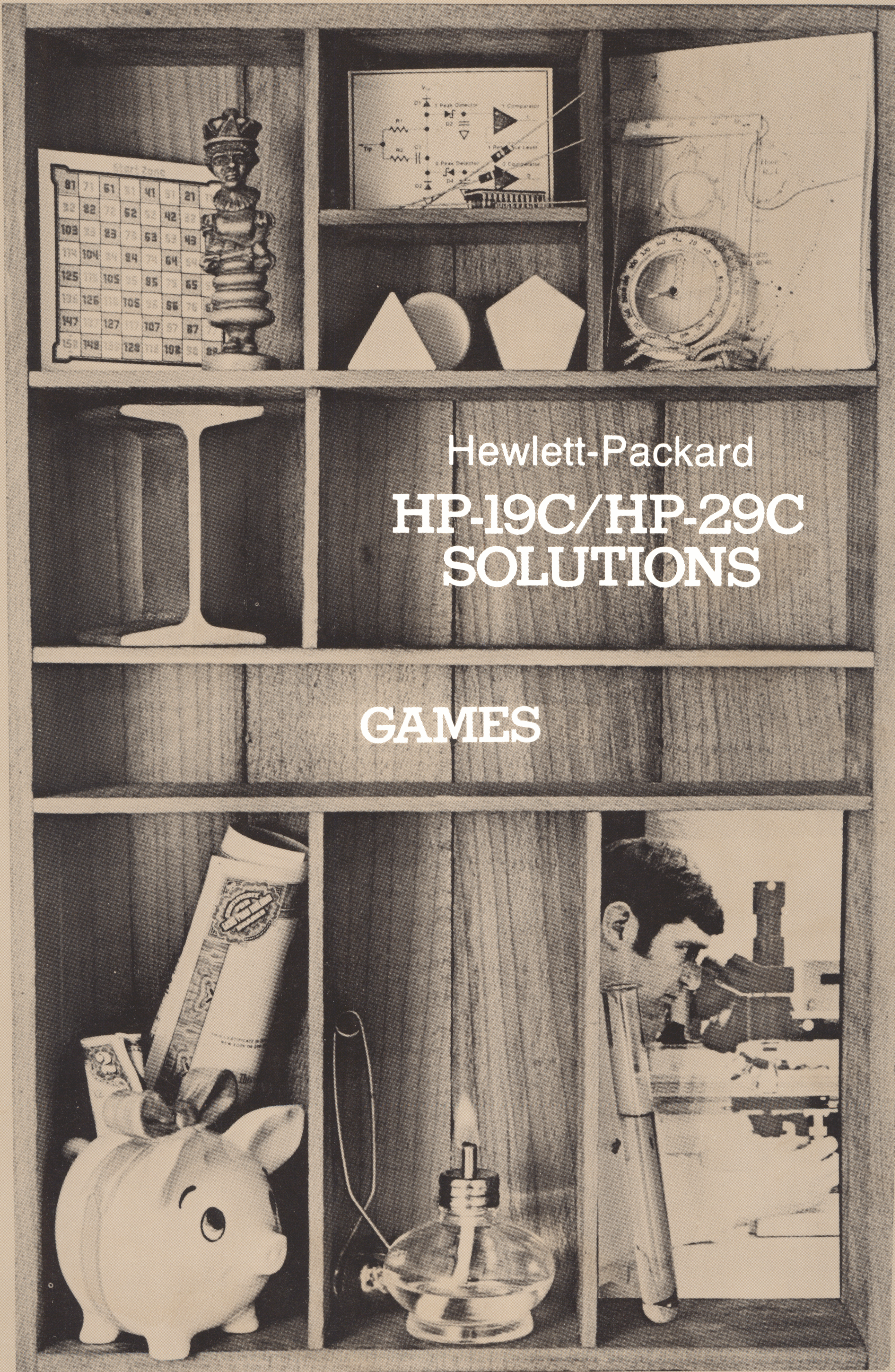

Hewlett-Packard

HP-19C/HP-29C SOLUTIONS

GAMES

INTRODUCTION

This HP-19C/HP-29C 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 an expert on your HP calculator.

You will find general information on how to key in and run programs under "A Word about Program Usage" in the Applications book you received with your calculator.

We hope that this Solutions book will be a valuable tool in your work and would appreciate your comments about it.

The program material contained herein is supplied without representation or warranty of any kind. Hewlett-Packard Company therefore assumes no responsibility and shall have no liability, consequential or otherwise, of any kind arising from the use of this program material or any part thereof.

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RACETRACK

This game simulates a two-car race (or a one-car race against time) on a track of arbitrary shape. The track shown may be used, or other tracks of any shape may be designed. The program computes the velocities and positions of the cars.

Initially, both cars are at rest on the start-finish line. Car 1 is at (x,y) position (0,0) and car 2 is at position (5,0.). Player 1 starts. For each move, a player may accelerate in any direction or coast. To make a move, enter the direction (in degrees) and magnitude (0-9) of acceleration and press car number (1 or 2). To coast, enter any direction and a magnitude of zero. For a panic stop, enter a direction exactly opposite (180° away) from your present direction and use a magnitude of 9. The faster you go, the more moves it will take to stop completely.

After making your move, the display will show your car's velocity.

By rolling down the stack, the car's direction of travel, and it's (x,y) position may be displayed.

Traction limits the maximum rate of change of velocity to 9 meters per second per second. Note that this realistically limits the ability to turn when accelerating or declerating.

If the center points of the two cars get within 2 meters of each other, the cars collide, and the display shows flashing zeros. This destroys the two cars, and the game must be started over from the beginning.

It is most convenient to use a fresh sheet of graph paper with the track drawn on it for each game; then the positions of the cars may be plotted, and sequential positions joined by straight line segments. The players must decide after each move whether the car is off of the track, or if it had to go off of the track to travel between the last two positions.

EQUATIONS:

$$V_f = V_i + \Delta V$$

$$P_f = P_i + ((V_i + V_f)/2)t$$

where

V_i & V_f = Initial & final velocities (x & y)

ΔV = Velocity change due to 1 sec. accel.

P_i & P_f = Initial & final positions (x & y)

t = Time, seconds (1 sec. in this prog.)

NOTES:

The program halts, displaying zero if + 90° is used in P→R function; press "R/S" to continue. Direction of car's travel is with respect to the fixed frame of reference of car's starting position (origin) and the start-finish line (0°). See the sketch.

All directions are entered and displayed as A + or - Angle between 0° and 180°.

A collision of the two cars (flashing zeros) ends the game.

Each move advances the car one second in time.

REFERENCES:

Martin Gardner, Mathematical Games, Scientific American, Jan. 1973 and May 1973.

REFERENCES: (continued)

This program is adapted from HP-65 Users' Library program #04326A by Delmer D. Hinrichs.

