue before any inflation increase has accrued to the coupon or to the redemption value.

Before going on to an example and the program listing, it might be as well to have a look at the Normal Gilt Edged Gross Redemption Yield calculation using the Financial Keys:-

Example **65. Standard Gilt Edged Gross Redemption Yield.**

Given:- Example 65 Data:-

Coupon (CPN%)	3% p.a.
Market Price (PV)	£75.
Term (N)	5 years.

N.B. It is assumed that the redemption value is 100 and that the payments of interest are made half yearly in arrear in common with most Gilt Edged Stocks.

Part (a) of the example shows the normally Quoted Gross Redemption Yield.
Part (b) shows the effective annual yield. As an alternative Program E/N could have been used to convert the result in part (a) from a nominal to an effective rate.

EXAMPLE 65. GROSS REDEMPTION YIELD.
(a)STOCK MARKET BASIS.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	BAS	43	BASIC	Selects Basic Program
2	10		10	Selects 10 Half Yearly Compounding Periods
3	N	11	N=10.0000	Enters " " " " "
4	75		75	Selects Present Value / Purchase Price
5	CHS	42	-75	Changes to a Negative to reflect payment
6	PV	13	PV=-75.0000	Enters PV
7	1.5		1.5	Selects Half Yearly Coupon
8	PMT	14	PMT=1.5	Enters " " "
9	100		100	Selects Redemption Value
10	FV	15	FV=100.0000	Enters " "
11	I	12	I=4.6889	Displays Half Yearly GRY
12	2		2	
13	X	71	9.3778	Displays GRY on "Normal" Quotation Basis

(b)ANNUAL EFFECTIVE BASIS (from Step 12 above)

12	100		100	
13	÷	81	0.0469	
14	1		1	
15	+	61	1.0469	
16	ENTER	41	1.0469	Enters Number Again
17	X	71	1.0960	
18	1		1	
19	-	51	0.0960	
20	100		100	
21	X	71	9.5976	Displays GRY on Annual Effective Basis

Program IL should be entered in the calculator bearing in mind that it requires 45 registers of program memory, and with reference to the Owner's Handbook for detailed instructions on how to enter programs.

Once entered the Program can be operated as follows:-

1) Out of 'USER' MODE.
2)'XEQ' (Keycode 32)
3) 'Alpha'
4) 'I' (Keycode 24)
5) 'L' (Keycode 33)
6) 'Alpha'

This sequence selects the program and produces the first prompt symbol which is "?". This prompts for the selection of one of the following calculations by:-

In 'USER' Top Row Key 'B'(Keycode 12) :- Price and Initial Yield.
" " " 'C'(Keycode 13) :- Implied Annual Growth Rate.
" " " 'D'(Keycode 14) :- Gross Redemption Yield.

Thereafter data for the known elements is input following the prompts.

Example **66.THE GROSS REDEMPTION YIELD OF AN INDEXED LINKED GILT-EDGED STOCK** on Issue allowing for Inflation.

Given:- Example 66 Data:-

Coupon (CPN%?) - - - - - - - - - - - - - - - - 2% p.a.
Market Price (PV?) - - - - - - - - - - - - - - £95.
Term (N?) - - - - - - - - - - - - - - - - - - 5 years.
Inflation (GR%?) - - - - - - - - - - - - - - - 8%.

See overleaf for the Example Listing.

EXAMPLE 66. GROSS REDEMPTION YIELD OF AN INDEXED LINKED STOCK.

	KEYS & DATA	KEY CODE	DISPLAY	COMMENTS
1	USER	-		Selects Out of User Mode
2	XEQ	32	XEQ _ _	Starts Sequence for Program IL Selection
3	ALPHA	-	XEQ _	Selects Alpha Mode
4	I	24	XEQ I _	
5	L	33	XEQ IL	
6	ALPHA	-	?	Out of Alpha & Prompts for type of calculation
7	USER	-	?	Into User Mode
8	D	14	N?	Selects GRY Calculation & Prompts No. of Years
9	5		5	Selects 5 Years
10	RUN	84	CPN%?	Prompts for the Annual Coupon
11	2		2	Selects 2% Coupon
12	RUN	84	GR%?	Prompts for the Inflation Rate
13	8		8	Selects an 8% Inflation Rate
14	RUN	84	PV?	Prompts for Market Value
15	95		95	Selects £95 Current Value
16	RUN	84	RY%=11.3504	Displays the Redemption Yield as an Annual Effective Rate reflecting the half-yearly receipts of income.

