Induces harcode for easy software entry. HEWLETT-PACKARD HP-41 USERS' LIBRARY SOLUTIONS Small Business



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INTRODUCTION

This HP-41C Solutions book was written to help you get the most from your calculator. The programs were chosen to provide useful calculations for many of the common problems encountered.

They will provide you with immediate capabilities in your everyday calculations and you will find them useful as guides to programming techniques for writing your own customized software. The comments on each program listing describe the approach used to reach the solution and help you follow the programmer's logic as you become and expert on your HP calculator.

KEYING A PROGRAM INTO THE HP-41C

There are several things that you should keep in mind while you are keying in programs from the program listings provided in this book. The output from the HP 82143A printer provides a convenient way of listing and an easily understood method of keying in programs without showing every keystroke. This type of output is what appears in this handbook. Once you understand the procedure for keying programs in from the printed listings, you will find this method simple and fast. Here is the procedure:

1. At the end of each program listing is a listing of status information required to properly execute that program. Included is the SIZE allocation required. Before you begin keying in the program, press **XEQ ALPHA** SIZE **ALPHA** and specify the allocation (three digits; e.g., 10 should be specified as 010).

Also included in the status information is the display format and status of flags important to the program. To ensure proper execution, check to see that the display status of the HP-41C is set as specified and check to see that all applicable flags are set or clear as specified.

- 2. Set the HP-41C to PRGM mode (press the **PRGM** key) and press **GTO** • to prepare the calculator for the new program.
- 3. Begin keying in the program. Following is a list of hints that will help you when you key in your programs from the program listings in this handbook.
 - a. When you see " (quote marks) around a character or group of characters in the program listing, those characters are ALPHA. To key them in, simply press **ALPHA**, key in the characters, then press **ALPHA** again. So "SAMPLE" would be keyed in as **ALPHA** "SAMPLE" (ALPHA).
 - b. The diamond in front of each LBL instruction is only a visual aid to help you locate labels in the program listings. When you key in a program, ignore the diamond.
 - c. The printer indication of divide sign is /. When you see / in the program listing, press + .
 - d. The printer indication of the multiply sign is \ddagger . When you see \ddagger in the program listing, press 🗵.
 - e. The H character in the program listing is an indication of the **APPEND** function. When you see H, press **APPEND** in ALPHA mode (press **A** and the K key).
 - f. All operations requiring register addresses accept those addresses in these forms:

nn (a two-digit number) IND nn (INDIRECT: , followed fy a two-digit number) X, Y, Z, T, or L (a STACK address: followed by X, Y, Z, T, or L) IND X, Y, Z, T or L (INDIRECT stack: followed by X, Y, Z, T, or L)

Indirect addresses are specified by pressing and then the indirect address. Stack addresses are specified by pressing • followed by X, Y, Z, T, or L. Indirect stack addresses are specified by pressing • and X, Y, Z, T, or L.

Printer Listing

Keystrokes

Display

LBL ALPHA SAMPLE ALPHA	$01 LBL^{T}SAMPLE$
ALPHA THIS IS A ALPHA	02' THIS IS A
ALPHA APPEND SAMPLE	$03^{ au} \vdash \mathbf{SAMPLE}$
AVIEW ALPHA	04 AVIEW
6	05 6
ENTER+	06 ENTER 1
	07 -2
- <u></u>	08 /
XEQ ALPHA ABS ALPHA	09 ARS
	03 460
STO L	10 STO IND L
$\begin{bmatrix} ALPHA \end{bmatrix} B_3 = \begin{bmatrix} ARCL \end{bmatrix} 0_3$	11 ^T R3=
	12 APCI 03
AVIEW	TZ ANGE 05
ALPHA	13 AVIEW
RTN	14 RTN
	LBL ALPHA SAMPLE ALPHA ALPHA THIS IS A ALPHA ALPHA APPEND SAMPLE AVIEW ALPHA 6 ENTER+ 2 CHS + XEO ALPHA ABS ALPHA STO • L ALPHA R3= ARCL 03 AVIEW ALPHA RTN

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* 6.	ESTIMATING INVENTORY
7.	INVENTORY ORDERING
8.	ORDER POINT CALCULATION
9.	WORKING CAPITAL NEEDS - BARDAHL FORMULA51 Determines the working capital needs of a com- pany in conformance with the Internal Revenue Service guidelines for avoidance of tax for un- reasonable accumulation of earnings.
*10.	DEPRECIATION SCHEDULES

- * These programs require an additional memory module.

PAYROLL

1

(This program requires one memory module and a card reader)

This payroll system is composed of three parts: 1) a master payroll program "PAYROLL", 2) an employee data card initialization program "EMP" and 3) a data card for each employee which contains his year to date statistics, wage and other information. First set up a data card for each employee using "EMP". Then at the end of each pay period "PAYROLL" is used to calculate gross pay, deductions and net pay for each employee. At the end of the year "EMP" is used again to reset all year to date summations to zero.

Note:

The user must provide the applicable Federal and State tax tables.

If FICA changes from a maximum of \$22900 and 6.13% lines 135 and/or 144 of PAYROLL can be changed accordingly.

Example 1:

Set up an employee data card using ployee information:	g "EMP" for the following em-
Ben A. Waters	S S No: 541-80-0051
Single	1 Exemption
Hourly wage: \$6.00	Overtime is time and a half (1.5)
Deductions: 5% of gross toward stock \$1.00 to United Way	

Keystrokes:	Display:
[XEQ] [ALPHA] EMP [ALPHA]	NO. OF DED. ?
5 [R/S]	SET SIZE 20 (Also mark data card)
[XEQ] [ALPHA] SIZE [ALPHA] 020 [R/S]	FIRST NAME ?
BEN A. [R/S]	LAST NAME ?
WATERS [R/S]	SOC SEC NO ?
541800051 [R/S]	MORS?

S [R/S]		EXEMPTIONS ?	
1 [R/S]		WAGE ?	
6 [R/S]		O.T. FACTOR ?	
1.5 [R/S]		% DEDUCTIONS	
		DED. NAME ?	
STOCK [R/S]	% ?	
5 [R/S]		DED. NAME ?	
[R/S]		\$ DEDUCTIONS	
		DED. NAME ?	
UW [R/S]		\$?	
1 [R/S]		RDY 01 OF 02	
Record bot	h sides of a card for Ben A	A. Waters.	
Example 2:			
	For the period ending 9/1/ and 2 overtime hours. Use data.	79, Ben A. Waters worked 40 reg hour "PAYROLL" to calculate all pertinen	s t
Keystrokes	:	Display:	
[XEQ] [ALPI	HA] SIZE [ALPHA] 020		
Load Ben's	data card		
[XEQ][ALPH	A] PAYROLL [ALPHA]	BEN A.	
		WATERS	
		541-80-0051	
		SINGLE	
		1 EXEMPT.	
		REG HOURS	
40 [R /S]]	\$240.00	
[R/S]	O.T. HOURS	
2 [R/S]	\$18.00	
[R/S]	G=\$258.00	
[R/S]	F ?	

(\$42.41 is found to be the fed. tax)

2

42.41 [R/S]	S ?
(\$15 is found to be the state tax)	
15 [R/S]	FICA=\$15.82
[R/S]	STOCK=\$12.90
[R/S]	UW=\$1.00
[R/S]	$\Sigma DED = \$87.13$
[R/S]	ΣG=\$258.00
[R/S]	$\Sigma F = 42.41
[R/S]	ΣS=\$15.00
[R/S]	ΣFICA=\$15.82
[R/S]	ΣSTOCK=\$12.90
[R/S]	Σ UW=\$1.00
[R/S]	NET=\$170.87
[R/S]	RDY 01 OF 02

Load Ben A. Waters data card again to update the year to date summations.

				SIZE: 014+
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	To set up an employee data card go to			
	step 4.			
2	To start a new year go to step 24.			
3	To compute payroll go to step 29.			
4	Load program "FMP"			
5	Initialize		[XEQ] EMP	NO. OF DED. ?
6	Key in total number of deductions for this			
	employee including fed., state and FICA	n	[R/S]	SET SIZE (NNN)
7	NNN is the minimum number of data registers			
	required for this employee.			
	If SIZE is not already at or above this,			
	then set this SIZE.		[XEQ] SIZE NNN	
			[R/S]	FIRST NAME ?
8	Key in the first name or initials with no			
	more than 6 characters	F. Name	[R/S]	LAST NAME ?
9	Key in the last name with no more than			
	12 characters	L. Name	[R/S]	SOC SEC NO ?
10				N OD G O
10	Key in social security number	55#	[K/S]	M OK 5 ?
11	Key M if married and S if single.	M or S	[R/S]	EXEMPTIONS ?
12	Key in the number of exemptions	k	[R/S]	WAGE ?
13	Key in hourly wage	wage	[R/S]	O.T. FACTOR ?
14	Key in the multiplier for overtime hours	m	[R/S]	%DEDUCTIONS
				DED. NAME ?
15	Key in the name of a deduction which is to			
	be figured by % of gross (no more than			
	6 characters). If there are none or you			
	have keyed them all in just press [R/S] and	ded. name	[R/S]	% ?

				SIZE :014+
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
	go to step 18			
16	Key in the %	%	[R/S]	DED. NAME ?
17	Go to step 15			
18				\$ DEDUCTIONS
				DED. NAME ?
19	Key in the name of a deduction which is			
	always the same dollar amount (no more			
	than 6 characters).	ded. name	[R/S]	\$?
20	Key in the dollar amount	Ş	[R/S]	DED. NAME ?
21	Go to step 19			
22	Sometime during steps 15 through 21 you			
	will have keyed in all of the deductions			
	at which time "RDY O1 OF (NN)" will be			
	displayed. Load the data card for this			
	employee.			
23	For another employee go to step 4.			
24	Load program "EMP"			
25	Load an employee data card			
26	Clear all summations and accumulations to			
	zero		[XEQ] NY	RDY 01 OF NN
27	Load the employee data card for update			
28	For another employee go to step 25.			
29	Load program "PAYROLL"			
30	Load an employee data card			
31	Begin program		[XEQ] PAYROLL	RELOAD DATA*
				CARD AFTER*
				SIZE (NNN)*

				SIZE: 014+
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
*	You will only see these displays if the			
	size was less than it should have been;			
	otherwise go to step 34			
32	Set the correct SIZE		[XEQ] SIZE NNN	
33	Reload the employee data card then press			
	[R/S]		[R/S]	
34				(first name)
				(last name)
				(SS#)
				MARRIED
				(or) SINGLE
				(N) EXEMPT.
				PER ENDING
35	If prompted for, key in the date of the end			
	of the period	MM.DDYY	[R/S]	REG HOURS
36	Key in the number of hours and minutes			
	worked for regular pay.	H.MM	[R/S]	\$(Reg)
			[r/s] [†]	O.T. HOURS
37	Key in the number of hours and minutes			
	worked for overtime pay.	H.MM	[R/S]	\$(0.T.)
			[R/S] [†]	G=(gross)
			[r/s] [†]	F ?
38	Key in federal withholding	F	[R/S]	s ?
39	Key in state withholding	S	[R/S]	FICA=\$()
			[r/s] [†]	(other ded.)
			[R/S] [†]	$\Sigma DED=$()$
			[r/s] [†]	ΣG=\$()

				SIZE: 014+
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
			[r/s] [†]	ΣF=\$()
			[r/s] [†]	ΣS=\$()
			[r/s] [†]	ΣFICA=\$()
			[R/S] [†]	Σ (other ded.)
			[r/s] [†]	NET=\$()
			[R/S]	RDY 01 OF(NN)
40	Load employee data card for update of			
	year to date summations.			
41	For another employee go to step 25.			
+	Only required if a printer is present.			