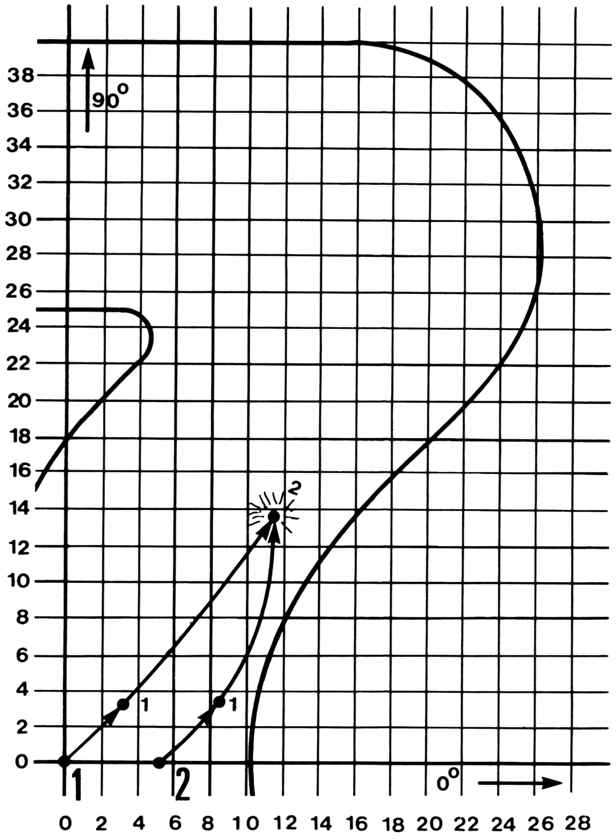


DIAGRAM OF SOLUTION

RULES:

1. A car which goes off the track, either at a plotted position or between plotted positions, loses the race.

2. A car which collides with the other one loses.

3. If both cars cross the start/finish line on the same move, the car which finishes farthest from the line wins.

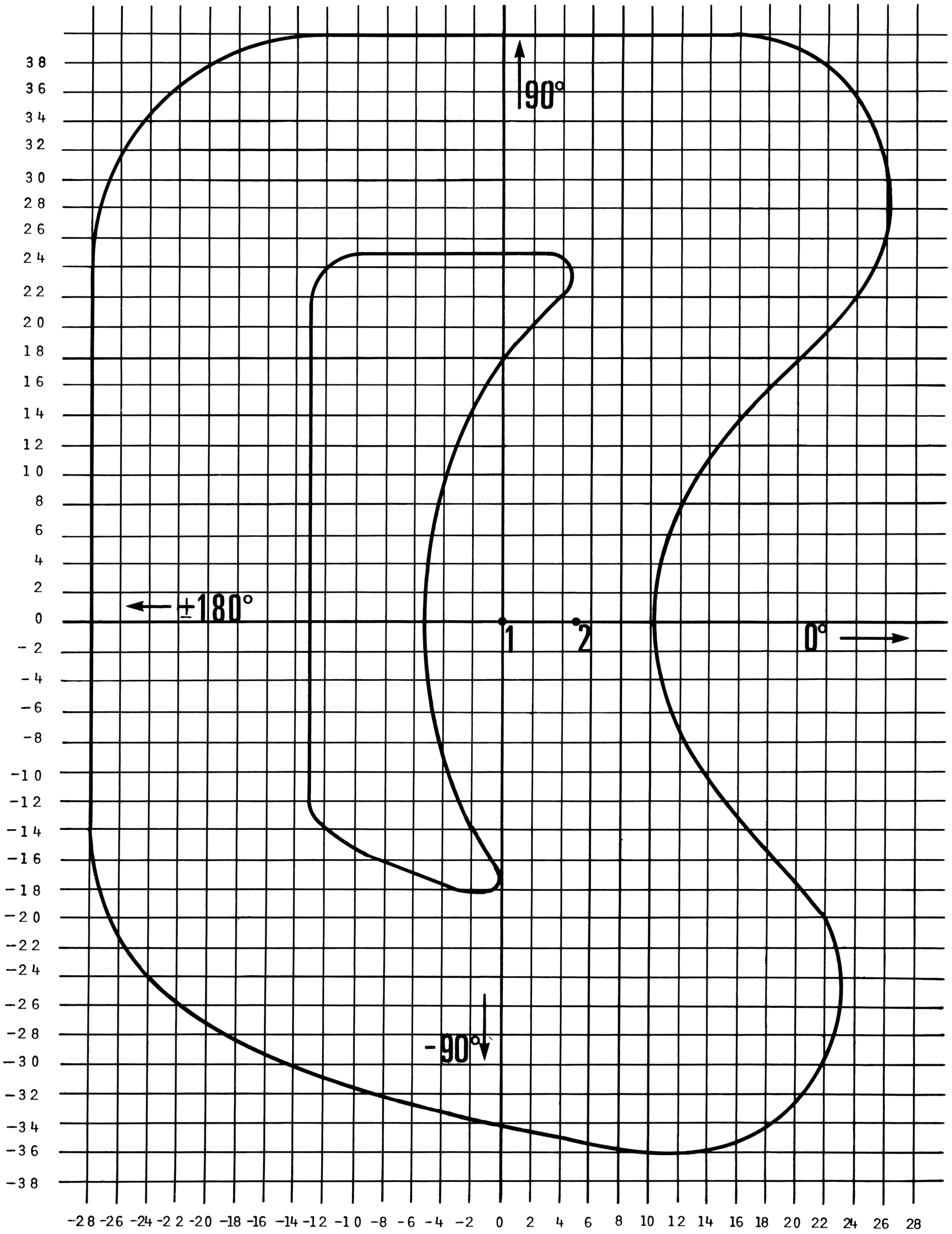
SOLUTIONS:

```
         GSB0
  45.00 ENT↑
   9.00 GSB1
   9.00  ***   Car 1 velocity
          R↓
  45.00  ***   Direction
          R↓
   3.18  ***   x-position
          R↓
   3.18  ***   y-position

  45.00 ENT↑
   9.00 GSB2
   9.00  ***   Car 2 velocity
          R↓
  45.00  ***   Direction
          R↓
   8.18  ***   x-position
          R↓
   3.18  ***   y-position

  60.00 ENT↑
   9.00 GSB1
  17.85  ***   Car 1 velocity
          R↓
  52.50  ***   Direction
          R↓
  11.80  ***   x-position
          R↓
  13.44  ***   y-position

 135.00 ENT↑
   9.00 GSB2   Car 2
   0.00  ***   (flashing)collision
               -- car 2 loses
```



RACETRACK

You may wish to copy this to play your game.

For variety, you may wish to draw your own track.

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Initialize		GSB	0	5.00
3.	Enter parameters for car x*:				
	Direction of acceleration, degress	Angle	ENT↑		
	Magnitude of acceleration	Acc	GSB	n*	Velocity
	* n = 1 for car 1; n = 2 for car 2				
4.	Display car n's status:				
	Velocity, meters/sec				Velocity
	Direction of travel, degrees		R↓		Direction
	x-position, meters		R↓		x-pos.
	y-position, meters		R↓		y-pos.
5.	For next move, go to step 3.				
6.	For a new game, go to step 2				
7.	Flashing zeros indicate a collision and the end of the game.				

Program Listings

01 *LBL0	Initialize
02 FIX2	
03 DEG	
04 CLRG	
05 5	Car 2 x position
06 STO6	
07 R/S	
08 *LBL1	Car 1
09 1	
10 STO0	
11 GTO9	
12 *LBL2	Car 2
13 5	
14 STO0	
15 *LBL9	Acc.
16 R↓	
17 9	
18 X≤Y?	Limit acc. to
19 X⇄Y	9 m/sec^2
20 R↓	
21 →R	x component y comp.
22 GSB6	Calculate V_f and P_f
23 X⇄Y	y component
24 ISZ	Calculate V_f and P_f
25 GSB6	
26 RCL8	
27 RCL4	
28 -	
29 RCL6	Check for
30 RCL2	collision
31 -	(i.e. < 2m.)
32 →P	
33 2	
34 X>Y?	
35 GTO5	
36 RCLi	
37 DSZ	
38 RCLi	
39 DSZ	
40 RCLi	Prepare display
41 DSZ	
42 X⇄Y	
43 RCLi	
44 →P	*** "Print Stack" may be inserted before "R/S".
45 R/S	
46 *LBL5	
47 0	Blinking zero
48 PSE	
49 GTO5	

50 *LBL6	
51 RCLi	
52 +	New velocity, V_f
53 STOi	Old velocity, V_i
54 LSTX	
55 +	
56 2	
57 ÷	
58 ISZ	
59 ST+i	New position, P_f
60 RTN	
61 R/S	

REGISTERS

0 Pointer	1 x_1 vel	2 x_1 pos	3 y_1 vel	4 y_1 pos	5 x_2 vel
6 x_2 pos	7 y_2 vel	8 y_2 pos	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

PINBALL MACHINE

This game allows multiple scoring for 5 balls. The balls may be controlled with 4 flippers and tilting is also allowed. As the ball scores, the score is flashed and the running total is displayed. When the ball falls, the display blinks zero. New balls may be set up and played until the 5th ball falls; at that time the total score for the game is displayed as a negative number.