Example (65) could have been calculated using the IL Program with the entries being made in terms of the Annual Coupon and the Period of the investment entered in years. The program itself makes allowance for half yearly interest payments. The result displayed will be the annual effective rate of 9.5976%. The appropriate entry for the "GR%?" prompt is zero in this example.

"After tax" calculations can be undertaken by adjusting the coupon to a nett of income tax figure.

When calculating the price the Initial Yield can be displayed by pressing 'R/S' (Keycode 84) after the "PV=---" appears in the display.

ANALYSIS PROGRAM FOR INDEXED LINKED STOCKS ON ISSUE

PROGRAM LISTING

The program requires 45 Program Registers for entry into the calculator, the registers should be adjusted with the 'SIZE' Function as necessary. The Owner's Handbook describes how to load a program. It should be noted that the VALPAC Module must be in place in the calculator for the program to work.

```
01#LBL "IL" - - - - - Program Label.
02 1 E2
03 STO 14 - - - - - - Stores initial redemption value of £100.
04 FIX 4  - - - - - - Sets decimal display i.e. 4 places of decimals shown.
05 "?"  - - - - - - - Prompts for element for analysis.
06 PROMPT

07#LBL B  - - - - - - Commences PV or PRICE calculation.
08 SF00
09 CF01
10 XEQ 12 - - - - - - Executes sub-routine 12.
11 XEQ 13
12 XEQ 11
13 X=Y?   - - - - - - Tests for identical Growth Rate and Redemption Yield.
14 XEQ 03
15 XEQ 08
16 GTO 07

17#LBL 03
18 RCL 10
19 ST+03  - - - - - - If Growth = Red.Yield a nominal amount added to Growth Rate
20 RTN

21#LBL 11
22 "GR%?" - - - - - - Prompts for Assumed Growth Rate (Annual Effective Rate).
23 PROMPT
24 XEQ 10
25 SQRT   - - - - - - Adjusts Growth Rate To appropriate nominal rate for bi-
26 STO 03                                                annual compounding.
27 RTN

28#LBL 12
29 1 E-6  - - - - - - Nominal Number used in Zero Check.
30 STO 10
31 1
32 STO 17
33 "N?"   - - - - - - Prompts for the length of the investment in years.
34 PROMPT
35 2
36 X    - - - - - - - Doubles N to reflect bi- annual payments of interest.
37 STO 02
38 RTN

39#LBL 13
40 "RY%?" - - - - - - Prompts for the Redemption Yield (Annual Effective Yield).
41 PROMPT
42 XEQ 10
43 SQRT   - - - - - - Adjusts Red. Yield to Nominal Rate appropriate for Bi-
44 STO 01                                                annual compounding.
45 RTN
```

```
46#LBL D  - - - - - - Commences Redemption Yield Calculation.
47 SF 01
48 CF 00
49 XEQ 12
50 XEQ 08
51 XEQ 11
52 XEQ 05
53 +
54 1
55 -
56 STO 01 - - - - - - Stores 1st. guess.
57 GTO 07

58#LBL 10 )
59 1 E2   )
60 ÷      )
61 1      )- - - - -  1 + X/100
62 +      )
63 RTN    )

64#LBL 08
65 "CPN%?"  - - - - - Prompts for the initial annual coupon.
66 PROMPT
67 2
68 ÷  - - - - - - - - Halves Coupon to reflect bi-annual Payment.
69 X=0? - - - - - - - Zero check to accommodate zero coupon bonds.
70 RCL 10
71 STO 07
72 RTN

73#LBL 05
74 SF 15
75 SF 16
76 SF 08
77 CF 09
78 SF 17
79 RCL 07
80 "PV?"  - - - - - - Prompts for Price.
81 PROMPT
82 ÷    - - - - - - - Finds Initial Yield, expressed as a decimal.
83 1
84 +
85 STO 05
86 RTN

87#LBL C  - - - - - - Commences Implied Growth Calculation.
88 CF 01
89 CF 00
90 XEQ 12
91 XEQ 08
92 XEQ 13
93 XEQ 05
94 -
95 1
96 +
97 STO 03 - - - - - - Stores 1st. guess .
```

```
 98#LBL 07 - - - - - - Labels start of calculation.
 99 1         )
100 RCL 01    )
101 RCL 03    )
102 ÷         )
103 RCL 02    )
104 1         )
105 -         )
106 CHS       )
107 Y↑X       )
108 -         ) - - -
109 RCL 01    )
110 RCL 03    )
111 -         )
112 ÷         )
113 RCL 07    )
114 RCL 03    )
115 X↑2       )
116 X         )
117 X         )
118 RCL 07    )
119 +         )
120 RCL 01    )
121 ÷         )
122 RCL 03    )
123 RCL 02    )
124 Y↑X       )
125 RCL 14    )
126 X         )
127 RCL 01    )
128 RCL 02    )
129 Y↑X       )
130 ÷         )
131 +         )
132 FS? 00
133 XEQ 01
134 RCL 07    )
135 X><Y      )
136 ÷         ) - - - - Finds the Initial Yield.
137 1 E2      )
138 X         )
139 FS? 00
140 GTO 02
141 XEQ 10
142 RCL 05
143 -
144 RCL 17 - - - - - - Acceleration Factor.
145 X
146 FS? 08
147 XEQ "DD" - - - - - Acceleration Routine in the VALPAC Module.
148 FS? 01
149 GTO 06
150 ST+ 03 - - - - - - Improves guess.

151#LBL 04
152 ABS
153 1 E-6 - - - - - - Number against which reiterations are tested i.e. .000001
154 X≤=Y?
155 GTO 07  - - - - - Repeats the calculation.
156 RCL 03
157 FS? 01
```