Г

		47 RCL 00	
		40 9/00	
ROLL"	I n itialize	48 / 10 /	
02 FIX 0		49 "SINGLE"	
03 CF 29		DØ HVIEW	
04 PC1 00		51 EC2 55	
04 KUL 00			
05 ABS	Test for correct	52 PSE	
GE THT		53 ABS	
00 100	size		
07 SF 25		54 FRU	
		55 100	
BO KUL IND			
X		56 *	
00 ECOC 25		57 CL9	
07 75:0 25			
10 GTO 00		58 HKUL X	
4 4 4		59 "F EXEMP	
12 +		1."	
17 CE 21		60 OVIEN	
13 CF 21			no. of exempt.
I 14 "RELOAD		61 FC? 55	
DOTO:		62 PSE	
рнін			
15 AVIEW		63 FU? 55	
14 000		64 CTO 00	
16 F3E			
17 "CARD AF		65 "PER END	
TED"		TNC "	
IER			(fo r printer
18 AVIEW		66 PRUMPI	(=== p=================================
10 000		67 INT	only)
17 FSC			
20 "SIZE "		68 HRCL X	
01 100		69 " 1- / "	
21 100			
22.X>Y?		70 LASTX	
		71 ERC	
23 76			
24 ARCL Y		72 100	
OF DROMDT		77 *	
25 PRUMPI			
26+LBL 00		74 INT	
07 ECO 55	General output	75 ORCI X	
27 632 33	ocherar output		
28 SF 21		76 "⊢∕"	
		77 LOSTV	
27 ULH			
30 ARCL 01		78 FRC	
		79 100	
JI MYIEW	First name		
32 FC? 55		80 *	
77 PSF		81 ARCL X	
			Destate 1.
34 CLH		82 PKH .	Print date
75 ORCI 02		83+LBL 00	
			Input new data
36 ARCE 03		84 "KEG HUU	-
37 AVIEW	Last name	RS "	
	Last name	05 000MDT	Pag hours
38 FC? 55		OJEKUNEL	keg nours
39 PSF		86 FIX 2	
40 010	1	07 000 V	
40 LLH		OF MAUL A	
41 ARCL 04		88 HR	
40 0001 05	1	00 500 55	
42 HKUL 05			
43 AVIEW	Soc Sec #	90 PRA	
44 E00 EE		91 PC1 04	
44 FC? 55	1	51 R.CL 00	
45 PSE		92 *	
AC MODDICD	4	97 PND	
46 "MHKKIED]	73 KHD	
	1	94 "\$"	

95 ARCL X		145 %	
96 SF 21		146 RND	
97 OVIEW		147 ST+ 10	
		140 CT + 17	
98 °U. I. H		148 317 13	
OURS "	0 11 1	149 "FICH=\$"	
99 PROMPT	0.1. hours	150 ARCL X	
100 ARCL X		151 AVIEW	
101 HR		152 RCL 00	
100 500 55		157 OPC	
102 F3: 00		100 800	
103 PRH		154 181	
104 RCL 06		155 1 E3	
105 RCL 07		156 /	
106 *		157 13	
107 *		158 +	
		159 010 00	
108 RND		137 610 88	
109 "\$"		160+LBL 01	Other deductions
110 ARCL X		161 CLA	other deductions
111 AVIEW		162 ARCL IND	1
112 +			1
		163 "+=\$"	
110 010 00		164 TSC X	1
113 "G=\$"		163 RUL 08	1
116 ARCL X		166 RUL IND	i
117 AVIEW	Gross	Y	
118 "F ?"		167 X>0?	:
119 PROMPT	Federal tax	168 %	
120 "F=\$"	rederat Lax	169 ABS	
121 OPCL V		170 RND	
100 FC0 FE		171 ST+ 10	
122 F3: JJ		171 070 10 170 0001 V	
123 PRH		172 HRUL A	i
124 STO 10		173 HVIEW	1
125 ST+ 11		174 ISG Z	
126 "S ?"		175 ST+ IND	
127 PROMPT	State tax	z	
128 "S=\$"		176 RDN	
		177 RDN	
127 HKOL A 170 ECO EE		17041 01 00	+
130 F37 33			
131 PRH		179 186 8	
132 ST+ 10		180 GIU 01	
133 ST+ 12		181 "∑DED=\$"	Sum of deductions
134 RCL 08		182 ARCL 10	this period
135 22900	Marimum FICA	183 AVIEW	•
136 RCI 09	Haximum FIOA	184 "ΣG=\$"	
177 -		185 0801 09	Voor to data
		102 OVIEU	
130 KUL 00		107 "TE-4"	aeductions
137 +			
140 X>Y?		188 HRUL II	
141 X<>Y		189 AVIEW	
142 X<0?	1	190 "∑S=\$"	
143 CLX	1	191 ARCL 12	
144 6.13	FTCA 7	192 AVIEW	
1 144 0.10	ITTOM %		

193 "∑FICA=\$		01+LBL "EMP	Initialize
			inicialize
194 ARCL 13		92 "NO. OF	
195 OVIEW			
100 500			
196 FRC		03 PRUMPI	
197-13		04 3	Calculate
198 +		05 *	ST7E
199 CTO 00		04 5	SIZE
		00 0	
200+LBL 02		07 +	
201 "Σ"		08 "SET SIZ	
202 ARCL IND		E "	
X			
207 "L-#"			
203 F-*		10 CF 29	
204 2		11 ARCL X	
205 +		12 PROMPT	
206 ARCL IND		13.1	
v		14 _	
			•
207 HVIEW		15 \$10 00	
208+LBL 00		16 "FIRST N	First name
209 ISG X	Net	AME ?"	
210 CTO 02		17 00N	
210 010 02			
211 "NE!=∌"		18 PRUMPT	
212 RCL 08		19 ASTO 01	
213 RCL 10		20 "LAST NA	Last name
214 -		ME 2"	
215 OPCL V			
215 ARCE A		21 PROMPT	1
216 CF 21		22 HUFF	
217 AVIEW		23 ASTO 02	
218 SF 21		24 8SHE	
219 ES2 55			
		20 H310 05	
220 FRH		26 "SUC SEC	SS #
221 STOP		NO ?"	
222 WDTA	T	27 PROMPT	
223 RTN	Update	28 " "	
224 END			3 spaces
224 .END.	4	29 HRUL X	
		30 ASTO Y	
		31 ASHF	
	1	32 ASTO X	
	4		
	4		
	4	34 " "	3 spaces
40		35 ARCL Y	_
		36 "⊢-"	
	7	37 ARCL X	
	4		
	4		
		39 4510 04	
		40 ASHF	
	1	41 ASTO X	
	4	42 "-"	
	4		
	4	43 HRUL A	
	_	44 HSTU 05	
50	7	45 "M OR S?	Married or single

		92 AVIEW	
46 AON	1	93 PSE	
47 PROMPT		94 GTO 03	
48 00FF			
49 LF 00		96 ASIU IND	
50 ASTO Y		X	
51 "S"		97 ISG X	
52 OSTO X		00 "4 7"	
53 X=1?	1	99 857 00	
54 SF 00	1	100 "% ?"	
55 "EXEMPTI	no, of exemptions	101 PROMPT	
ONS 2"		102 502 00	
		102 FC? 00	
J6 PRUNFI	1	103 CHS	
57 100	1	104 STO IND	
58 /		Y	
59 801 00		105 PTN	
60 +	1	106 ISG X	
61 FS?C 00	4	107+LBL 00	
62 CHS		108 ISG X	
63 STO 00			
24 "HOCE 2"	Wago		
64 WHGE (wage	110+LBL "NT"	New Year
65 PRUMPT		111 0	1
66 STO 06		112 STO 09	
67 "O. T. F	Ο Τ ΕΔΟΤΟΒ	113 STO 11	
OCTOR 2"	ori: morek	114 910 12	•
		114 510 12	
68 PRUMPT		115 RCL 00	
69 STO 07		116 ABS	
70 RCL 00		117 INT	
71 OBS		110 1 57	
		119 /	1
- 73 1 E3		120 13.00003	
74 /		121 +	
75 13		122 0	
76 +		10741 01 04	
		123VLBL 04	
77 SF 00	1	124 STO IND	
78 "% DEDUC	1	Y	
TIONS"		125 ISG Y	
79 AVIEW	1	126 610 04	
81 610 88		128 R N	
82+LBL 03		129 .END.	
83 "DED. NA		1	
ME 2"	1	1	
85 CF 23			
86 PROMPT	1		1
87 AOFF			4
88 FS2 23			4
	1		4
89 610 61			
90 CF 00			1
91 "\$ DEDUC	1	00	1
TIONS"			L

¹²**REGISTERS, STATUS, FLAGS, ASSIGNMENTS**

	DATA REGISTERS		STATUS								
00	Used First name Last name Last name	50		SIZE ENG DEG	<u>014</u>	<u>++</u>	TOT. FIX – RAD	REG. <u>8</u> SC GR	2+ I AD	_ USER MO ON C	DE)FF
05	SS# SS#	55					0.5.7.1	FL	AGS		0.4750
	Wage			#	S/C		SETI	NDICATE	S	CLEAR INDI	CATES
	0.T. Wage			00		<u>%</u>	ded			\$ ded	
	G						······				
10		60									
	2 Ded	00									
	2F										
	25										
	ZFICA										
15	Name of ded.	CE.									
15	% or dollar amount	65									
	•										
	:										
20		70									
20		70									
25		75									
-25		/5									
						-					
30		80									
35		85									
								ASSIGN	MEN	ITS	
					FUNCT		1	KEY		FUNCTION	KEY
40		90									
45		95									

INVOICING

(Requires One Memory Module)

Given a discount rate (DISC), number of units (UNITS), and price per unit (PRICE) for each line item, this program calculates the net line total (NLT), maintains a running subtotal (ST) and grand total (GT), and determines each line total's percent of the grand total (%T). A manimum of 40 line items may be input. If more than 40 are input, ">LIM" is displayed.

The net line total is the number of units multiplied by the unit price, less the discount amount. Each time it is calculated, the value is added to both the running subtotal and the grand total. Pressing [R/S] displays the running subtotal and clears the subtotal accumulation (grand total is not affected). Pressing [RS] again displays the grand total (without clearing it). The grand total is not cleared (set to zero) until you start a new problem.

Each line total's percent of the grand total is also calculated. The last output is FINISHED, indicating that all percentages have been calculated.

If after calculating a net line total it is discovered that one of the last input values was keyed incorrectly, press [E] to delete the last line total. Repeat if a prior line total was incorrect.

The discount rate is retained and must only be keyed in when it changes.

Invoicing Net line total = $\left(\text{Price - Price x } \frac{\text{DISC}}{100} \right) \times (\#)$

Example 1:

The controller of a small company can take advantage of several discounts if he pays the two bills shown below. What amount should be remitted for each bill, what is the grand total to be paid, and what percentage of the grand total is each payment?