NOTE:

On very rare occasions, the machine will overflow (θ=90°...). In that event, store some other seed in R_2 or start a new game.

This program is adapted from HP-65 Users' Library program #03458A by Peter C. Wang.

SOLUTION:

```
           GSB0 Initialize
 0.32147   ST02 *
           GSB1 Use flipper [1]
     200.   *** Total score
           GSB3 [3]
                Flashing Ø-Ball 1 falls
           RCL0 4 balls left
       4.   ***

           GSB2 [2]
     500.   *** Score=300,total=500
           GSB2 [2]
    1800.   *** Total
           GSB1 [1]
                Flashing Ø-Ball 2 falls
           RCL0
       3.   *** 3 Balls Left

           GSB4 [4]
    2100.   ***
           GSB2
    2700.   ***
           GSB1
    3300.   ***
           GSB1
    8000.   ***
           GSB4
    8800.   ***
           GSB1
    8900.   ***
           GSB2
    9400.   ***
           GSB3
   11300.   ***
           GSB4
   12000.   ***
           GSB4
   12800.   ***
           GSB4
   12800.   ***
           GSB4
   15500.   ***
           GSB4
   16600.   ***
           GSB2
   26200.   ***
```

* To reproduce this example, store 0.32147 in R2. When playing follow user instruction 2.

SOLUTION:

```
            GSB3
  26400.    ***
            GSB1
  27200.    ***  Score=800,Total=27,200
            GSB3
  27300.    ***
            GSB1
  27800.    ***
            GSB4
  28600.    ***
            GSB3
  29500.    ***
            GSB1
                 Flashing Ø-Ball 3 falls
            RCL0
      2.    ***  2 balls left

            GSB3

            RCL0
      1.    ***  1 ball left

            GSB2
  29500.    ***
            GSB3
  30000.    ***
            GSB1
  30900.    ***
            GSB4
  31000.    ***
            GSB1
  32200.    ***
            GSB1
  32700.    ***
            GSB3
  39800.    ***
            GSB2
  39800.    ***
            GSB2
  40200.    ***
            GSB3
  40900.    ***
            GSB2
 -40900.    *** Last ball falls, total=
                  40,900
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Initialize -- let initialization run		GSB	0	
	between 1-45 seconds; then halt by		Any		
	pressing any key		Key		
3.	Play the ball with any of the four		GSB	1	
	flippers. The score flashes and the total	or	GSB	2	
	is displayed	or	GSB	3	Score/total
		or	GSB	4	
4.	Repeat step 3 with the same ball until a				
	blinking zero appears, indicating the				
	ball has fallen.				
5.	When the ball has fallen, set up a new	Blinking	Any		
	ball and go to step 3 to play it.	zero	Key		0.
6.	The number of balls remaining may be		RCL	0	# of balls
	recalled at any time				Left
7.	When the fifth ball has fallen the game				
	is over and the total score is displayed				
	as a negative number				
8a.	You may "tilt" the machine at any time		GSB	5	
	(this operation changes the seed)				
8b.	Stop the tilting operation by pressing		Any		
	any key. Go to step 3.		Key		
9.	For a new game, go to step 2.				

Program Listings

```
01 *LBL0      Initialize
02  CLRG
03    1
04  STO2
05    .
06    9
07    8
08    5
09    3
10  STO3
11   EEX
12    2
13  STO5
14    8
15    5
16  STO7
17    5
18  STO0      i=# of balls=5
19  FIX0
20 *LBL5      tilting operation
21  RCL3
22  STx2       (.9853)^n-->R2
23  GTO5       n=#of loops
24 *LBL1
25    3       39=k for flipper[1]
26    9
27  GTO4
28 *LBL2
29    5       53=k for flipper[2]
30    3
31  GTO4
32 *LBL3
33  RCL7      85=k for flipper[3]
34 *LBL4
35  RCL2
36  RCL7      lastx = k for
37    x          flipper [4]
38    +
39  RCL3
40   Yx
41  RCL3      (85) R2 + K
42    x
43   X2
44   FRC
45  RCL5
46    x
47  STO4      θ
48   TAN
49   ABS      |tanθ|
```

```
50  STO2
51  RCL4
52  RCL7      θ > 85°?
53  X≤Y?      Ball falls(tanθ too large)
54  GTO8      0 < |tanθ| < 11.43
55  RCL2
56    1
57    0
58    x
59   INT
60  RCL5      "round" to 100's
61    x
62  ST+1      Σ scores
63   PSE      Display score
64  RCL1
65   R/S      Display total
66 *LBL8      Reduce # of balls
67   DSZ      Indicate fall of
68  GTO9        ball
69  RCL1
70  CLRG
71   CHS      Display game total
72   R/S        as a negative no.
73 *LBL9
74    0       Blinking zero
75   PSE
76  GTO9
77   R/S
```

REGISTERS

0 i=# of balls	1 Σ Scores	2 Seed	3 .9853	4 θ	5 100
6	7 85	8	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

15 BALL ROTATION POOL

The game proceeds with a random selection of the players' shots being scoring shots. The balls are pocketed in rotation (1 through 15). Player skills can be varied by selecting a skill factor between 1 and 20. This determines the relative number of scoring shots to total shots. The random sequences are variable by seed number selection. The program continously tallys each of two players scores.

NOTE:

This program is adapted from HP-65 Users' Library program #03427A by Robert A. Plack.

Guide Lines for Skill Factor Selection:

SKILL FACTOR:

2---	To	pocket	15	balls	may	need	120	shots
7---	"	"	"	"	"	"	50	"
10---	"	"	"	"	"	"	30	"
13---	"	"	"	"	"	"	22	"
15---	"	"	"	"	"	"	20	"
17---	"	"	"	"	"	"	16	"

SOLUTION:

```
      11.00 STO6  Skill factor
  1.2345987 STO7  Seed
            GSB1  Initialize
             R/S  Shoot
         1.  ***  Sunk ball #1
             R/S  Shoot
         2.  ***
             R/S  Shoot
         3.  ***
             R/S  Shoot
         4.  ***
             R/S  Shoot
         0.  ***  Miss

             R/S  Player 2 shoots
         5.  ***
             R/S  Shoot
         0.  ***  Miss

            GSB2  Review
       4.01  ***  Score:  Player 1 has
                          sunk 4 balls;
                          player 2 has
                          sunk 1.
```

SOLUTION:
(after more play)

```
             R/S
       11.   ***
             R/S
       12.   ***
             R/S
       13.   ***

            GSB2  Review
     10.03   ***  Score

             R/S  Shoot
        0.   ***
             R/S  Shoot
        0.   ***
             R/S  Shoot
        0.   ***
             R/S  Shoot
       14.   ***
             R/S  Shoot
     10.05   ***  Game over
                  Player 1 wins
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Enter skill factor (between 1 and 20)	S.F.	STO	6	
3.	Enter seed (any number)	Seed	STO	7	
4.	Initialize		GSB	1	-1.00
5.	First player shoots		R/S		Ball # or 0.
6.	A player continues to shoot until a zero		R/S		Ball # or 0.
	is displayed, indicating the shot was missed				
	(If the shot was made, the ball number is				
	displayed). It is then the opponent's turn.				
7.	The score is tallied automatically to				
	review the score.		GSB	2	$S_1S_1 \cdot S_2S_2$
	e.g., 7.02 is read player one has sunk 7				
	balls, player two has sunk 2.				
8.	When all fifteen balls have been sunk, the				
	game is over and the score is displayed.				
9.	For a new game, go to step 4 (or step 2				
	if desired).				