$$\frac{(1+G)^2\,\frac{\text{Coupon}}{2}\left[1-\frac{(1+RY)^{-(N-1)}}{(1+G)}\right]}{(1+RY)-(1+G)} + \frac{\text{Coupon}}{2} \qquad + \quad 100\left[\frac{(1+G)^N}{(1+RY)^N}\right]$$

$$\frac{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}{(1+RY)}$$

where:-

RY = Redemption Yield (half yearly nominal rate expressed as a decimal).

G = Growth Rate (half yearly nominal rate expressed as a decimal).

N = Number of half yearly compounding periods.

```
158 RCL 01
159 X↑2
160 1
161 -
162 1 E2
163 X
164 "IG%="  - - - - - Displays the Implied Growth as an Effective Annual Rate.
165 FS? 01
166 "RY%="  - - - - - Displays the Redemption Yield as an Effective Annual Rate.
167 BEEP
168 ARCL X
169 AVIEW
170 RTN

171#LBL 06
172 ST- 01  - - - - - Improves guess.
173 GTO 04

174#LBL 01    )
175 "PV="     )  - - - Displays PV Solution.
176 ARCL X    )
177 AVIEW     )
178 STOP      )
179 RTN       )

180#LBL 02
181 2
182 X
183 "IY=" - - - - - - Displays the Initial Yield.
184 ARCL X
185 AVIEW
186 RTN
187 END
```

This section may have whetted the appetites of budding programmers, in which case we wish them good luck in creating new programs of use to the property professional. Alternatively it, perhaps, demonstrates to those with no interest in programming what good value VALPAC represents. The IL Program's requirement for 45 program registers compares with the 572 required to house the Module contents and the Module is in a much more condensed form. To have produced a list of VALPAC Programs would have required more than 50 pages if the format of Pages 154 to 157 were used.

PROGRAMS INDEX

Tax allowance optional where * is indicated. A letter in brackets e.g. '(a)' denotes prior use of the 'Shift' Key (Keycode 31) when used in conjunction with the program letter.