Bi11	1	(2%	discount	if	paid	today))
------	---	-----	----------	----	------	--------	---

Line Item	# of Units	Unit Price		
1	25	\$ 2.75		
2	60	1.50		
3	71	1.50		

Bill 2 (2% discount if paid today)

Line Item	# of Units	Unit Price		
1	12	\$10.50		
2	17	37.20		

Solution:		
Keystrokes	Display:	
[USER]		(set USER mode)
[XEQ] [ALPHA] SIZE [ALPHA] 045		
[XEQ] [ALPHA] INVOICE [ALPHA]	% DISC. ?	
2 [R/S]	UNITS ?	
25 [R/S]	PRICE ?	
2.75 [R/S]	NLT=\$67.38	
[B]	UNITS ?	
60 [R/S]	PRICE ?	
1.5 [R/S]	NLT=\$88.20	
[B]	UNITS ?	
71 [R/S]	PRICE ?	
1.5 [R/S]	NLT=\$104.37	
[R/S]	S.T.=\$259.95	
[B]	UNITS ?	
•	•	
	•	
[R/S]	S.T.=\$743.23	
[R/S]	G.T. =\$1003.18	
[R/S]	%T1=6.72	
[R/S]	%T2=8.79	
•		
•		
•		
	%T5=61.78	
[R/S]	FINISHED	

				SIZE: 045 •
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program and set USER mode		[USER]	
2	Initialize the program		[XEQ] INVOICE	% DISC ?
3	Input: percent discount;	%	[R/S]	UNITS ?
4	no. of units; and	units	[R/S]	PRICE ?
	price	price	[R/S]	
5	Find Net Line Total			NLT=\$()
6	(optional) Find running subtotal		[R/S]	S.T.=\$()
7	(optional) Find running grand total		[R/S]	G.T.=\$()
8	(optional) Find each line total's percent		[R/S]	%T1=()
	of the grand total		[R/S]	%T2=()
			(etc)	
9	If last net line total was incorrect, press	→	[E]	(NLT)
	to delete it from the running sums			
10	For another bill, press →		[A]	% DISC ?
	and go to step 3, or press \rightarrow		[в]	UNITS ?
	and go to step 4			
	*While this program has been written to accept up to 40 line items, the user may size the registers less than this value			
	if they so desire to gain additional program steps. If this is done, lines 004			
	and 036 should be changed accordingly.			

01+LBL "INV OICE" 02 CF 29 03 CLRG 04 4.044 05 STO 00 06+LBL A 07 "% DISC. ?" 08 PROMPT 09 STO 03 10+LBL B 11 "UNITS ?	Initialize Input data	00 47 X=0? 48 GTO 03 49 RCL 02 50 / 51 100 52 * 53 "⊢=" 54 ARCL X 55 PROMPT 56 ISG 00 57 GTO 02 58+LBL 03 Correction 59 "FINISHE routine
12 PROMPT 13 "PRICE ? " 14 PROMPT 15 RCL 03 16 % 17 -	Calculate results	D" 60 PROMPT 61◆LBL E 62 1 63 ST- 00 64 RCL IND 00
18 * 19 STO IND 00 20 ST+ 01 21 ST+ 02 22 "NLT" 27 ISC 00		65 ST- 01 66 ST- 02 67 ST- IND 00 68 STOP 69*LBL 00 Display routine 70 "b-*"
23 136 00 24 GTO 01 25 ">LIM" 26 PROMPT 27+LBL 01 28 XEQ 00 29 RCL 01	Display subtotal	70 F-¥ 71 ARCL X 72 PROMPT 73 RTN 74 .END.
30 ST- 01 31 "S.T." 32 XEQ 00 33 RCL 02 34 "G.T." 35 XEQ 00 36 4.044	grand total	90
37 STO 00 38◆LBL 02 39 "%T" 40 RCL 00 41 3 42 -	% of total	
43 FIX 0 44 ARCL X 45 FIX 2 46 RCL IND		00

REGISTERS, STATUS, FLAGS, ASSIGNMENTS["]

DATA REGISTERS			STATUS						
00	Pointer S.T. G.T. % discount	50	SIZE ENG DEG	<u>045</u> 	TO1 FIX RAD	T. REG. <u>7(</u> SC GR	0 AD	USER MOI - ON <u>X</u> 0	DE IFF
05	NLT1 NLT2	55	#	INIT S/C	SET		AGS s	CLEAR INDI	CATES
10		60							
15		65							
20		70							
25		75							
30									
35		85				ASSIGN		ſS	
40		90		FUNCT	ION	KEY	Fl	JNCTION	KEY
45	NLT40	95							

ACCOUNT POSTING

This program posts to registers by line item or account number (0 through 24). Amounts are posted to any of the registers in random order by inputting the account number (register number) to be posted to. After the last posting, the grand total is found, the amount in each register and the grand total may be printed, and an updated data card written.

References: HP-67/HP-97 Users' Library program #00428D submitted by D. A. Jeffus.

Example: Post \$5.00 and \$25.00 to account number 1 and \$13.00 to account number 5, and find the grand total.

Keystrokes:	Display:	
[USER]	(Set	USER mode)
[XEQ] [ALPHA] SIZE [ALPHA] 025		
[XEQ] [ALPHA] POST [ALPHA]	ACCOUNT NO. ?	
1 [R/S]	AMOUNT ?	
5 [R/S]	ACCOUNT NO. ?	
1 [R/S]	AMOUNT ?	
25 [R/S]	ACCOUNT NO. ?	
5 [R/S]	AMOUNT ?	
13 [R/S]	ACCOUNT NO. ?	
[B]	G.T.=\$43.00	

				SIZE :	025	*
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPL	_AY	
1	Load the program and set USER mode		[USER]			
2	Initialize the program		[XEQ] POST	ACCOUNT	NO.	?
3**	Read data card					
4	Input the account number	no	[R/S]	AMOUNT	?	
	and amount to be posted to it.	amount	[R/S]	ACCOUNT	NO.	?
5	Repeat step 4, or					
6	Find the grand total		[B]	G.T.=\$()	
7	Print the grand total and all registers		[R/S]			
8	Write updated registers on data card		[XEQ] WDTA			
*	While this program has been written to pos	t to 25				
	whatever number he desires, changing progr	am step				
	010 accordingly.					
**	This step is performed only after the					
	8 has been executed.					

01+LBL "POS	Initialize	51	
02+LBL A 03 "ACCOUNT NO. ?"	Add "Amount" to "Account No."XX		
04 PROMPT 05 "AMOUNT ?"			
06 PROMPT 07 ST+ IND		60	
08 GTO A 09◆LBL B 10 .024 11 ENTER↑			
12 0 13+LBL 01 14 RCL IND			
Y 15 + 16 ISG Y 17 CTO 01	Add register contents up	70	
18 "G.T.=\$" 19 ARCL X 20 PROMPT	Display grand total		
21 PRA 22 PRREG 23 STOP 24 .FND.	Print grand total and re- gister contents		
30		80	
		-	
40		90	
50		00	

REGISTERS, STATUS, FLAGS, ASSIGNMENTS²¹

		DATA RE	GIS	TERS					ST	ATUS	;	
00	u	sed	50		SIZE ENG DEG	_ <u>025</u> 	j	TOT. FIX — RAD _	REG 2 S G	35 CI RAD	USER MO	DE 0FF
05			55		#	INIT S/C		SET IN	FI	.AGS	CLEAR INDI	CATES
10			60									
15			65									
20			70									
25		/	75									
30			80									
35			85									
								A	SSIG	NMEN	NTS	
40			90			UNCT	ION		KEY		FUNCTION	KEY
45			95									

TABULATOR

This program is designed to be of aid in tabulating applications such as accounting and estimating. It can be used to find column and row totals for any number of columns and rows. In addition, it finds the grand total, the percent of the grand total the row and column totals represent, and the proportion to some reference number the row totals represent.

	1	2	3		m	
1	Val 1.1	Val 1.2	Val 1.3		Val 1.m	RTL1
2	Val 2.1	Val 2.2	Val _{2.3}	• • •	Val 2.m	RTL ₂
3	Val 3.1	Val 3.2	Val 3.3		Val 3.m	RTL 3
		•			•	
		•			•	
		•			•	
n	Val n.1	Val _{n.2}	Val n.3		V n.m	RTL n
	CTL ₁	CTL ₂	CTL3		CTL	GRAND TOTAL (GT)

Equations: proportion of $total_i = \frac{Total_i}{Grand total} \times ref.$ number % of $total_i = \frac{Total_i}{Grand total} \times 100$

Reference: HP-67/HP-97 Users' Library Program; #00231D by Howard Kutner.

Example: The following table is to be totaled (both rows and columns). Also, find the percent of total sales for each booklet.

	Jan	Feb	March	April	May
Book 1 Book 2 Book 3	273 1093 423	284 847 654	303 1222 683	244 1027 540	252 978 570
Book 4	118	255	453	755	805

Booklet Sales Data

Booklet Sales Data

Solution:

	Jan	Feb	March	April	May	Totals	Percents
Book 1 Book 2 Book 3 Book 4	273 1093 423 118	284 847 654 255	303 1222 683 453	244 1027 540 755	252 978 570 805	1356 5167 2870 2386	11.51% 43.87% 24.37% 20.26%
TOTALS	1907	2040	2661	2566	2605	11779.00	100.00%

Keystrokes:

Display:

[USER]	(set USER mode	:)
[XEQ] [ALPHA] TAB [ALPHA]	NO. COLUMNS ?	
5 [R/S]	NO. ROWS ?	
4 [R/S]	SIZE=15.00	
[XEQ] [ALPHA] SIZE [ALPHA] 015		
[R/S]	VALUE?	
273 [R/S]	VALUE?	
1093 [R/S]		
423 [R/S]		
118 [R/S]	•	
284 [R/S]	•	
847 [R/S]		
•	VALUE?	
805 [R/S]	G. TOT.=11,779.00	
[B]	ROW,1.=1,356.00	
[R/S]	ROW, 2. =5,167.00	
	•	
[R/S]	ROW,4.=2,386.00	

COL,1.=1,907.00
COL,2.=2,040.00
:
%,1.=11.51
%,2.=43.87
:
%,4.=20.26

				SIZE: 6+
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program and set USER mode.		[USER]	
2	Initialize		[XEQ] TAB	NO. COLUMNS ?
3	Input: the number of columns	М	[r/s]	NO. ROWS ?
	and the number of rows	N	[R/S]	SIZE=XXX
4	Size the program		[XEQ] SIZE XXX	
5	Press →		[R/S]	VALUE ?
6	Input values in order by columns	value	[r/s]	VALUE ?
7	Repeat step 6 until all values are input,			(or) G. TOT.=()
	at which point the grand total will auto-			
	matically be displayed. Then perform any			
	of the following in any order. Find:			
8	Row totals:		[в]	ROW,1=()
	Perform this step for x=2,3,N		[R/S]	ROW,x=()
9	Column totals:		[c]	COL,1=()
	Perform this step for x=2,3,M		[R/S]	COL,x=()
_10	Row percentages of G. TOT.:		[D]	%,1=()
	Perform this step for x=2,3,N		[R/S]	%,x=()
11	Column percentages of G. TOT.:		[A]	%,1=()
	Perform this step for x=2,3,M		[R/S]	%,x=()
12	P <u>roportion of row total to a number</u> :			
	I <u>nput</u> reference number	ref	[E]	PROP,1=()
	Perform this step for x=2,3,N		[r/s]	PROP,x=()