Program Listings

```
01 *LBL1      Initialize
02    0
03  STO1
04  STO2
05  STO8
06    1       Pointer
07  STO0
08   CHS
09  STO4
10   R/S      "Shoot"
11 *LBL0
12  FIX0
13  RCL7      Seed
14    Pi
15    +
16    X²
17   FRC
18  STO7
19   EEX
20    3
21    x
22   FRC
23   EEX
24    2
25    x
26  RCL6      Skill factor
27    ÷
28   INT
29    6
30  X≤Y?      RND > 6?
31  GTO9      Miss
32    1       Made the shot;
33  ST+i      Increment score and
34  ST+8        count
35    1
36    5
37  RCL8
38  X=Y?
39  GTO2      Game over
40   R/S      Display ball no.
41  GTO0
42 *LBL9
43  RCL4
44   CHS
45  STO4
46  ST+0      Switch pointer
47    0       Display 0 to
48   R/S        indicate a miss
49  GTO0
50 *LBL2      Get score
51  RCL2
52    1
53    %
54  RCL1
55    +
56  FIX2
57   R/S      Display score in
58  GTO0        format S1S1•S2S2
59   R/S
```

REGISTERS

0 i,pointer	1 Score (player1)	2 Score (player 2)	3	4 ± 1	5
6 Skill factor	7 Seed	8 Counter	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

ROULETTE

The player bets by entering the dollar amount of the bet and the number on which the bet is placed in the form B.##. For instance, $5 on #7 would be entered as 5.07 and $50 on #27 would be 50.27.

A winning number bet pays off at 32-to-1. A winning even-odd bet pays off at one-to-one.

In the "win" sequence, the player's total bankroll is displayed. In the "lose" sequence, the Roulette number is displayed, after which the total bankroll may be displayed by pressing R/S.

NOTES:

1. Bet only whole dollars.
2. The maximum bet is $99,999,999
3. If your winnings cause your bankroll to exceed 9.9999999 x 10^{99}, ERROR will be displayed.

This program is adapted from HP-65 Users' Library program #03076A by William A. Sholar.

SOLUTION:

```
            GSB5
       0.00 ST02
       0.00 ST07    Seed
     500.27 GSB1
       0.28  ***    #
             R/S
    -500.00  ***    Bankroll

     500.27 GSB1
       0.02  ***    #
             R/S
   -1000.00  ***

     500.27 GSB1
       0.14  ***    #
             R/S
   -1500.00  ***

     500.27 GSB1
   14500.00  ***    Winner

     500.27 GSB1
   30500.00  ***    Another winner

            GSB2    Bet even
       0.25  ***    #
             R/S
       0.00  ***    Total bankroll
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Initialize		GSB	5	
3.	Store your bankroll	$	STO	2	
4.	Store seed (any number)	Seed	STO	7	
5.	Play one of the following:				
5a.	Enter bet and number in BB.## format	B.##	GSB	1	*
	and spin				
5b.	Enter bet on even number and spin	B.	GSB	2	*
5c.	Enter bet on odd number	B.	GSB	3	*
6.	Repeat step 4 as often as desired, or				
	go to step 3 to change your luck.				
	* If you win, your updated total is				
	displayed. If you lose, the spin is				
	displayed. To see your new total.		R/S		Total

Program Listings

```
01 *LBL5      Initialize
02  FIX2
03  CLRG
04 *LBL1
05   INT
06  STO1      Bet ---> R1
07  LSTX
08   FRC
09  STO3      # ---> R3
10  GSB9      Spin
11  RCL3
12  X≠Y?
13  GTO0      You lose
14  RCL1      You win
15     3
16     2
17     x
18  ST+2
19  RCL2
20   R/S      Display total
21 *LBL2      Bet (even)
22     0
23  STO0
24  GTO8
25 *LBL3      Bet (odd)
26     .
27     5
28  STO0
29 *LBL8
30    R↓      Bet, $
31  STO1
32  GSB9      Spin
33     5
34     0
35     x
36   FRC      0 or .5
37  RCL0
38  X≠Y?
39  GTO0
40  RCL1      You lose
41  ST+2      You win
42  RCL2
43   R/S      Display total
44 *LBL0      Lose routine
45  RCL1
46  ST-2      Deduct bet
47  RCL6
48   R/S      Display spin ("pause" may replace "R/S")
49  RCL2
```

```
50   R/S      Display total
51 *LBL9
52  RCL7      Seed
53    Pi
54     +
55    X²
56   FRC
57  STO7      New seed
58   EEX
59     2
60     x
61     3
62     ÷
63   INT
64     1
65     %
66  STO6      Spin ---> 6
67   RTN
68   R/S
```

REGISTERS

0 0 or .5	1 Bet, $	2 Total	3 #	4	5
6 Spin	7 Seed	8	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

TIC - TAC - TOE

This program plays tic-tac-toe with the user. The keyboard of the machine is used as the playing board, with each digit representing one of the nine positions, as shown at right. The machine moves first, into a side position (position 2). The user may move into any of the eight remaining positions. As play continues, user may move into any unoccupied position for each move.

7	8	9
4	5	6
1	2	3

Tic-tac-toe can be won only if one player makes a mistake. This program takes advantage of user mistakes by completing a row of three, or by setting a trap to force a win. If all user moves are correct, a draw results. The side opening by the machine gives the user a better chance to avoid losing.

This program operates on a game tree look-up basis; a different register, containing the machine responses, may be selected for each of the eight possible user first moves.

NOTES:

1. Illegal moves (to occupied positions) gives erroneous results.
2. No win, lose, or draw signals are given; the user must keep track of the progress of the game.

This program is adapted from HP-65 Users' Library program #03363A by Delmer D. Hinrichs.

REFERENCE:

Gardner, Martin,Mathematical Puzzles & Diversions, Simon and Schuster, New York, 1959 pages 37-46.

EXAMPLE:

Machine plays "X", User plays "O"

	X	

Turn: 1

	O	
	X	

2

	O	X
	X	

3

	O	X
	O	
	X	

4

	O	X
	O	
	X	X

5

	O	X
	O	O
	X	X

6

	O	X
	O	O
X	X	X

7

Machine Wins

SOLUTIONS:

```
 1.5873649 ST01   Store constants
 3.5891467 ST02
   4.13598 ST03
 5.1374698 ST04
   6.31578 ST05
   7.13589 ST06
0.154763657 ST07
   9.31587 ST08
```

(1)

```
          FIX0
          GSB1
    2.     ***   Machine's 1st move
    8.     R/S   Player's 1st move
    9.     ***
    5.     R/S
    3.     ***
    6.     R/S
    1.     ***   Machine Wins
```

(2)

```
          GSB1
    2.     ***
    9.     R/S
    3.     ***
    1.     R/S
    5.     ***
    8.     R/S
    7.     ***   Machine wins
```

(3)

```
          GSB1
    2.     ***
    1.     R/S
    5.     ***
    8.     R/S
    7.     ***
    3.     R/S
    6.     ***
    9.     R/S
    4.     ***   Machine Wins
```

(4)

```
          GSB1
    2.     ***
    8.     R/S
    9.     ***
    1.     R/S
    3.     ***
    6.     R/S
    5.     ***
    4.     R/S
    7.     ***   Machine wins
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Enter program				
2.	Store constants:				
	1.5873649		STO	1	
	3.5891467		STO	2	
	4.13598		STO	3	
	5.1374698		STO	4	
	6.31578		STO	5	
	7.13589		STO	6	
	1.5476365774 [EEX] [CHS] [1]		STO	7	
	9.31587		STO	8	
3.	Set display		f	Fix	
			0		
4.	Start game		GSB	1	2
5.	Enter move (any number 1-9)	Player's Move	R/S		
6.	Repeat step 5 until the outcome is resolved				
	(HP-29C/19C wins or a draw). The player				
	must keep track of the progress of the				
	game.				
7.	For a new game, go to step 4.				