ADVANCED SECTION (Allowing for rental growth)

BASIC SECTION

OTHER PROGRAMS

PRINTER LISTINGS OF THE MOST USEFUL EXAMPLES

The following examples are shown numbered as they are numbered in the main text. The layout of each example is as would be produced by the Hewlett Packard Printer when used with the HP41 range of calculators. The left hand column shows the Alpha Displays and Prompts with the displayed Results where these have been labelled alphabetically. The centre column shows the data inputs and the results where these have not been labelled alphabetically. The right hand column shows the keystrokes used. These keystrokes marked XROM are those labels in the module which have been assigned to keys and are marked on the keyboard overlay. The keystrokes marked XEQ refer to the top row keys which are automatically designated A,B,C,D and E; and small a, b, c, d and e when using the shift key. These top row keys perform different functions in different programs, the keyboard overlay shows only the 5 Financial Key Functions in the Basic Section. 'N' on the keyboard overlay is shown 'A' on the print out. The use of the top row keys in the other programs is not shown on the keyboard overlay as 'A' equates to Program A and 'B' to Program B and so on. The only exception to this is Program N-E where Key 'A' selects Nominal to Effective Conversion, Key 'B' selects Effective to Nominal Conversion, Key 'C' selects payments in advance and Key 'D' payment in arrear, these functions are marked on the Keyboard Overlay.

Many users will find that these examples are more useful for quick reference than refering back each time to the main text. All the information for working out problems is available from these print-outs.

ADVANCED SECTION EXAMPLES

EXAMPLE **1**. Page 21.
FREEHOLD ANALYSIS.
IMPLIED GROWTH RATE.
ADV. Program A

		XROM "*ADV"
UNTAXED		
ADVANCED		
		XEQ A
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IG"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
INIT. YIELD%?		
	5.0000	RUN
IG%=9.3916		

EXAMPLE **2**. Page 22.
FREEHOLD ANALYSIS.
INITIAL YIELD / YEARS PURCHASE
ADV. Program A

		XROM "*ADV"
UNTAXED		
ADVANCED		
		XEQ A
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
IY%=5.0000		
		LASTX
	19.9999	***

EXAMPLE **3.** Page 23.

FREEHOLD ANALYSIS.
OVERALL YIELD.
ADV. Program A

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ A
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "OY"
REVIEW P?		
	5.0000	RUN
INIT. YIELD%?		
	5.0000	RUN
GROWTH%?		
	9.3916	RUN
OY%=14.0000		

EXAMPLE **4.** Page 24.

FREEHOLD TERM AND REVERSION
I Y / VALUE
ADV. Program B

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	10,000.0000	RUN
RACK RENT?		
	23,000.0000	RUN
TERM?		
	8.0000	RUN
	381,046.6372	***
IY%=2.6244		

EXAMPLE **5.** Page 25.(ADV.PROG.B)

FREEHOLD TERM AND REVERSION
'AFTER TAX' I Y / VALUE

		XROM "*ADV"
UNTAXED ADVANCED		
		XROM "TAX"
TAXED		
		XROM "*ADV"
TAXED ADVANCED		
		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	12.7500	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	10,000.0000	RUN
INCOME TAX?		
	30.0000	RUN
RACK RENT?		
	23,000.0000	RUN
TERM?		
	8.0000	RUN
	380,351.2036	
IY%=1.8404		

EXAMPLE **7.** Page 27.(ADV.PROG.B)

FREEHOLD TERM AND REVERSION
OVERALL YIELD ALLOWING FOR TAX

		XROM "*ADV"
TAXED ADVANCED		
		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "OY"
REVIEW P?		
	5.0000	RUN
RENT RES.?		
	10,000.0000	RUN
INCOME TAX?		
	30.0000	RUN
RACK RENT?		
	23,000.0000	RUN
TERM?		
	8.0000	RUN
GROWTH%?		
	9.3916	RUN
PV?		
	380,351.0000	RUN
OY%=12.7497		

EXAMPLE **8.** Page 28.(ADV.PROG.B)

FREEHOLD

EQUATED YIELD

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ B
MODE?		
		XROM "A-"
WHICH CALC.?		
		XROM "OY"
REVIEW P?		
	1.0000	RUN
RENT RES.?		
	5.0000	RUN
RACK RENT?		
	6.0000	RUN
TERM?		
	10.0000	RUN
GROWTH%?		
	0.0000	RUN
PV?		
	100.0000	RUN
OY%=5.5810		