01+LBL "TAB	Initialize	45 GTO 03	
		46 STO 03	
02 CLRG		47 "G. TOT.	
03 "NO. COL		= "	
UMNS ?"		48 ARCL X	
04 PROMPT	Compute size and	49 PROMPT	
05 5	register loss-	50+1 BL A	Dieplay column
00 0 04 +	tions for a lum	51 CE 01	totol normanters
07 CTO 01	crons for column	52 CE 02	cotal percentages
00 CTO 00	sums and row sums	JZ CF 02	
08 510 00		53 LF 03	
09 "NU. RUW		54 XEQ 00	
S ?"		55 100	Display row total
10 PROMPT		56 STO 04	
11 +		57 GTO 04	
12 STO 02		58+LBL B	
13 1		59 SF 01	
14 ST+ 00		60 GTO 01	Recall, calculate
15 +		61+LBL D	and display
16 1 F3		62 CE 01	regulte
17 97/ 01		67AL PL 01	resures
10 CT/ 01		64 CE 02	
		64 LF 02 /F CF 07	
19 ULX		65 LF 03	
20 6		66 100	
21 ST+ 01		67 STO 04	
22 RCL 00		68+LBL 10	
23 ST+ 02		69 1.1	
24 RCL 02	1	70 STO 05	
25 STO 00		71 RCL 00	
26 "SIZE="		72 STO 02	
27 ARCL T	1	73+LBL 04	
28 PROMPT	1	74 RCL IND	
29+1 BL 02	Trout and sum	02	
70 "VOLUE 2		75 502 01	
. SO PALOC :	values	70 63: 01	
	1	76 610 83	
31 PRUMPT	1	77 RUL 03	
32 ST+ IND	t		
01	1	79 RCL 04	
33 ST+ IND	1	80 *	
02	4	81 "%,"	
34 ISG 02	Adjust column	82+LBL 05	
35 GTO 02	and row pointers	83 FS? 01	
36 RCL 00	and low poincers	84 "ROW,"	
37 STO 02		85 FS? 02	
38 ISG 01		86 "COL,"	
39 GTO 02	1	87 FS? 03	
40 0	1	88 "PROP."	Display column
41 + I BI 97	Display grand	89 XEO 09	totals
42 DCI TND		90 TSC 02	colard
42 KUL IND 00	total	90 ISG 02 91 CTO 04	
02 47	4	71 GIU 04	Calculate column
43 +	4	92 STUP	Carcurate corumn
44 ISG 02		93+LBL C	pointer

 ,		1		
94 XEQ 00		51		
95 SF 01				
96 SF 02				1
97 CF 03				
98 GTO 04	1			1
101 510 05				
102 RCL 01	Display			
103 FRC	proportions	60		
104 6				
105 +				
106 STO 02	Dicplay routing			
107 PTN	Display loucine			
109 510 04				
110 CF 01				
111 CF 02				1
112 SF 03				1
113 GTO 10		70		
114+LBL 09		/0		
115 FIX 0				
116 BRCL 05				
117 "H="				
119 HRUL X				1
120 PRUMPT				
121 ISG 05				
122 RTN				
123 .END.				4
		80		
	1			
	1			1
	1			4
	4			4
	4			4
	4			4
40	4	90		4
	4			•
	1		• · · · · · · · · · · · · · · · · · · ·	1
	1			1
	1			1
	4			4
	4			4
	4			4
	4			4
50		00	l	

²⁸REGISTERS, STATUS, FLAGS, ASSIGNMENTS

	DATA REGISTERS			STATUS					
00	initial R ₂ contents column pointer row pointer G. TOT.	\$ 50	SIZE ENG DEG	<u>6+</u> X	TOT FIX - RAD	. REG. <u>42</u> 2 SCI GR	2+ AD	_ USER MO _ ON <u>X</u> (DE DFF
05	100 or ref display index	55			SET		AGS		
			<i>#</i>				<u>, 1</u>	OLEAN IND	IOATES
						y row t	otala	1	
			02			y_colum	n tota	als	
10		60	03		displa	y propo	rtions	5	
<u> </u>	•								
	•								
	•	·····							
	•								
15	row sums	65							
15	•	03							
	•								
	•								
	•								
	•	70							
20	•	70							
	•								
	•								
		75							
25		/5							
30		80							
35		85							
		l							
						ASSIGN	IMEN ⁻	TS	
				FUNCT	TION	KEY	F	UNCTION	KEY
40		90							
45		95							

RETAIL INVENTORY MONITOR

Given an initial inventory of Qo units, having a wholesale value Co, and purchase data (providing the quantity Qp whose cost Cp is figured per unit Up for each transaction), and sales data (providing the quantity Qs whose cost Cs is figured per unit Us for each transaction), this program will provide:

а.	Sum of Purchase Quantities	ΣQp
b.	Sum of Sales Quantities	ΣQs
c.	Perpetual Inventory Quantity	$Qf = Qo + \Sigma Qp - \Sigma Qs$
d.	Estimated Retail Value of Remaining Stock	$kV = Qf \frac{\Sigma(Qs Cs/Us)}{\Sigma Qs}$
e.	Cost of Goods Sold	$CGS = \left(\frac{Co + \Sigma(Qp Cp/Up)}{(Qo + \Sigma Qp)}\right) \Sigma Qs$
f.	Total Purchase Expense	$PE = \Sigma(Qp Cp/Up)$
g.	Total Gross Sales Revenue	$GSR = \Sigma(Qs Cs/Us)$
h.	Margin of Profit on Sales (in decimal form)	$MP = 1 - \frac{Co + \Sigma(Qp Cp/Up)}{\Sigma(Qs Cs/Us)}$

Calculation of Estimated Retail Value of Remaining Stock prior to entry of any sales data will yield an error condition due to an undefined operation i.e., division by zero.

References: HP-65 Users' Library program #01281A submitted by David M. Baum.

```
Example: Starting Inventory: Qo = 1000 units
                                                Co = $150,000
          Purchases: 100 units @ $100/1 unit
                                                 Sales: 15 units @ $225/1 unit
                       25 units @ $300/2 units
                                                          100 units @ $175/1 unit
                        1 unit @ $1500/5 units
                                                         1000 units @$1300/10 units
Given the data provided above, compute:
     a. Total Quantity of units purchased
                                                  e. Cost of Goods Sold
     b. Total Quantity of units sold
                                                  f. Total Purchase Expense
     c. Final Inventory after transactions
                                                  g. Total Gross Sales Revenue
     d. Estimated Retail Value of Final
                                                  h. Margin of Profit on Sales
        Inventory
Keystrokes:
                                             Display:
[USER]
                                                                 (Set USER mode)
[XEQ] [ALPHA] SIZE [ALPHA] 006
[XEQ] [ALPHA] RET [ALPHA]
                                             INIT. QUANT. ?
1000 [R/S]
                                             INIT. COST ?
150000 [R/S]
                                             QTY <PURCH>?
100 [R/S]
                                             COST ?
100 [R/S]
                                             UNIT OF COST
1 [R/S] [A]
                                             QTY <PURCH>?
 :
                                                :
[в]
                                             QTY <SOLD> ?
1000 [R/S]
                                             COST ?
1300 [R/S]
                                             UNIT OF COST
10 [R/S] [C]
                                             PURCH.=$126.00
[R/S]
                                             SALES=$1,115.00
                                             END INV.=$11.00
                                             RET. VAL.=$1,488.45
                                             C.G.S.=$16,2447.38
                                             PUR. EXP.=$14,050.00
[R/S]
                                             GROSS=$150,875.00
[R/S]
                                             MARGIN=%90.02
```
				SIZE: 006
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program and set USER mode		[USER]	
2	Initialize the program		[XEQ] RET	INIT. QUANT. ?
3	Enter initial conditions: Quantity	Qo	[R/S]	INIT. COST ?
	Cost	Со	[R/S]	QTY. <purch> ?</purch>
4	Enter Purchase Transactions Data: Quantity	Qp	[R/S]	COST ?
	Cost	Ср	[R/S]	UNIT OF COST
	Unit of Cost	Up	[R/S]	
	Press →		[A]	QTY. <purch> ?</purch>
	and repeat step 4 for each transaction, or		[B]	QTY. <sold> ?</sold>
5	Enter Sales Transaction Data: Quantity	Qs	[R/S]	COST ?
	Cost	Cs	[R/S]	UNIT OF COST
	Unit of Cost	Us	[R/S]	
	Repeat step 5 for each transaction. To correct either a step 4 or 5 entry, re-enter the data using the negative of the previously entered quantity "Q" term. Then enter correct data as next step).		
6	Computation and Output:			
	Quantity of units purchased		[c]	PURCH.=\$()
	Quantity of units sold		[R/S]	SALES=\$()
	Final Stock Quantity		[R/S]	END INV.=\$()
	Estimated Retail Value of Of		[R/S]	RET. VAL.=\$()
	Cost of Goods Sold		[R/S]	C.G.S.=\$()
	Total Purchase Expense		[R/S]	PUR. EXP.=\$()
	Total Gross Sales Revenue		[R/S]	GROSS=\$()
	Margin of Profit on Sales		[R/S]	MARGIN=%()
			-	

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Г

01+LBL "RET				
			45 XEQ 00	
02 SF 29			46 RCL 01	
03 CLRG			47 *	
04 "INIT. Q	Initialize		48 RCL 00	
UANT. ?"			49 /	
05 PROMPT			50 "REI. VH	
06 STO 02				
07 "INIT. C			51 XEQ 00	
OST ?"			52 RCL 03	
08 PROMPT			53 RCL 05	
09 STO 03			54 +	
10+LBL A	Input purchase		55 RCL 02	
11 "QTY <pu< td=""><td>data and com-</td><td></td><td>56 RCL 04</td><td></td></pu<>	data and com-		56 RCL 04	
RCH>?"	pute PE	1	57 +	
12 PROMPT			58 /	
13 ST+ 04			59 RCL 00	
14 "COST ?"			60 *	
15 PROMPT			61 "C.G.S."	
16 "UNIT OF			62 XEQ 00	
COST"			63 RCL 02	
17 PROMPT			64 RCL 05	
18 /			65 "PUR. EX	
19 *			Ρ."	
20 ST+ 05			66 XEQ 00	
21 STOP			67 +	
22+LBL B	input sales data		68 RCL 01	
23 "QTY <so< td=""><td>and compute GSR</td><td></td><td>69 "GROSS"</td><td></td></so<>	and compute GSR		69 "GROSS"	
LD> ?"			70 XEQ 00	
24 PROMPT			71 /	
25 ST+ 00			72 CHS	
26 "COST ?"			73 1	
27 PROMPT			74 +	
28 "UNIT OF			75 100	
COST"			76 *	
29 PROMPT			77 "MHRGIN=	
30 /				
31 *			78 HRCL X	
32 ST+ 01			79 PRUMPI	
33 STOP			80+LBL 00	
34+LBL C	Display results		81 "F=\$"	
35 RCL 02			82 HRUL X	
36 RUL 04			83 PRUMPI	
37 "PURCH.			84 KIN	
38 XEQ 00			85 .END.	
37 + 40 DC1 00				
40 KUL 00 41 "COLEC"				
41 "SHLES" 49 VEO 00				
42 AEQ 00 47 -		•		
43 - 44 "FND INV		00		

REGISTERS, STATUS, FLAGS, ASSIGNMENTS³³

	DATA F	REGISTERS	6				STA	TUS		
00	ΣQ ΣGSR Qo Co	50		SIZE ENG DEG	OC	06 TO FIX RAD	r. REG _2 SC GR	43 I AD	USER MC ON(DE DFF
05	ΣQp ΣPE	55		#	INIT S/C	SET		AGS s	CLEAR IND	ICATES
				29	S	for pr	oper di	splay	format	
10		60								
15		65								
20		70								
25		75								
30		80								
35		85								
							ASSIGN	IMEN [®]	TS	
40		90			UNCT	ION	KEY	F	UNCTION	KEY
45		95								

ESTIMATING INVENTORY

(Requires one memory module)

This program estimates the cost of ending inventory using either the gross profit or the retail method.