Program Listings

```
01 *LBL1     Initialize
02   EEX
03    5      10^5
04  STO9
05    2      Machine's 1st move
06   R/S     Player's 1st move
07    8
08  STO0     i=8
09  X=Y?     Is it 8?
10  GTO6     Yes
11   R↓      No
12 *LBL3     Find reg. which
13  RCLi     contains correct
14  GSB0       responses
15   DSZ
16  GTO3
17 *LBL0
18   INT
19  X=Y?     Match?
20  GTO4       Hit
21   R↓        Miss
22   RTN
23 *LBL4
24  RCLi
25    +      Save in last x
26 *LBL5
27  GSB9     Find response
28  X=Y?     Is it correct?
29  GSB9     No, get it this
               time
30   R/S     Enter player's move
31  GTO5
32 *LBL9
33  LSTX
34   FRC
35    1
36    0
37    x      ~
38   INT     Saves ~ in last x
39   RTN
40 *LBL6     Interactive
               strategy for 8
41    9
42   R/S     Player's 2nd move
43    4
44  X>Y?     Is it 1 or 3?
45  GTO7     Yes
46   CLX
47    6
48  X≤Y?     Is it 6 or 7?
49  GTO8
```

```
50    3      No,response is 3
51   R/S     Enter player's 3rd
               move
52    1
53  X=Y?     Is it 1?
54    6      Yes, 6 is response
55   R/S     No, 1 is response;
56 *LBL8      end game
57    1      Response is 1
58   R/S     Enter player's move
59    3
60  X=Y?     Is it 3?
61    5      Yes, response is 5
62   R/S     No, response is 3;
63 *LBL7      end game
64   CLX
65    1
66  X=Y?     Is it 1?
67  RCL9     Yes, use last 5
68  RCL7       digits in R7
69    x      Mult. R7 by 1 or
70    +        10^5 same in lastx
71  GTO5     Go find responses
72   R/S
```

REGISTERS

0 Pointer	1 Library	2 Lib.	3 Lib.	4 Lib.	5 Lib.
6 Lib.	7 Lib.	8 Lib.	9 10^5	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

BELL FRUIT

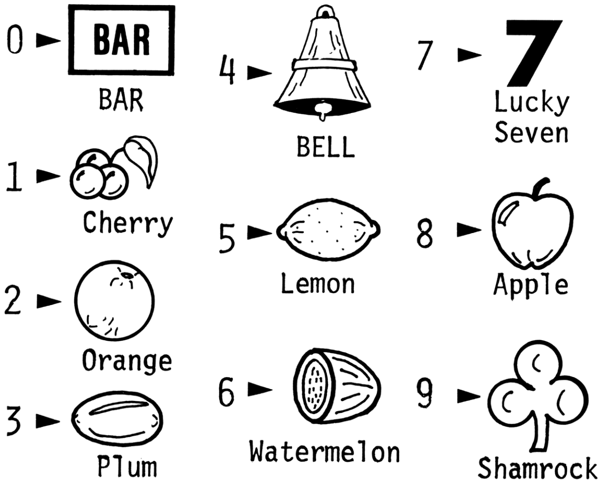
Contrary to popular belief, the "Auto-Bell" and "Bell Fruit" brands of slot machines are not rigged. However, the odds at getting a jackpot pattern are extremely low. For example, on a real slot machine, each 'wheel' contains 20 symbols, only one of which is a bar. Thus, with 3-wheels, a 3-bar combination (or 'Jackpot') comes up once every 8000 plays!

This program is more sporting.(depending on the seed used in initialization, this program can be down right generous). When GSB 1 is pressed the 'wheels' spin and a 3 digit decimal is arrived at. (The no. is to the right of the decimal point, ignore the '0' to the left). A dime is deducted from the 'pot' (R_1). If you win, the payoff amount is paid into the 'pot'. This may be reviewed at any time by pressing RCL 1. Any 3-of-a-kind (except cherries) wins $1.00. Any 2-of-a-kind (except cherries) followed by a 'bar', wins $1.00. A cherry in the first position wins 20¢. A cherry in the second position, when following the 1st cherry, wins an additional 30¢. All other combinations are "Fruit-Salad" and win you zilch! Good Luck.

NOTES:

It's best to key in a many digit decimal as a seed, as opposed to a small number (use a number like '251.0637948' instead of '3'). Due to the nature of the program, one is generally assured of winning 20¢ (one cherry) immediately following a jackpot (3-bars).

This program is adapted from HP-65 Users' Library program #03044B by Craig A. Pearce.



SOLUTION:

```
32147.000 GSB5  Seed
          GSB1  Play
    0.174  ***  $.20 winner
          GSB2  Pot now has $.10
     0.10  ***
          GSB1  Play
    0.994  ***  No luck
          GSB2  As expected, pot even
     0.00  ***
          GSB1
    0.067  ***  Lost
          GSB1
    0.385  ***  Lost
          GSB1
    0.905  ***  Lost
          GSB2  Sure enough,$.30 in hole
    -0.30  ***
          GSB1
    0.997  ***  Lost
          GSB1
    0.120  ***  Won $.20
          GSB1
    0.496  ***  Lost
          GSB1
    0.722  ***  Lost
          GSB1
    0.999  ***  Won $1.00!
          GSB2  Let's stop while
     0.40  ***    we're ahead
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Enter seed (any number below 10^6)	Seed	GSB	5	
	and initialize				
3.	Play		GSB	1	0.XYZ
	Winning combinations:				
	0.1nm pays 20¢				
	0.11n pays 30¢				
	0.XXX pays $1.00				
	0.XX0 pays $1.00				
	(where X ≥ 2)				
	0.000 pays $10.00				
4.	Recall pot of winnings (or losses) at		GSB	2	Pot
	any time				
5.	Repeat steps 3-4 any number of times				
6.	For a new game, go to step 2				
7.	For a new seed (at any time)	Seed	STO	8	

Program Listings

```
01 *LBL5     Seed & initialize
02  CLRG
03  ST08
04   DEG
05   R/S
06 *LBL1
07  FIX3
08  RCL8
09   EEX
10     3
11     x
12   COS
13   ABS
14  ST08     RND
15   EEX
16     6
17     +       Adjust format
18  LSTX         (0.XYZ)
19     -
20   FRC
21  ST05
22  GSB9
23  ST02     X
24     -
25  GSB9
26  ST03     Y
27     -
28  GSB9
29  ST04     Z
30     1
31  RCL2
32  X=Y?     A cherry?
33  GT06
34  RCL3
35  X≠Y?     Do 1st two digits
36  GT07       match?
37  RCL4     Not a winner
38  X≠Y?     Do 2nd two digits
39  GT08       match?
40     1     If not, test for
41  GSB0     Z=0 otherwise pay
42     1     $1. for 3-way match
43  ST00     Set flag to show
44    R↓     3-way match
45 *LBL8     Z=0? if not, no.
46  X≠0?     is not a winner
47  GT07     Was no. a 3-way
48     9     match? No, input a1
49   DSZ     otherwise input a 9
             for a jackpot
```