EXAMPLE **9.** Page 29.(ADV.PROG.B)

FREEHOLD

EQUATED YIELD WITH RENTAL WEIGHTING

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ B
MODE?		
		XROM "A-"
WHICH CALC.?		
		XROM "OY"
REVIEW P?		
	5.0000	RUN
RENT RES.?		
	1,000.0000	RUN
RACK RENT?		
	3,000.0000	RUN
TERM?		
	10.0000	RUN
GROWTH%?		
	0.0000	RUN
PV?		
	35,641.4700	RUN
OY%=5.9529		

EXAMPLE **10.** Page 30.(ADV.PROG.B)

FREEHOLD

VALUATION OF UNLET PREMISES

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ B
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
RENT RES.?		
	0.0000	RUN
RACK RENT?		
	5.0000	RUN
TERM?		
	3.0000	RUN
	88.3559	

EXAMPLE **13.** Page 35.(ADV.PROG.D)

LEASEHOLD TERM AND REVERSION

IY / VALUE

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ D
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IY"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.4000	RUN
RENT RES.?		
	5.0000	RUN
RACK RENT?		
	7.0000	RUN
TERM?		
	3.0000	RUN
NUMBER OF P?		
	4.0000	RUN
	82.1614	
IY%=6.0856		

EXAMPLE **14.** Page 37.(ADV.PROG.D)

LEASEHOLD TERM AND REVERSION
IMPLIED GROWTH RATE

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ D
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "IG"
REVIEW P?		
	5.0000	RUN
RENT RES.?		
	5.0000	RUN
RACK RENT?		
	7.0000	RUN
TERM?		
	3.0000	RUN
NUMBER OF P?		
	4.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
PV?		
	82.1614	RUN
IG%=9.3996		

EXAMPLE **15.** Page 38.(ADV.PROG.D)

LEASEHOLD TERM AND REVERSION
OVERALL YIELD

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ D
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "OY"
REVIEW P?		
	5.0000	RUN
RENT RES.?		
	5.0000	RUN
RACK RENT?		
	7.0000	RUN
TERM?		
	3.0000	RUN
NUMBER OF P?		
	4.0000	RUN
GROWTH%?		
	9.4000	RUN
PV?		
	82.1614	RUN
OY%=14.0002		

EXAMPLE **19.** Page 43.(ADV.PROG.(c))

LEASEHOLD TERM AND REVERSION
VALUE ALLOWING FOR A FIXED GROUND RENT

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ c
MODE?		
		XROM "Q+"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.4000	RUN
RENT RES.?		
	7.0000	RUN
RACK RENT?		
	9.0000	RUN
TERM?		
	3.0000	RUN
HEAD RENT?		
	2.0000	RUN
TERM?		
	23.0000	RUN
L=92.3236		

EXAMPLE **25.** Page 56.(ADV.PROG.A)

CONSTANT RENT FACTOR
or **EQUIVALENCE FACTOR**

		XROM "*ADV"
UNTAXED ADVANCED		
		XEQ A
MODE?		
		XROM "Q+"
WHICH CALC.?		
		XROM "EQF"
REVIEW P?		
	5.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
IY%=5.0000		
REVIEW P?		
	21.0000	RUN
OVRL. YIELD%?		
	14.0000	RUN
GROWTH%?		
	9.3916	RUN
IY%=7.9808		
EQF=1.5961		

NOMINAL / EFFECTIVE RATE CONVERSION EXAMPLES

EXAMPLE **26.** Page 68.(PROG.(E-N))

NOMINAL TO EFFECTIVE

		XROM "N-E"
NOM--EFF?		
		XEQ A
NO. PMTS P.A?		
	4.0000	RUN
ADV OR ARR?		
		XEQ C
NOM%=?		
	14.0000	RUN
EFF%15.316313		

EXAMPLE **27.** Page 68.(PROG.(E-N))

EFFECTIVE TO NOMINAL

		XROM "N-E"
NOM--EFF?		
		XEQ B
NO. PMTS P.A?		
	4.0000	RUN
ADV OR ARR?		
		XEQ C
EFF%=?		
	15.316313	RUN
NOM%14.000000		

BASIC SECTION EXAMPLES

VALUATION TABLE EXAMPLES

EXAMPLE **32.** Page 79.(FINANCIAL KEYS)

THE AMOUNT OF £1.