The gross profit method uses the following equations:

$$I_2 = I_1 + P - [S(1 - R)]$$

where:

I₂ = Ending inventory

- I₁ = Beginning inventory
- P = Purchases
- S = Sales
- R = Estimated gross profit percentage on sales

After inputting any 4 of the above 5 unknowns, the remaining one is calculated. The retail inventory method uses these equations:

$$I_{r2} = R_{1} - R_{2}$$
$$I_{c2} = I_{r2} \times \frac{R_{3}}{R_{1}}$$

where: R₁

$$R_1 = I_{r1} + P_r + M_u$$

 $R_2 = S + M_j + E + W_r$

$$R_3 = I_{c1} + P_{c} T$$

and:

 I_{c_2} = Ending inventory at cost

- I_{r_2} = Ending inventory at retail
- I_{r_1} = Beginning inventory at retail
- P_r = Purchases at retail
- M₁ = Markups less markup cancellations
- E = Employee discounts (if not recorded on the books)

- P_{c} = Purchases at cost
- M_{1} = Markdowns less markdown cancellations
- S = Sales
- T = Transportation in

References Lipkin, Lawrence; Feinstein, Irwin; Derrick, Lucille, <u>Accountants Handbook of Formulas and Tables</u>, pages 74-75, Prentice-Hall, Inc., 1963. HP-65 Users' Library programs #0763A and #839A written by E.Wayne Brasch.

Examples :

1) If a company estimates its gross profit percentage on sales to be 35% and its sales for the period under review were \$175,000, what would its estimated inventory be if beginning inventory was \$200,000 and purchases were \$55,000 using the gross profit method?

2)		At Cost		<u>At Retail</u>	
	Beginning inventory	\$80,000.00	I	\$100,000.00	I r
	Purchases	45,000.00	Pc	50,000.00	P _r
	Transportation in	2,000.00	Т		
	Worthless inventory			1,000.00	W _r
	Employee discounts			2,500.00	E
	Markups			7,500.00	
	Markup cancellations			2,500.00	
	Markdowns			8,000.00	
	Markdown cancellations			3,000.00	
	Sales			85,000.00	S

Using the retail method, what would be an estimate of the ending inventory at cost? (approximates lower of cost or market)

Solutions: Keystrokes: Display: [USER] [XEQ] [ALPHA] SIZE [ALPHA] 007 1) [XEQ] [ALPHA] GP [ALPHA] PURCH. ? 200000 [R/S] 55000 [R/S] SALES ? 175000 [R/S] 35 [R/S] [R/S]2) [XEQ] [ALPHA] RT [ALPHA] 100000 [R/S] 50000 [R/S] SALES ? 7500 [ENTER] 2500 [-] [R/S] 85000 [R/S] 8000 [ENTER] 3000 [-] [R/S] 2500 [R/S] 1000 [R/S] 80000 [R/S] TRANS. ? 45000 [R/S] 2000 [R/S] [R/S]

				SIZE :007
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program and set USER mode		[USER]	
2	Gross Profit Method:		[XEQ]GP	BEG. INV. ?
3	Input 4 of the following; beg. inv.	I1	[R/S]	PURCH. ?
	purchases;	Р	[R/S]	SALES ?
	sales;	S	[R/S]	% G. MARGIN
	% gross margin; and	R	[R/S]	END INV. ?
	ending inventory.	I	[R/S]	BEG. INV. = \$
4	When prompted for the unknown			or
	variable, press [R/S] make no			PURCH. = $()$
	input]. The unknown variable			or
	is automatically calculated			SALES = \$ ()
	when all the data is input			or
				MARG. = % ()
				or
	· · · · · · · · · · · · · · · · · · ·		_	END INV.=\$()
5	Retail method:		[XEQ]RT	BEG. INV. <r>?</r>
	Input: beginning inventory at retail	I _{r1}	[R/S]	PURCH. <r>?</r>
	purchases at retail;	Pr	[R/S]	MARKUPS ?
	markups less cancellations;	Mu	[R/S]	SALES ?
	sales;	S	[R/S]	MARKDOWNS ?
	markdowns less cancellations;	Mj	[R/S]	EMPL. DISC. ?
	employee discounts;	E	[R/S]	WORTHLESS INV.
	worthless inventory;	Wr	[R/S]	BEG. INV. <c>?</c>
	beginning inventory at cost;	Ici	[R/S]	PURCH. <c>?</c>
	purchase at cost; and	Pc	[R/S]	TRANS. ?
	transportation in	т	[R/S]	
6	Find: Ending inventory at cost			END INV. <c>=\$(</c>
	and Ending inventory at retail		[R/S]	END INV. <r>=\$(</r>

01+LBL "GP"	Gross Profit	45 -	
02 1.1	Method	46 RCL 02	
03 STO 00		47 -	
04 CF 22		48 RCL 04	
05 "BEG. IN	Input data	49 1	
V. ?"		50 -	
06 XEQ 09		51 /	
07 "PURCH.		52 "SALES"	
?"		53 XEQ 00	
08 XEQ 09		54+LBL 04	Calculate R
09 "SALES ?		55 RCL 05	darearate n
••		56 RCL 01	
10 XEQ 09		57 -	
11 "% G. MA		58 RCL 02	
RGIN ?"		59 -	
12 XEQ 09		60 RCL 03	
13 "END INV		61 +	
. ?"		62 RCL 03	
14 XEQ 09		63 /	
15 100		64 100	
16 ST/ 04		65 *	
17 GTO IND		66 "MARG.≃%	
06			
18+LBL 01	Calculate I.	67 ARCL X	
19 RCL 05	-1	68 PROMPT	
20 RCL 02		69+LBL 05	Calculate I
21 -		70 RCL 01	2
22 RCL 03		71 RCL 02	
23 +		72 +	
24 RCL 04		73 RCL 03	
25 RCL 03		74 -	
26 *		75 RCL 04	
27 -		76 RCL 03	
28 "BEG. IN		77 *	
V."		78 +	
29 XEQ 00	Coloulate D	79 "END INV	
30+LBL 02 71 DCL 05	Carculate F		
31 KUL 00 70 DCL 01		80 XEQ 00	-
32 RUL 01 77		81 4 LBL 09	Input storage
33 - 74 pci 07		02 FRUMF / 07 STO IND	routine
34 KUL 03 75 ±		03 370 IND 00	
33 T 74 PCI 04		00 04 DCI 00	
30 KCL 04 37 RCL 03		04 KUL 00 05 Eror oo	
78 *		00 FC/C 22 02 CTA 82	
39 -		97 ISC 00	
40 "PURCH."		88 RTN	
41 XFQ 00		89+1 BL 00	Display routine
42+LBL 03	Calculate S	90 "H=\$"	opia, routine
43 RCL 05		91 ARCL X	
44 RCL 01		92 PROMPT	

93 RTN		133 RCL 02	
QAALDI "DT"		174 "END THU	
95 "BEG. IN	Retail method	• (R2"	
V. <r>?"</r>		135 XEQ 00	
96 PROMPT	Input data	136 .END.	
97 "PURCH	Input data		
ZD\0"			
NR/:	1		
98 PRUMPI			
99 +			
100 "MARKUPS		60	
2.			
101 PROMPT			
102 +			
103 STO 01			
104 "001 60 2	Б		
104 SHEES :	^K 1		
••			
105 PROMPT			
106 "MARKDOW			
NS 2"			
107 DEOMET			
107 FROMF1		70	
108 +			
109 "EMPL. D			
ISC. 2"			
110 DDOMDT			
110 EKOMET			
111 +	1		
112 "WORTHLE			
SS INV.?"			
113 PROMPT			
114 1]		
114 +			
115 RCL 01	R ₂	80	
116 -	2		
117 CHS			
118 STO 02			
110 010 02	-		
II9 "BEG. IN	$ _{r^2}$		
V. <c>?"</c>			
120 PROMPT	ł		
121 "PURCH			
ZCN2"			
NUZ:	1		
122 PRUMPI	1	h	
123 +	4		
124 "TRANS.		90	
2"			
: 195 DDOMDT	1		
125 FRUMPI	1_		
126 +			
127 RCL 01			
128 /			
100 DCL 00	1		
127 RUL 02	4		1
130 *	4		1
131 "END INV			
. <c>"</c>			
132 XEQ 00	1	00	

^{*}**REGISTERS, STATUS, FLAGS, ASSIGNMENTS**

	DATA RE	GIS	TERS				STA	TUS		
00	pointer I_1 , R_1 P , I_{r_2} S	50		SIZE ENG DEG		7 TO1 FIX RAD	. REG(_2 SC GR	65 I AD	. USER MO 	DE DFF
05	R I ₂	55			INIT		FL	AGS		
	subroutine pointer			#	S/C	SET	INDICATE	<u>s</u>	CLEAR INDI	CATES
				22		Numeri	<u>c input</u>		no input	
10		60								
15		65								
20		70								
25		75								
			· · · · · · · · · · · · · · · · · · ·							
30		80								
25		95								
35		05								
				S				I		
							ASSIGN	IMEN	TS	
				l	FUNCT	ΓΙΟΝ	KEY	F	UNCTION	KEY
40		90								
				ļ						
							 			
45		95					 			
								<u> </u>		

INVENTORY ORDERING

This program averages the given demand for a given number of periods and computes MAD. Then, given the most recent period usage, it calculates the smoothed MAD, smoothed projection for the next period, and the order point quantity required to provide a 95% service level. Subsequent periods should be calculated using the accompanying program, "Order Point Calculation." Formulas used:

Average demand:	$\overline{\mathbf{X}} = \frac{1}{n} \sum_{\mathbf{i}=1}^{n} \mathbf{X}_{\mathbf{i}}$
mad:	$MAD = \frac{1}{n} \sum_{i=1}^{n} (X_i - \overline{X})$
Smoothed projection:	\overline{X} :DC (d) + DA (1-d) = \overline{X}_{LT}
Smoothed mad: MAI	:CAD (d) + MAD (1-d) = \overline{MAD}_{LT}
Order point quantity:	$OP: \overline{X}_{LT} + \overline{MAD}_{LT} = O.P.$
Where: d = arbits	ary choice of smoothing constant (in this program d=.1)
CAD = currer	t absolute deviation
MAD = mean a	bsolute deviation
DA = demand	average (actual usage)
DC = demand	current (actual usage)

Note: Program output adjustment is required where the demand periods used are not equal to the lead time required, e.g.,

> Demand period = one month Lead time required = two months

Multiply output by 2.

References: Production and Inventory Control Handbook, James H. Greene. APICS, McGraw-Hill Book Company, Section 8-11/13. 1970. Production and Inventory Control Systems and Decisions, James H. Greene, Richard D. Irwon, Inc., pp. 96-102. 1965, revised 1974. Inventory Systems and Controls Handbook, Stanley E. Larson, Prentice-Hall, Inc., pp. 134-135. 1976. HP-67/HP-97 Users' Library program #011720 by Ernest Smart.