```
50     1
51  GSB0
52 *LBL7
53  RCL5
54     .
55     1     -10¢
56   CHS
57 *LBL0
58  ST+1
59    R↓
60   RTN
61 *LBL6     Cherry routine
62     .
63     2     Pay 20¢ for 1
64  GSB0        cherry
65  RCL3
66  X≠Y?     Second cherry?
67  GT07
68     .
69     3     Pay 30¢ for 2nd
70  GSB0        cherry
71  GT07
72 *LBL9     Peel off digits
73     1
74     0
75     x
76  ENT↑
77   INT
78   RTN
79 *LBL2     RCL Pot
80  RCL1
81  FIX2
82   R/S
```

REGISTERS

0 Flag	1 Pot	2 "X" digit	3 "Y" digit	4 "Z" digit	5 RND(.XYZ)
6	7	8 Seed	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

BLACKJACK (21)

The player places a bet and draws a card. Jack, Queens, and Kings count as 10 and Aces count as 1. The player keeps taking "hits" (drawing cards) until satisfied with the total. If his total exceeds 21 he loses. The machine draws until its total exceeds the player's.

If its total exceeds 21, you win.

If you win, your bet is added to your bankroll and should you lose, your bet is deducted.

The program uses a random number generator to pick the cards where the probabilitites of drawing a deuce through an ace are all equal.

NOTE:

This program is based on three HP-65 Users' Library programs: 237A by Duke Castle, 1296A by Gary D. Campbell, and 2024A by Mordecai Schwartz, M.D.

SOLUTION:

```
2.654 ST01 Enter seed
50.00 ST02 Enter your bankroll
15.00 GSB1 Enter your bet and draw
             1st card
   8.  *** Total count after 1st card
       R/S Hit
  18.  *** Total after second card
           Stick
      GSB2 Machine plays
           After each card, the fol-
           lowing count totals are
           flashed: 7,8,9,14, 24
65.00  *** You win, bankroll is now
             $65.00
15.00 GSB1 Bet $15.00 on another game
   1.  *** Total count after 1 card
       R/S
   3.  *** After 2 cards
       R/S
  12.  *** After 3 cards
       R/S
  14.  *** After 4 cards
       R/S After 5 cards your total of
             24 is flashed.
50.00  *** You lose-Bankroll is back
             to $50.00
20.00 GSB1 Now you bet $20.00
   3.  ***
       R/S
   5.  ***
       R/S
  10.  ***
       R/S
  14.  ***
       R/S
           5 card total is flashed:22
30.00  *** Loss reduces bankroll to
             $30.00
10.00 GSB1 You bet only $10.00
  10.  ***
       R/S
  11.  ***
       R/S
  15.  *** Decide to stick with a
             15 total
      GSB2 Machine wins again with
           totals of 10,16 and 20
20.00  *** You are left with $20.00
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Initialize:				
	Store seed	Any number	STO	1	
	Store bankroll to play with	W_0	STO	2	
3.	Enter bet and draw a card	Bet	GSB	1	P_1, value of first card
4.	Take a "hit"		R/S		P_i, players total after ith card
5.	Repeat step 4 until satisfied with the				
	total (go to step 6)				
6.	"Stick". Let machine draw,machine draws		GSB	2	$M_1, M_2 ... W$
	until it's total:				
	a) exceeds 21 in which case you win and				
	your bet is added to your bankroll.				
	b) is greater than your total but less				
	than 21, in which case you lose and				
	your bet is subtracted from your				
	bankroll, W.				
7.	For another hand, go to step 3.				

Program Listings

```
01 *LBL1
02   STO6      Bet
03     0
04   STO0
05   STO4
06   STO5
07   FIX0
08 *LBL7
09   GSB0      Get card
10   ST+5
11     2
12     1
13   RCL5      Total
14    PSE
15   X=Y?
16   GTO9      You win
17   X>Y?
18   GTO8      You lose
19    R/S
20   GTO7
21 *LBL2       Machine draws
22   GSB0
23   ST+4
24     2
25     1
26   RCL4
27    PSE
28   X>Y?      You win
29   GTO9
30   RCL5      Your total
31    X⇄Y
32   X>Y?
33   GTO8      You lose
34   GTO2      Machine draws
35 *LBL8         again
36     1       Set flag
37   STO0
38 *LBL9
39   RCL6      Bet
40    DSZ      Add winnings and
41    CHS        subtract losses
42    CHS
43   ST+2
44   FIX2
45   RCL2      Display total
46    R/S        (bankroll)
47 *LBL0         random number
48     1         generator
49     0
50   RCL1
51     Pi
52     +
53     X²
54    FRC
55   STO1
56     1
57     3
58     x
59     1
60     +
61    INT
62   X>Y?
63   X⇄Y       10. for jack-king
64   RTN
65   R/S
```

REGISTERS

0 i	1 Seed	2 Bankroll	3	4 Mach. Tot	5 Player's Tot.
6 Bet	7	8	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

CANNIBALS AND MISSIONARIES

The program completely simulates the classical cannibal-missionary river crossing problem in the following form:

3 missionaires and 3 partially-civilized cannibals must cross a river with a boat that can hold no more than 3 passengers. At no time may cannibals outnumber missionaries at either bank or on the boat lest the cannibals regress to an earlier mode of behavior! Further, cannibal(s) left aboard the boat alone will run off with it after launching.

Missionaries, cannibals and boat are all initially on the left bank. Press GSB 1 once for each cannibal you wish to put aboard and GSB 2 for each missionary. After each crossing (GSB 3) or return (GSB 4) the right bank distribution (those already across)is displayed in the form 0.$C_R M_R$:

For example: 0.00 No one has crossed-
initial condition
0.23 2 cannibals & 3 missionaries on Rt. bank
0.33 Successful simulation-everyone across

After a crossing (GSB 3 or GSB 4), improper operations are appropriately punished:

		DISPLAY
A.	Impossible crossing-boat on wrong bank	"Error"
B.	Boat adrift (no one on) or stolen (no miss. on)	1.00
C.	C's outnumber M's on boat	2.00
D.	Boat sinks - 4 or more aboard	4.00
E.	M's outnumbered at either bank	3.00

NOTE:

This program is adapted from HP-65 Users' Library program number 02286A by Mordecai Schwartz, M.D.