		XROM "BASIC"
BASIC		
	15.0000	XEQ A
N=15.0000		
	7.0000	XEQ B
I=7.0000		
	1.0000	XEQ C
PV=1.0000		
		XEQ E
FV=-2.7590		

EXAMPLE **34.** Page 80.(FINANCIAL KEYS)

THE PRESENT VALUE OF £1.

		XROM "BASIC
BASIC		
	15.0000	XEQ A
N=15.0000		
	7.0000	XEQ B
I=7.0000		
	1.0000	XEQ E
FV=1.0000		
		XEQ C
PV=-0.3624		

EXAMPLE **36.** Page 81.(FINANCIAL KEYS)

THE AMOUNT OF £1 p.a.

		XROM "BASIC"
BASIC		
	15.0000	XEQ A
N=15.0000		
	7.0000	XEQ B
I=7.0000		
	1.0000	XEQ D
PMT=1.0000		
		XEQ E
FV=-25.1290		

EXAMPLE **38.** Page 82.(FINANCIAL KEYS)

ANNUAL SFP TO PROVIDE £1.

		XROM "BASIC
BASIC		
	15.0000	XEQ A
N=15.0000		
	4.0000	XEQ B
I=4.0000		
	1.0000	XEQ E
FV=1.0000		
		XEQ D
PMT=-0.0499		

EXAMPLE **40.** Page 83.(FINANCIAL KEYS)

THE ANNUITY £1 WILL PURCHASE.

		XROM "BASIC"
BASIC		
	15.0000	XEQ A
N=15.0000		
	7.0000	XEQ B
I=7.0000		
	-1.0000	XEQ C
PV=-1.0000		
		XEQ D
PMT=0.1098		

EXAMPLE **42.** Page 84.(FINANCIAL KEYS)

THE PRESENT VALUE OF £1 p.a. (Y.P.).

		XROM "BASIC
BASIC		
	15.0000	XEQ A
N=15.0000		
	7.0000	XEQ B
I=7.0000		
	1.0000	XEQ D
PMT=1.0000		
		XEQ C
PV=-9.1079		

EXAMPLES OF NPV, AND IRR PROGRAMS

EXAMPLES 51 & 52. PAGE 96.

NETT PRESENT VALUE

		XROM "NPV"
GROUPS?		
N		RUN
CF 0=?		
	-70,000.00	RUN
CF 1=?		
	1,000.00	RUN
CF 2=?		
	3,000.00	RUN
CF 3=?		
	103,000.00	RUN
CF 4=?		
		RUN
CF CHANGES?		
N		RUN
DSCNT RATE=?		
	15.00	RUN
NPV=862.17		
		RUN
CF NO.=?		
	2.00	RUN
CF 2=3,000.00		
	1,500.00	RUN
CF NO.=?		
		RUN
DSCNT RATE=15		
		RUN
NPV=-272.05		

EXAMPLES 53 & 54. PAGE 99.

INTERNAL RATE OF RETURN

		XROM "IRR"
GROUPS?		
N		RUN
CF 0=?		
	-100,000.00	RUN
CF 1=?		
	-50,000.00	RUN
CF 2=?		
	-25,000.00	RUN
CF 3=?		
	10,000.00	RUN
CF 4=?		
	10,000.00	RUN
CF 5=?		
	12,500.00	RUN
CF 6=?		
	362,500.00	RUN
CF 7=?		
		RUN
CF CHANGES?		
N		RUN
IRR=16.678		
		RUN
CF NO.=?		
	6.00	RUN
CF 6=362,500		
	312,500.00	RUN
CF NO.=?		
		RUN
IRR=13.79		

Printed by Copy King, 148 Sloane Street, London SW1. Tel: 01-730 6765