Example:	Listed a product'	are t s us	he age	sales :	dat	a fo	r tl	he pı	cevic	ous	twelve	mont	ths of	а
	Month:	1	2	3	4	5	6	7	8	9	10	11	12	
	Sales:	3	6	8	7	4	4	4	6	7	6	4	5	
	Current	actu	a1	usage	= 8	5								
Keystroke	s:							Ι	Displ	Lay:				
[XEQ] [AL	PHA] SIZE	[AL	PHA] 019										
[XEQ] [AL	PHA] INVO	ORD [ALP	HA]				Σ	K,1 ?					
3 [R/S]								Σ	K,2 ?					
6 [R/S]								Σ	x,3 ?					
•									:					
								Σ	X,12	?				
5 [R/S]								(CURRE	ENT	х?			
8 [R/S]								1	AVG.	USE	E=5.33			
[R/S]								1	1AD=1	.33	}			
[R/S]								1	MAD,I	LT=1	.47			
[R/S]								(ORD.	QTY	z.=5.60			
[R/S]								(ORD.	PT.	=7.07			

				SIZE: 019*
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program and size registers*			
2	Initialize the program		[XEQ] INVORD	X,1 ?
3	Input demand for period n	x	[R/S]	X,n+1 ?
4	Repeat step 3 for each period when all			
	the x_n are input, \rightarrow			CURRENT X ?
	is automatically displayed			
5	Input current demand	х	[R/S]	
6	Find: average usage;			AVG. USE=()
	mean absolute deviation;		[R/S]	MAD=()
	weighted average MAD;		[R/S]	MAD,LT=()
	weighted average projection; and		[r/s]	ORD. QTY.=()
	order point quantity.		[R/S]	ORD. PT.=()
	*While this program was written to accept			
	demand history for twelve periods, the			
	user must size the registers to the number	c		
	of periods he is using, changing program			
	steps 03, 05, 17 and 24 accordingly.			

Г

01+LBL "INV	Initialize	47 -	
00 CE 39		48 HBS	
02 CF 27 07 SPEC 17		49 510 05	
04 CLKG 05 1 012		51 514 04 52 CT+ 05	
05 1.012 04 STO 00		57 PCI 83	
07+1 BL 01		53 KUL 02 54 g	
08 "X."		55 ¥	
09 FIX 0	Input and store	56 ST+ 04	
IN ARCI NO	data	57 RCL 01	
11 FIX 2	Gaca	58 .9	
12 "+ ?"		59 *	
13 PROMPT		60 ST+ 05	
14 STO IND		61 RCL 04	
00		62 RCL 05	
15 ISG 00		63 +	
16 GTO Ø1		64 STO 06	
17 12		65 RCL 02	Display results
18 STO 00		66 "AVG. US	
19+LBL 02		E	
20 RCL IND	Calculate \overline{x}	67 XEQ 00	
00		68 RCL 01	
21 Σ+		69 "MAD"	
22 DSE 00		70 XEQ 00	
23 GTO 02		71 RCL 05	
24 1.012		72 "MAD,LT"	
25 510 00		73 XEQ 00	
26 MEHN 07 ENTERA		74 RUL 04	
27 ENIERI 20 ENTERA		75 "URD. QI	
20 ENTERT		77 450 00	
20 CL2 30 ALBI 03		70 100	
31 PCL IND		70 "OPD PT	
91 KCE 1112	Coloulate MAD	ro okb. II	
32 -	Calculate MAD	- 79♦FBL 00	Dianlan mautina
33 88S		80 "+="	Display fourine
34 Σ+		81 ARCL X	
35 RDN		82 PROMPT	
36 ISG 00		83 RTN	
37 GTO 03		84 .END.	
38 RCL 13			
39 RCL 18	$\frac{1}{x}$		
40 /			
41 STO 01			
42 RCL T			
43 STO 02	Calculate MAD		
44 "CURRENT	order quantity.		
X ?"	and order point		
45 PRUMPI			
46 510 04		00	

REGISTERS, STATUS, FLAGS, ASSIGNMENTS^{⁴⁵}

DATA REGISTERS				STATUS								
00	pr X _r	n na standar an	50		SIZE ENG DEG	01	9	TOT. FIX _ RAD _	REG4 _2 SC GR	5 I AD	_ USER MO ON C	DE DFF <u>X</u>
05			55		#	INIT S/C		SET II		AGS s	CLEAR INDI	CATES
					29	С	for	prop	per dis	play	format	
10			60									
	st	Latistics										
15			65									
20			70									
25			75									
			/0									
30			80									
	-											
35			85									
									ASSIGN	IMEN	ITS	
40			90						NE Î		FUNCTION	NET
45			95									

This program generates order control points to provide for a 95% service level by the Weighted Moving average method. Demand averaging should be accomplished first, using the accompanying program, "Inventory Ordering."

Where the data necessary for demand averaging is not available, the required initial input may be guessed at. Continued use of this program's results will then eventually (in 6 to 12 months) provide the same effective results.

Formulas:

OQ: DC(a) + DA(1-a) = OQMAD: CAD(a) + MAD(1-a) = new MADOP: OQ + MAD = OP

where

a = arbitrary exponential smoothing factor. In this program a=.1. For a more rapid response to changing demand patterns, a may be increased along with a corresponding decrease in 1-a, but a may NOT exceed 1.00. CAD = current absolute deviation MAD = mean absolute deviation OQ = order quantity (or forecast) OP = order point (or time to re-order)

Note: Where the demand period used is NOT equal to the lead time required, program output must be correspondingly adjusted, e.g.,

Demand period used = one month

Lead time required = two months

Adjust program output: multiply by 2.

References: McGraw-Hill Book Company, 1970, James H. Greene, APICS. Production and Inventory Control Handbook

Example:	From the "Inventory Ordering" sample problem, $MAD_{TT} = 1.47$ and
	Order Quantity = 5.60. If the current actual usage is 5, find
	the new $ extsf{MAD}_{ extsf{LT}}$, Order Quantity, and Order Point.

Display:
MAD,LT ?
ORD. QTY. ?
CURRENT USE?
MAD=1.38
ORD. QTY.=5.54
ORD. PT.=6.92

				SIZE: 005
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program			
2	Initialize		[XEQ] ORDPT	MAD,LT ?
3	Input: previous smoothed MAD;	MADLT	[R/S]	ORD. QTY. ?
	previous order quantity;	OQ	[R/S]	CURRENT USE ?
	and current usage	DC	[R/S]	
4	Find: new MAD;			MAD=()
	new order quantity;		[R/S]	ORD. QTY.=()
	and new order point		[R/S]	ORD. PT.=()

	T	1	
01+LBL "ORD	Input data	51	
2"			
03 PROMPT			
04 STO 01			
05 "ORD. QT			
Y. ?"			
		60	
08 "CURRENT			
USE?"			
09 PROMPT			
10 510 03	Calculate		
12 085	results		
13 STO 04			
14 RCL 03			
15.1			
16 ST* 04		70	
17 * 19 PCI 02			
19.9			
20 ST* 01			
21 *			
22 +			
23 RCL 04 24 RCL 01			
25 +			
26 "MAD"	Display results	80	
27 XEQ 00			
28 X()1 29 "OPD OT			
Y."			
30 XEQ 00			
31 +			
32 "URD. FT			
33+1 BL 00	Display routine		
34 "+="			
35 ARCL X		90	
36 PROMPT			
37 KIN 38 END			
·	4		
	4		
	1		
]		
50		00	

⁵⁰REGISTERS, STATUS, FLAGS, ASSIGNMENTS

DATA REGISTERS				STATUS						
00	MAD _{LT} ORD. QTY. current usage	50		SIZE ENG DEG	 	TO FIX RAD	T. REG2 _2 SC D GR	20 I RAD	USER MC _ ON	DDE OFF <u>X</u>
05	CAD	55		#	INIT S/C	SET		AGS s	CLEAR IND	ICATES
10		60								
15		65								
20		70								
25		75								
30		80								
35		85					ASSIG		TS	
40		90			FUNCT	ION	KEY	F	UNCTION	KEY
45		95								

WORKING CAPITAL NEEDS - BARDAHL FORMULA

This program determines the working capital needs of a business for avoidance of Tax on unreasonable accumulation of earnings by a corporation. Working capital needs are determined by application of the "Bardahl Formula" defined by the courts and recognized by the Internal Revenue Service. This "formula" determines the amount required to cover expenses for one operating cycle, or the time required to convert inventory to sales and sales (accounts receivable) to cash.

	I ₁ = Beginning inventory
$\frac{I_1 + I_2}{1} \times 365 = T$	I ₂ = Ending inventory
2C 1 000 1	C = Cost of sales (annual)
	A_1 = Beginning Accounts Receivable
A. + A.	A_2 = Ending Accounts Receivable
$\frac{1}{2S} \times 365 = T_{A}$	S = Sales (annual)
	E = Annual operating expenses including cost of sales excluding depreciation plus Income taxes
$\frac{T_A + T_1}{T_A + T_1}$ v F - W	T = Turnover in days
365 × E – w	W = Working capital needs

Reference(s): Internal Revenue Code Sec. 531 and related regulations. HP-65 Users' Library program #05120A written by Howard Kutner, CPA.

Example:

Annual operating expenses	\$105 , 234
Depreciation	9,641
Taxes	4,215
Annual cost of goods sold	57,241
Annual sales	247,321
Inventory - beginning	15,123
- end	18,765
Accounts Receivable - beginning	25,123
– end	29,678

Bardahl Formula Worksheet

1.	Operating expense for full year including cost of goods sold		\$
	Less:		
	Depreciation included in Line 1 Federal income taxes included in Line 1	\$ \$	_
2.	Operating expense for year as adjusted		\$
3.	Operating business cycle		
	 a) Cost of goods sold b) Average inventory Inventory at beginning of year plus Inventory at end of year divided by two c) Line b) divided by Line a) 	\$	-
	 Multiplied by 365 = Inventory Turnover d) Net sales for year e) Average accounts receivable Receivables at end of year divided by two f) Line e) divided by Line d) multiplies by 365 = Accounts Receivable Turnover g) Add Lines c) and f) = days in Operating cycle h) Divide Line g) by 365 = Operating Cycle expressed as percentage of year 	\$ \$	\$ - \$ \$ \$
4.	Multiply Line 2 by Line 3h) = Amount of working capital needs for one cycle		\$

Solution:

Keystrokes:

Display:

[XEQ] [ALPHA] CAP [ALPHA]	EXP. ?
105234 [R/S]	DEP. ?
9641 [R/S]	TAX ?
4215 [R/S]	B. INV. ?
15123 [R/S]	E. INV. ?
18765 [R/S]	C.G.S. ?
57241 [R/S]	B. A/R ?
25123 [R/S]	E. A/R ?
29678 [R/S]	SALES ?
247321 [R/S]	A/R TURN.=40.44
[R/S]	INV. TURN.=108.04
[R/S]	DEMAND=0.41
[R/S]	CAPITAL=37,172.65

				SIZE : Any
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program.			
2	Initialize the program.		[XEQ] CAP	EXP. ?
3	Enter data:			
	Operating expense for year (including			
	cost of sales);	Е	[R/S]	DEP. ?
	Depreciation;	DEP	[R/S]	TAX ?
	Income tax;	TAX	[R/S]	B. INV. ?
	Inventories - beginning;	I ₁	[R/S]	E. INV. ?
	Inventories - ending;	I ₂	[R/S]	C.G.S. ?
	Cost of goods sold (per year;	CGS	[R/S]	B. A/R ?
	Accounts Receivable - beginning;	A ₁	[R/S]	E. A/R ?
	Accounts Receivable - ending; and	A ₂	[R/S]	SALES ?
	Sales (annual).	S	[R/S]	
4	Calculate - A/R Turnover (days);			A/R TURN.=()
	- Inventory turnover (days);		[R/S]	INV. TURN.=(
	- Operating Cycle Demans (as %			
	of year);		[R/S]	DEMAND=()
	- Working Capital Needs (\$)		[R/S]	CAPITAL=()
5	For new case, go to step 2			