SOLUTION:

```
           GSB5  Initialize
           GSB1  Cannibal boards
           GSB2  Missionary boards
           GSB2  Missionary boards
           GSB2  Missionary boards
           GSB3  Left to right crossing
   4.00    ***   Boat overloaded-try
                    again
           GSB5  Initialize
           GSB2  M
           GSB2  M
           GSB2  M
           GSB3  -------->
   0.03    ***   0 cannibals & 3 Miss.
           GSB2  M    on right bank
           GSB2  M
           GSB4  <-----(right to left
   3.00    ***   C's outnumber M's on
                     left bank

           GSB5  Initialize
           GSB1  C
           GSB2  M
           GSB3  -------->
   0.11    ***   IC + 1M on right bank
           GSB2  M
           GSB4  <-------
   0.10    ***   1C + 0M on right bank
           GSB1  C
           GSB1  C
           GSB2  M
           GSB3  -------->
   2.00    ***   Missionaries out-
                    numbered on boat
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Initialize: Cannibals, missionaries, and		GSB	5	0.00
	boat at left bank				
3.	Load the boat:				
3a.	A cannibal boards		GSB	1	1.00
3b.	A missionary boards		GSB	2	1.00
4.	Repeat 3a/3b until all passengers are				
	loaded				
5.	Cross the river (in the proper direction):				
5a.	Left to right --------->		GSB	3	$0.C_RM_R$*
5b.	Right to left <---------		GSB	4	$0.C_RM_R$*
	Output = $0.C_RM_R$				
	e.g. 0.23 means 2 cannibals and 3				
	missionaries on right bank				
6.	Repeat steps 3-5 until everyone is on				
	right bank.				
7.	For a new game or after an improper				
	operation *, go to step 2.				
	* Outputs after an improper operation:				
	a. Impossible crossing-boat on wrong side				Error
	b. Boat adrift (no one on) or stolen				1.00
	(only C's on)				
	c. M's outnumbered on boat				2.00
	d. Boat overloaded - 4 or more aboard				4.00
	e. C's outnumber M's on either bank or				3.00
	too many M's called, e.g., 1 M on				
	bank and 2 M's loaded aboard				

If crossing involves multiple errors, the display hierarchy is as above.

Program Listings

01	*LBL5	Initialize
02	FIX2	0
03	CLRG	R/S
04	0	
05	R/S	
06	*LBL1	A cannibal boards
07	1	
08	ST+3	
09	R/S	
10	*LBL2	A missionary boards
11	1	
12	ST+4	
13	R/S	
14	*LBL3	Cross river (--→)
15	RCL5	
16	X≠0?	Left bank?
17	GTO0	
18	1	
19	STO5	Set flag
20	RCL3	New right bank Distribution
21	ST+1	
22	RCL4	
23	ST+2	
24	*LBL9	River crossing over or back
25	1	
26	STO0	
27	RCL4	
28	X=0?	
29	GTO8	
30	ISZ	i = 1
31	RCL3	
32	X>Y?	
33	GTO8	i = 2
34	+	
35	4	
36	STO0	
37	X≤Y?	
38	GTO8	i = 4
39	RCL2	
40	X=0?	
41	GTO7	Safe
42	3	
43	X=Y?	
44	GTO7	Safe
45	RCL1	
46	RCL2	
47	DSZ	
48	X≠Y?	i = 3
49	GTO8	
50	*LBL7	Safe crossing configuration
51	0	
52	STO3	
53	STO4	
54	RCL1	Set up display
55	EEX	
56	1	
57	÷	
58	RCL2	
59	EEX	
60	2	
61	÷	
62	+	
63	R/S	Display 0.$C_R M_R$
64	*LBL4	Cross river (←)
65	RCL5	
66	X=0?	Right bank?
67	GTO0	
68	0	Clear flag
69	STO5	
70	RCL3	
71	ST-1	New right bank Distribution
72	RCL4	
73	ST-2	
74	GTO9	
75	*LBL0	
76	0	Display "Error"
77	÷	
78	*LBL8	
79	RCL0	
80	R/S	Display error code

REGISTERS

0 Error Code	1 ^{C}Right bank	2 ^{M}Right bank	3 ^{C}Boat	4 ^{M}Boat	5 Flag 1=set 0=clear
6	7	8	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

HUNT A MOVING SUBMARINE

Using your destroyer, you try to locate the position of the enemy submarine in a 10 x 10 grid, and then destroy it with a depth charge.

You input a seed (1-100) and the calculator will position the submarine in the center of one of the 100 squares (R,C), where R = row and C = column, and where R and C can each be 0, 1, 2, ...,9.

You make guesses as to where you think the submarine is hiding by taking sonar readings. Input the location of your destroyer (R,C) and press GSB 2. If the submarine is in one of the 8 adjacent squares(or direclty under your destroyer), the calculator will display "1." Otherwise, a "0" will be shown.

When you think you've located the submarine, move your destroyer directly over it (move to the same square) and drop a depth charge. A blinking "1" indicates a hit, while a "0" shows a miss. If you miss, the submarine will move randomly to one of the 4 adjacent squares in the same row or column (but it will not move off the grid).

A depth charge has a range of 0.8. When you position your destroyer for a depth charge drop, (or when you prepare for a sonar reading), you may move anywhere on the board, not just to the center of a square. For instance, a depth charge dropped from a (2.5,6.5) location would destroy any submarine in the center of square (2,6)(2,7)(3,6) and (3,7). Note that sonar's range=1.8

NOTE:

This program is adapted from HP-65 Users' Library program number 01957A by Moshi M. Breiner.

SOLUTION:

```
17.20 GSB1   Seed
 2.00 ENT↑
 2.00 GSB2   Search
 0.00  ***
 4.50 ENT↑
 4.50 GSB2   Search
 0.00  ***
 1.50 ENT↑
 6.50 GSB2   Search
 1.00  ***   Within 1.8 units
 2.00 ENT↑
 7.00 GSB2   Search
 0.00  ***
 1.00 ENT↑
 5.00 GSB2   Search
 0.00  ***
 3.00 ENT↑
 5.00 GSB2   Search
 1.00  ***   Within 1.8 units
 2.50 ENT↑
 5.50 GSB3   Fire depth charge
 0.00  ***   Miss
 2.50 ENT↑
 3.50 GSB2   Search
 1.00  ***   Within 1.8 units
 1.50 ENT↑
 3.50 GSB3
 1.00  ***   (flashing) Hit!
```

	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9	
9											9											9
8											8											8
7											7											7
6											6											6
5											5											5
4											4											4
3											3											3
2											2											2
1											1											1
0											0											0
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9	
9											9											9
8											8											8
7											7											7
6											6											6
5											5											5
4											4											4
3											3											3
2											2											2
1											1											1
0											0											0
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9	
9											9											9
8											8											8
7											7											7
6											6											6
5											5											5
4											4											4
3											3											3
2											2											2
1											1											1
0											0											0
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9	

Playing board for Hunt a Moving Submarine.

You might wish to use copies of this page for your games.

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Initialize and enter seed (any number				
	between 1 and 100)	Seed	GSB	1	1.00
3.	Take a sonar reading	R*	ENT↑		
	or	C*	GSB	2	0 or 1
	Fire a depth charge	R	ENT↑		
		C	GSB	3	0 or
					blinking 1
4.	Repeat step 3 until the submarine is				
	destroyed (blinking 1.)				
5.	For a new game, go to step 2.				
	* R = Row				
	C = Column				

Program Listings

01 *LBL1	Initialize	49 5	
02 CLRG		50 -	
03 STO2	Seed	51 ENT↑	
04 DEG		52 ABS	
05 FIX2		53 ÷	± 1 positive if RND ⩾ 5 neg if RND ⩽ 4
06 GSB0		54 DSZ	
07 STO4	C_S	55 RCL4	0 or 3 results
08 GSB0		56 +	$R_S \pm 1$ or $C_S \pm 1$
09 STO1	R_S	57 9	If P_i+x = 0 or P_i+x = 10, the new coordinate is P_i-x = $\|\|P_i+x-9\|-9\|$
10 1		58 -	
11 STO5	Clear flag 1	59 ABS	
12 R/S		60 9	
13 *LBL3	Charge fired	61 -	
14 0		62 ABS	
15 STO5	Set flag 1	63 ISZ	i = 1 or 4
16 R↓		64 STO i	
17 *LBL2		65 RCL5	Flag 1
18 1		66 X=0?	
19 STO0	i = 1	67 STO3	Zero out R_3
20 R↓		68 1	
21 RCL4		69 STO5	Clear flag 1
22 -	x_2 - C_S	70 RCL3	
23 X⇄Y		71 R/S	Result
24 RCL1		72 *LBL8	
25 -	x_1 - R_S	73 1	
26 →P	δ,Euclidean dist.	74 PSE	Blink 1.
27 .		75 GTO8	
28 8		76 *LBL0	Random number generator
29 -	δ - .8	77 2	
30 X>0?		78 RCL2	
31 GTO9	Continue flag 1	79 +	
32 RCL5		80 STO2	
33 X=0?		81 COS	
34 GTO8	Charge within .8 units	82 ABS	
35 R↓		83 EEX	
36 *LBL9		84 5	
37 1		85 x	
38 STO3		86 FRC	
39 X≤Y?	δ ⩾ 1.8?	87 1	
40 ST-3		88 0	
41 GSB0	Zero out R_3	89 x	
42 4		90 INT	
43 X≤Y?	4 < RND?	91 RTN	RND = 6th figure of cos (R_2)
44 STO0	i=4; C_S will change and R_S will remain the same	92 R/S	
45 RCL1			
46 GSB0			
47 4			
48 .			

NOTE: P_i = Any row or column location for sub.

REGISTERS

0 i	1 R_S	2 Seed	3 Result	4 C_S	5 Flag 1 0=set 1=clear
6	7	8	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

ARTILLERY GAME

In this game, the gun has a maximum range of 10,000 meters. At the start of a game, the target is at a random direction (0-360°) and random distance (5,000-10,000 meters) from the gun. To locate the target, fire a shell in an arbitrary direction and elevation (i.e., 90° direction and 45° elevation). The display then shows the direction and distance from the shell hit to the target. From this, it is possible to determine where the target was. The target randomly changes its direction from the gun by up to ± 5°, and randomly moves towards the gun by 0-1,000 meters after each shell hits. Taking into account the expected movement of the target, a new direction and elevation are estimated, and another shell fired. Corrections are made and shells fired until either the target is blown up (shell hits within 100 meters of target) or the gun is destroyed (target gets within 1,000 meters of gun without being hit).

Note that due to the way that the target moves, the closer it gets to the gun, the easier it is to hit.

A difficulty factor of 10 is stored in register 4. This limits the direction change of the target to ± 5°. This may be changed to any real number; for example, to 0 to eliminate zig-zags, or to 20 for a more difficult game. The factor 10 is automatically restored to register 4 at the beginning of the next game.

Independently, the "EEX,3" in steps 62, 63 of the program controls the distance (0-1,000 meters) that the target moves towards the gun after each shell is fired. This may be replaced by, for example, "EEX,2" to make a much easier game.

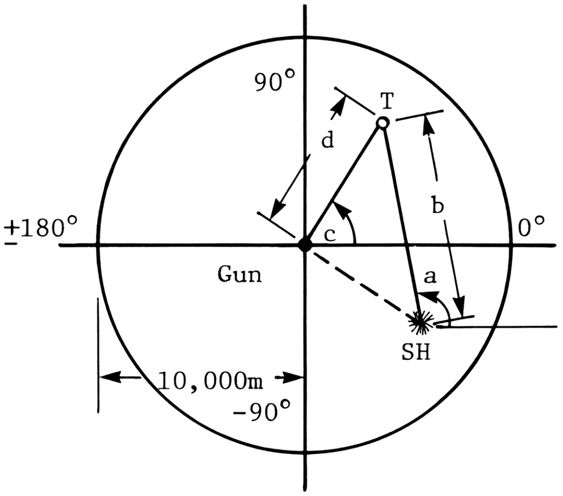
NOTE:

This program is adapted from HP-65 Users' Library program #03320A by Delmer D. Hinrichs.

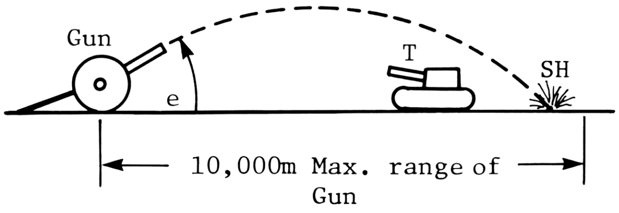
The range of the gun is given by the formula

Range = Sin 2θ · Maximum Range,

where θ = elevation angle



T = Target
SH = Shell Hit
a = Angle, shell hit to target
b = Distance, shell hit to target
c = Angle, gun to target
d = Distance, gun to target
e = Elevation, angle of gun



SOLUTION: (1)