01+LBL "CAP 02 "EXP. ?" 03 PROMPT 04 "DEP. ?" 05 PROMPT	Input data and calculate results		42 43 44 45 46	"H=" ARCL X PROMPT RTN .END.	
06 "TAX ?"]
07 PROMPT					
08 + 09 -					-
10 "B. INV.		60			-
?"					-
11 PROMPT					1
12 "E. INV.]
17 PROMPT					
14 +					4
15 "C.G.S.					-
?"					•
16 PRUMPI		70			1
18 "B. A/R					
?"					-
19 PROMPT					-
20 "E. H/R					•
21 PROMPT]
22 +					-
23 "SALES ?					4
" DA DROMRT		80			4
24 FROMET 25 /					1
26 182.5					
27 ST* Z					
28 * 28 *	Dianlas mogulta				1
29 "HZR TUR N "	Display results				1
					1
31 X<>Y					
32 "INV. TU		90			
жн. 33 хео йй					
34 +					
35 365					
36 / 77 "DEMOND"					
37 "DEMHND" 38 XF0 00					4
39 *					4
40 "CAPITAL					
" 41+LBL 00	Display routine	00			4

REGISTERS, STATUS, FLAGS, ASSIGNMENTS^⁵

DATA REGISTERS		STATUS							
00	5	50 	SIZE ENG DEG	0(00 FIX FIX RAD	T. REG. 23 SC GR	AD	USER MC 0N0	DDE OFF <u>x</u>
05	5	55	#	INIT S/C	SET		AGS s	CLEAR IND	
10	6	60							
15	6	5							
20	7	70							
25	7	/5							
30	8	0							
35	8	5							
			ASSIGNMENTS						
40	9	0		FUNCT		KEY	F	UNCTION	KEY
45	9	5							

DEPRECIATION

(Requires one memory module)

Three methods of depreciation are commonly used: straight-line, sum-of-theyears' digits, and declining balance. This program evaluates the depreciation schedules for these three methods, and calculates the crossover point between straight line and declining balance depreciation. For the schedules, the output is the annual depreciation amount (DEP), remaining depreciable amount (RDV), remaining book value (RBV), and the total depreciation to date (TOT DEP), as well as an increment for the next year's schedule.

An option is available to output the depreciation schedule beginning at a specified year.

Values for the last year of an asset with fractional years life (i.e., the 21st year's values for an asset with 20.5 years life) are calculated correctly. However, all other values represent a full year's depreciation. For this reason only integer values (whole number, 1.0, 2.0, 17.0, etc.) may be entered for YR. The program makes no checks on this value and generates invalid results if other than whole numbers are entered.

Fractional years life must be entered as an integer plus a fraction. Thus a life of 12 years 3 months would be keyed in as 12.25 for LIFE.

Straight Line Depreciation

The annual depreciation allowance using this method is determined by dividing the cost or other basis of valuation (starting book value) less its estimated salvage value by its useful life expectancy. This program develops the starting book value (SBV), salvage (SAL), life expectancy (LIFE), and first year of the schedule (YR). (The schedule may be started at any point in the useful life.)

Sum-of-the-Years'-Digits Depreciation

The sum-of-the-years'-digits method is an accelerated form of depreciation, allowing more depreciation in the early years of an asset's life than allowed under the straight line method. This program generates the schedule output, given the starting book value (SBV), the salvage value (SAL), expected useful life in years (LIFE), and beginning year (YR) for the schedule. (The schedule may be started at any point in the useful life.)

Variable Rate Declining Balance Depreciation

The variable rate declining balance method is another form of accelerated depreciation; as such it provides for more depreciation in earlier years and decreasing depreciation in later years. The program generates the depreciation schedule given the starting book value (SBV), salvage value (SAL), useful life expectancy (LIFE), the declining rate factor (FACT), and the first year of the desired schedule (YR). The schedule may be started at any point in the useful life. The "variable rate" is indicated as either a factor or percent with equal frequency in the business community. Thus, "1.5 declining balance factor" and "150% declining balance" have the same meaning. The number to be keyed in for FACT in this program, should be in factor form, that is 1.25, 1.5, 2, and not 125, 150 or 200.

This method of depreciation is unique in that it may generate depreciation greater than the depreciable value for some assets, while it may not generate sufficient depreciation for others. The crossover calculation is provided to assist in determining the best time to switch to straight line depreciation (tax laws permitting) so that an asset may be fully depreciated.

Crossover Point

As indicated in the description above, the declining balance method of depreciation may not fully depreciate an asset in the asset's lifetime. In these circumstances there is an optimum point in the useful life where a switch from the declining balance method to the straight line method should be made. This is the "crossover point", the first year in which the depreciation by the straight line method is greater than if depreciation were continued using declining balance method. (In accordance with Internal Revenue Service Publication 534, the straight line depreciation is determined by dividing the remaining depreciable value by the remaining useful life.)

Given the starting book value (SBV), salvage value (SAL), useful life expectancy (LIFE), and declining balance factor (FACT), this routine calculates the last year that the declining balance method should be used, and the remaining life and remaining book value after this "last year" so that a switch to straight line depreciation can be made. As in the previous routine, the factor (FACT) should be entered in factor form (1.25, 1.5, 2.0), not as a percent (125, 150, 200).

The crossover routine (D) may be used with the declining balance (C) and straight line (A) depreciation routines as follows:

- 1. Use D to determine the "crossover point" and associated values.
- 2. Use C to generate a declining balance depreciation schedule for the early years up to and including the year indicated as being the "last year". Since the same input values are used, only a value for YR need be keyed in before pressing C.
- 3. Now use A to generate a straight line depreciation schedule for the remaining years. The remaining book value at the end of the last "declining balance year" is keyed in for starting book value and the remaining life is keyed in for the asset's life.

For this portion of the depreciation schedule, the value for "total depreciation to date" will be in error by an amount equal to the amount depreciated during the declining balance calculations.

Depreciation Schedules

where:

K = value for YR
TOTDEP_K = total depreciation for years 1 through K.
W = integer portion of LIFE
F = decimal portion of LIFE
(i.e., for a LIFE of 12.25 years W = 12 and F = .25)

Straight Line Schedule

$$DEP_{K} = \frac{SBV - SAL}{LIFE}$$

$$DEP_{K}(last year) = \frac{SBV - SAL}{LIFE} \cdot F$$

$$TOTDEP_{K} = (K) \cdot \frac{SBV - SAL}{LIFE}$$

$$RDV_{K} = (LIFF - K) \cdot \frac{SBV - SAL}{LIFE}$$

$$RBV_{K} = RDV_{K} + SAL$$

Sum-of-the-years'-digits Schedule

$$SOYD = \frac{(W + 1)(W + 2F)}{2}$$

$$DEP_{K} = \frac{LIFE + 1 - K}{SOYD} \cdot (SBV - SAL)$$

$$TOTDEP_{K} = \left[1 - \frac{(W - K + 1) \times (W - K + 2F)}{2 \times (SOYD)}\right] \cdot (SBV - SAL)$$

$$RDV_{K} = \frac{(W - K + 1) \times (W - K + 2F)}{2 \times (SOYD)} \cdot (SBV - SAL)$$

$$RBV_{K} = RDV_{K} + SAL$$

Variable Rate Declining Balance Schedule

$$DEP_{K} = SBV \left(1 - \frac{FACT}{LIFE}\right)^{K-1} \cdot \frac{FACT}{LIFE}$$
$$TOTDEP_{K} = SBV \cdot \left[1 - \left(1 - \frac{FACT}{LIFE}\right)^{K}\right]$$
$$RDV_{K} = (SBV - SAL) - TOTDEP_{K}$$

$$RBV_{K} = RDV_{K} + SAL$$

Crossover Point--Declining Balance to Straight Line

$$SBV \quad 1 \quad -\left(\frac{FACT}{LIFE}\right) \quad K-1 \quad \cdot \left(\frac{FACT}{LIFE}\right) \quad > \quad \frac{(SBV - SAL) - TOTDEP_{K-1}}{L + 1 - K}$$

where TOTDEP_{K-1} is determined as shown above.

The largest integer value for K which maintains the above relationship is the "last year" to use the Declining Balance depreciation method.

Example: For a starting book value of \$375,000, a salvage value of \$30,000 and an expected life of 40 years, determine the crossover point and the associated remaining life and remaining book value. Generate the depreciation data for the declining balance "last year," and then switch to the straight line method to generate the depreciation data for the year following the declining balance "last year." Assume a declining balance factor of 1.5.

Solution:		
Keystrokes:	Display:	
[USER]		(set USER mode)
[XEQ] [ALPHA] SIZE [ALPHA] 012		
[XEQ] [ALPHA] DEP [ALPHA]	SBV ?	
375000 [R/S]	SAL ?	
30000 [R/S]	LIFE ?	
40 [R/S]	FACTOR ?	
1.5 [R/S]	A,B,C, or D ?	
[D]	LAST YR.=18.00	
[R/S]	R. LIFE=22.00	
[R/S]	RBV=188,471.01	
[c]	K=19.00	
18 [R/S]	K=18.00	
[R/S]	DEP=7,343.03	
[R/S]	RDV=158,471.01	
[R/S]	RBV=188,471.01	
[R/S]	T. DEP.=186,528.99	
[XEQ] [ALPHA] DEP [ALPHA]	SBV ?	
188,471.01 [R/S]	SAL ?	
30000 [R/S]	LIFE ?	
22 [R/S]	FACTOR ?	
1.5 [R/S]	A,B,C, or D ?	
[A]	*K=1.00	
[R/S]	DEP=7,203.23	
[R/S]	RDV=151,267.78	
[R/S]	RBV=181,267.78	
[R/S]	**T. DEP.=7,203.23	
[R/S]	K=2.00	
[R/S]	DEP=7,203.23	
	•	
Note: *Although the first year of straight year of the asset's life.	line depreciation, thi	s is the 19th

**add \$186,528.99 depreciated during the declining balance calculations.

				SIZE: 012
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program and set USER mode		[USER]	
2	Initialize the program		[XEQ] DEP	SBV ?
3	Input: SBV;	SBV	[R/S]	SAL ?
	Salvage value;	SAL	[R/S]	LIFE ?
	Life; and	LIFE	[x/s]	FACTOR ?
	Declining balance factor	FACT	[R/S]	A,B,C, or D?
4a	Straight line method, press \rightarrow		[A]	K=1
4Ъ	Find: Depreciation;		[R/S]	DEP=()
	RD V;		[R/S] *	RDV=()
	RBV; and		[R/S] *	RBV=()
	Total depreciation taken		[R/S] *	T. DEP.=()
4c	Go to step 4b, or		[R/S]	K=(k+1)
4d	If the schedule for a year other than k+1			
	is desired, enter it, press \rightarrow	x	[R/S]	K=(x)
	and go to step 4b			
5a	SOYD method, press		[в]	К=1
5b	Find: Depreciation;		[R/S]	DEP=()
	RDV;		[R/S] *	RDV=()
	RBV; and		[R/S] *	RBV=()
	Total depreciation taken		[R/S] *	T. DEP.=()
5c	Go to step 5b, or			K=(k+1)
5d	If the schedule for a year other than k+1			
	is desired, enter it, press \rightarrow	x	[R/S]	K=(x)
	and go to step 5b			
	* If there is a printer in the system these			
	[R/S]operations won't be necessary.			

				SIZE: 012
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
6a	Declining balance method, press		[c]	K=1
6Ъ	Find: Depreciation;		[R/S]	DEP=()
	RDV;		[R/S] *	RDV=()
	RBV; and		[R/S] *	RBV=()
	Total depreciation taken.		[R/S] *	T. DEP.=()
6c	Go to step 6b, or		[R/S]	K=k+1
6d	If the schedule for a year other than k+1			
	is desired, enter it, press \rightarrow	x	[R/S]	K=(x)
	and go to step 6b			
7	Crossover point, press		[D]	LAST YR.=()
			[R/S] *	R. LIFE=()
			[R/S] *	RBV=()
	* If there is a printer in the system,			
	these [R/S] operations won't be necessary.			

01+LBL "DEP " 02 SF 21 03 "SBV ?" 04 PROMPT 05 STO 06 06 "SAL ?" 07 PROMPT 08 STO 07 09 "LIFE ?" 10 PROMPT 11 STO 08 12 1 13 STO 09 14 "FACTOR ?" 15 PROMPT 16 STO 10 17 CF 22 18 "A,B,C, 0R D ?" 19 PROMPT 20+LBL 00 21 ADV 22 RCL 09 23 "K" 24 XEQ 09 25 FS? 55 26 STOP 27 FS?C 22 28 XEQ 01 29 RTN 30+LBL 01 31 STO 09 32 "K" 33 XEQ 09 34 RTN 35+LBL A 36 XEQ 00 37 RCL 06 38 RCL 07 39 - 40 RCL 08 41 / 42 STO 11 43 "DEP" 44 XEQ 09 45 RCL 08	Initialize and input data	$\begin{array}{c} 49 \\ 50 \\ 70 \\ 71 \\ 80 \\ 72 \\ 81 \\ 73 \\ 74 \\ 74 \\ 72 \\ 73 \\ 74 \\ 74 \\ 74 \\ 72 \\ 74 \\ 74 \\ 74 \\ 74 \\ 74 \\ 74 \\ 74 \\ 74$	SOYD method
44 XEQ 09		95 "RDV"	•
45 RCL 08		96 XEQ 09	i
46 RCL 09		97 KUL 07 98 +	
		99 "RBV"	
48 RCL 11		100 XEQ 09	

101 1	152 450 89	
102 PCL 00	102 AEW 07	
102 KUL 00	153 KUL 07	
103 -	154 +	
104 RCL 04	155 "RBV"	
105 *	156 XEQ 09	
106 XEQ 06	157 RCL 05	
107 XEQ 05	158 XEQ 06	
108 GTO B	150 AL& 90	
	1J7 AEQ 0J	
107VLDL 02	160 GIU C	
IIU ENTERT	161+LBL 04	
111 FRU	162 1	
112 ENTERT	163 RCL 10	
113 +	164 RCL 08	
114 X<>Y	165 /	
115 INT	166 STO 04	
116 +	167 -	
117 LOSTX	100 07	
110 1	168 510 83	
	169 KIN	D1 1 1
	170+LBL 06	Display routine
120 *	171 "T. DEP.	
121 2	••	
122 /	172+LBL 09	
123 RTN	173 "⊢="	
124+LBL C declining balan	ce 174 ARCL X	
125 XEQ 00 method	175 AVIEW	
126 XEQ 04	176 RTN	
127 RCL 09	177AL BL 05	inamoment V
120 1		Increment K
120 1		
	179 51+ 09	
	180 RCL 08	
131 RUL 06	181 RCL 09	
132 *	182 X<=Y?	
133 RCL 04	183 RTN	
134 *	184 STOP	
135 STO 11	185+LBL D	
136 "DEP"	186 0	Crossover point
137 XEQ 09	187 510 09	_
138 1	100 VEG 04	
139 RCL 03		
140 PCL 09		
140 KCL 07	190 RUL 03	
141 110	191 RCL 09	
	192 ISG 09	
143 KUL 05	193 +	
	194 Y1X	
145 STO 05	195 RCL 06	
146 RCL 06	196 *	
147 RCL 07	197 RCL 04	
148 -	198 *	
149 RCL 05	199 RCI 07	
150 -	200 PCL 00	
151 "PDV"	200 KUL 07	
IJI KDY	201 1	

202 -		51	
203 Y1X			
204 RCL 06			
205 *			
204 PCL 07	·		
200 KCL 01			
207 -			
208 STO 05			1
209 RCL 08			
210 1			
	e	0	
212 RCL 09			
213 -			
214 /			
215 X<>Y			
216 V\V2			
217 610 08			
218 RCL 09			
219 1			
220 -			
221 HLOST YP			
		0	
222 XEQ 09			
223 RCL 08			
224 X<>Y			
225 -			
226 "R. LIFE			
227 XEQ 09			
228 RCL 05			
229 RCL 07			
270 +	1	30	
231 "KBV"			
232 GTU 09			
233 .END.			
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[®]REGISTERS, STATUS, FLAGS, ASSIGNMENTS

DATA REGISTERS		STATUS								
00	Used used RDV used	50		SIZE ENG DEG		2 TOT FIX RAD	. REG. <u>70</u> 2 SC GR	AD	_ USER MC _ ON . <u>X (</u>)DE OFF
05	used TOT DEP SBV	55		#	INIT S/C	SET		AGS s	CLEAR IND	
	SAL			21	S	refer	to owne	r's r	anual	
	LIFE			22	С	refer	to owne	r's r	anual	
	YR			55		refer	to owne	r's r	nanual	
10	FACTOR	60								
	SBV-SAL/LIFE									
15		65								
20		70								
25		75								
30		80								
35		85								
							ASSIGN	IMEN	ITS	
				F	UNCT	ION	KEY		FUNCTION	KEY
40		90								
45		95								
		_								
							ļ			
Break-even analysis is a technique for analyzing the relationships among fixed costs, variable costs, and income. Until the break-even point is reached, at the intersection of the total income and total cost lines, the producer operates at a loss. After the break-even point, each unit produced and sold makes a profit. Break-even analysis may be represented as follows:



Units

Given four of the following variables: fixed costs (F), sales price per unit (P), variable costs per unit (V), number of units sold (U), and gross profit (GP), this program evaluates the remaining variable. To calculate the breakeven values, simply let the gross profit equal zero.

The degree of operating leverage (OL) at a point is defined as the ratio of the percentage change in net operating income to the percentage change in units sold. The greatest degree of operating leverage is found near the break-even point, where a small change in sales may produce a very large increase in profits. This happens because the profits are close to zero near the break-even point. Likewise, firms with a small degree of operating leverage are operating farther from the break-even point, and they are relatively insensitive to changes in sales volume.

The necessary inputs to calculate the degree of operating leverage are fixed costs (F), sales price per unit (P), variable costs per unit (V), and number of units (U).

For subsequent calculations, it is necessary only to input new data.

Break Even Analysis

$$GP = U(P-V) - F$$

$$OL = \frac{U(P-V)}{U(P-V) - F}$$

Example 1: The Cooper Company sells finance textbooks at \$13 each. Given costs and revenues below, how many textbooks must be sold to break even?

FIXED COSTS

Typesetting Graphics production	\$ 4,000 5,000
Princing and binding	
Total fixed costs	\$12,000
VARIABLE COSTS PER COPY	
Distribution Commissions Royalties	\$ 1.00 3.75 2.00
Total variable costs per copy	\$ 6.75
Sales price per copy	\$13.00

Example 2: What is the Cooper Company's degree of operating leverage at 2000 units? At 5000 units?

Keystrokes:	Display:			
[USER]		(Set	USER mode.)	
[XEQ] [ALPHA] SIZE [ALPHA] 007				
[XEQ] [ALPHA] BEA [ALPHA]	FIXED ?			
12000 [R/S]	PRICE ?			
13 [R/S]	VARIABLE ?			
6.75 [R/S]	UNITS ?			
[R/S]	G. PROFIT ?			
0 [R/S]	UNITS=1920.00			
[B]	UNITS ?			
2000 [R/S]	% LEV.=25.00			
[B]	UNITS ?			
5000 [R/S]	% LEV.=1.62			

User Instructions

				SIZE: 007
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program and set USER mode		[USER]	
2	Initialize		[XEQ] BEA	FIXED ?
3	Input 4 of the following: fixed cost;	F	[R/S]	PRICE ?
	price;	Р	[R/S]	VARIABLE ?
	variable cost;	v	[R/S]	UNITS ?
	no. of units;	U	[R/S]	G. PROFIT ?
	and gross profit.	G.P.	[R/S]	FIXED=\$()
3	When prompted for the unknown quantity,			-or- PRICE=\$()
	press [R/S] (make no input). The			-or- VAR.=\$()
	unknown will be calculated automatically			-or- UNITS=()
	when all the data is input			-or- G.P.=()
4	To find percent operating leverage		[в]	UNITS ?
5	Input number of units	U	[r/s]	% LEV.=()

Program Listings

01+LBL "BEA	Initialize and	45 -	
**	input data	46 STO 03	
02 1.1		47 "VAR."	
03 STO 00		10 YEQ 00	
04 CE 22			Solve for U
04 C/ 22 05 "FIVED 0		49+LBL 04	50110 101 0
05 FIXED ?		50 RCL 01	
		51 RCL 05	
06 XEQ 09		52 +	
07 "PRICE ?		53 RCL 02	
••		54 RCL 03	
08 XEQ 09		55 -	
09 "VARIARI		54 /	
E 2"			
10 VEO 99			
10 AEQ 07		58 "UNITS="	
11 "UNITS ?		59 ARCL X	
		60 PROMPT	
12 XEQ 09		61+LBL 05	Solve for G.P.
13 "G. PROF		62 RCL 02	
IT ?"		63 RCL 03	
14 XEQ 09		64 -	
15 CTO IND	1		
94		60 KCL 04	
	Solve for F		
16+LBL 01		67 RCL 01	
17 RLL 02		68 -	
18 RUL 03		69 STO 05	
19 -		70 "G.P."	
20 RCL 04		71 XEQ 00	
21 *		72+LBL B	Solve for OL
22 RCL 05		ZZ "UNITS 2	
23 -			
24 STO 01		74 PROMPT	
25 "FIXED"			
20 (IACD 26 VEO 00		73 KUL 02	
20 764 00	Color Con D	76 RUL 03	
27VLBL 02	Solve for P	77 -	
28 RCL 01		78 *	
29 RCL 05		79 STO 06	
30 +		80 RCL 06	
31 RCL 04		81 RCL 01	
32 /		82 -	
33 RCL 03		83 /	
34 +		94 - 7 + FV =	
35 STO 02			
76 "PPICE"			
77 VEO 88		OJ HKUL A	
37 AEQ 00 7041 D1 07			Dignlaw routing
384LBL 03 70 DC1 00	Solve for V	87+LBL 00	bispiay foutine
39 KUL 02		88 "⊢=\$"	
40 RCL 01		89 ARCL X	
41 RCL 05		90 PROMPT	
42 +		91 RTN	
43 RCL 04		92+LBL 09	Input storage
. 44 /		93 PROMPT	routine

Program Listings

94 STO IND		51	
00	1 F		1
95 801 00	1 · F		4
96 5020 22			
	↓ ⊢		
97 510 06			
98 ISG 00			
99 RTN	1 F		
100 .END.	1		
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⁷²**REGISTERS, STATUS, FLAGS, ASSIGNMENTS**

	DATA RE	GIS	TERS				STA	TUS		
00	pointer F P V	50		SIZE ENG DEG	007	TOT FIX RAD	. REG _2 SCI GR	43 AD	USER MOI 	DE)FF
05	U G.P. subroutine pointer	55		#	INIT S/C	SET		AGS s	CLEAR INDI	CATES
				22	С	refer	to owne	r's r	anual	
10		60								
15		65								
20		70								
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		/0								
30		80								
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							ASSIGN	IMEN	TS	
40		90		[UNCT	ION	KEY	F	UNCTION	KEY
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HP-41C

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SMALL BUSINESS

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ACCOUNT POSTING

















ORDER POINT CALCULATION



WORKING CAPITAL NEEDS – BARDAHL FORMULA PROGRAM REGISTERS NEEDED: 24







18





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SMALL BUSINESS

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