```
      0.00 GSB1   Enter seed of 0
  90.00000 ENT↑   Locate target
  45.00000 GSB2
 -75.14467  ***   Target was -75° and
                  14467 meters from
                  shell impact

 -45.00000 ENT↑   Shoot
  20.00000 GSB2
 141.01832  ***   You're closer
 -47.00000 ENT↑
  12.00000 GSB2   Shoot
  92.00286  ***
 -46.00000 ENT↑
  10.00000 GSB2
 -66.00207  ***
 -47.00000 ENT↑
  10.00000 GSB2
 137.00527  ***   The target is getting
                  further away from your
                  shell

 -48.00000 ENT↑
   7.50000 GSB2
  59.00192  ***
 -47.00000 ENT↑
   6.50000 GSB2
 125.00167  ***   Your shell hit only
                  167 meters away from
                  target

 -46.00000 ENT↑
   5.00000 GSB2
   0.00000  ***   (flashing)-Gun destroyed
                  You lose
```

SOLUTION: (2)

```
63    2              2 is put in step 63 to
                     improve chances of
                     victory
     5.00000 GSB1    Seed = 5
    90.00000 ENT↑
    45.00000 GSB2    Find target
  -142.02440  ***    Target location
   102.74932 ENT↑
    30.01001 GSB2    Shoot
    11.00588  ***
    98.85965 ENT↑
    29.70000 GSB2    Shoot
  -176.00229  ***    Missed by 229 m.
   100.37360 ENT↑    Shoot
    29.58000 GSB2
     1.00000  ***    (flashing)
                     Target destroyed
                     You win
```

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Key in the program				
2.	Enter seed (any number from 0 to 100				
	inclusive) and initialize.	Seed	GSB	1	10.00000
3.	Enter direction and elevation (both in	Direction	ENT↑		
	degrees) and fire.	Elevation	GSB	2	DDD.MMMMM
	Display shows direction and distance, shell				
	hit to target, in format: degrees. meters				
4.	Repeat step 3 until:				
4a.	Target is destroyed --flashing 1.				
4b.	Gun is destroyed--flashing 0.				
5.	For a new game, go to step 2.				

Program Listings

01 *LBL1		50 X⇄Y	θ
02 DEG		51 INT	
03 CLRG	Initialize	52 X<0?	
04 STO7		53 GSB7	
05 3		54 ST÷3	
06 6		55 RCL4	
07 0		56 GSB0	
08 GSB0	Starting angle	57 RCL4	
09 STO1		58 2	
10 5		59 ÷	
11 EEX		60 -	
12 3		61 ST+1	New angle
13 STO8		62 EEX	
14 GSB0		63 3	
15 RCL8		64 GSB0	1000
16 +		65 ST-2	
17 STO2	Starting distance	66 RCL2	
18 1		67 EEX	New distance
19 0		68 3	
20 STO4		69 X>Y?	New distance < 1000
21 FIX5	Set display	70 GTO8	
22 R/S		71 RCL3	
23 *LBL2	Elev. Dist.	72 R/S	Degrees • meters
24 2		73 *LBL8	
25 x		74 0	Display blinking 0
26 SIN		75 GTO9	
27 EEX		76 *LBL7	
28 4	10000	77 RCL3	
29 x		78 CHS	
30 →R	x_1y_1	79 STO3	
31 CLΣ		80 R↓	
32 Σ+		81 RTN	
33 0		82 *LBL6	
34 ST.0		83 1	Display blinking 1
35 RCL1		84 *LBL9	
36 RCL2	x_2y_2	85 PSE	Blink generator
37 →R		86 GTO9	
38 Σ-	x_2-x_1 y_2-y_1	87 *LBL0	Random number
39 x̄		88 RCL7	generator
40 →P	$r\theta$	89 Pi	
41 EEX		90 +	
42 2		91 X²	
43 X>Y?	r < 100?	92 FRC	
44 GTO6		93 STO7	
45 R↓	r	94 x	
46 EEX		95 RTN	
47 5		96 R/S	
48 ÷			
49 STO3			

REGISTERS

0	1 Angle	2 Distance	3 Display	4 $\Delta\theta$	5
6	7 Seed	8 5000	9	.0	.1
.2	.3	.4	.5	16	17
18	19	20	21	22	23
24	25	26	27	28	29

NOTES

NOTES

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