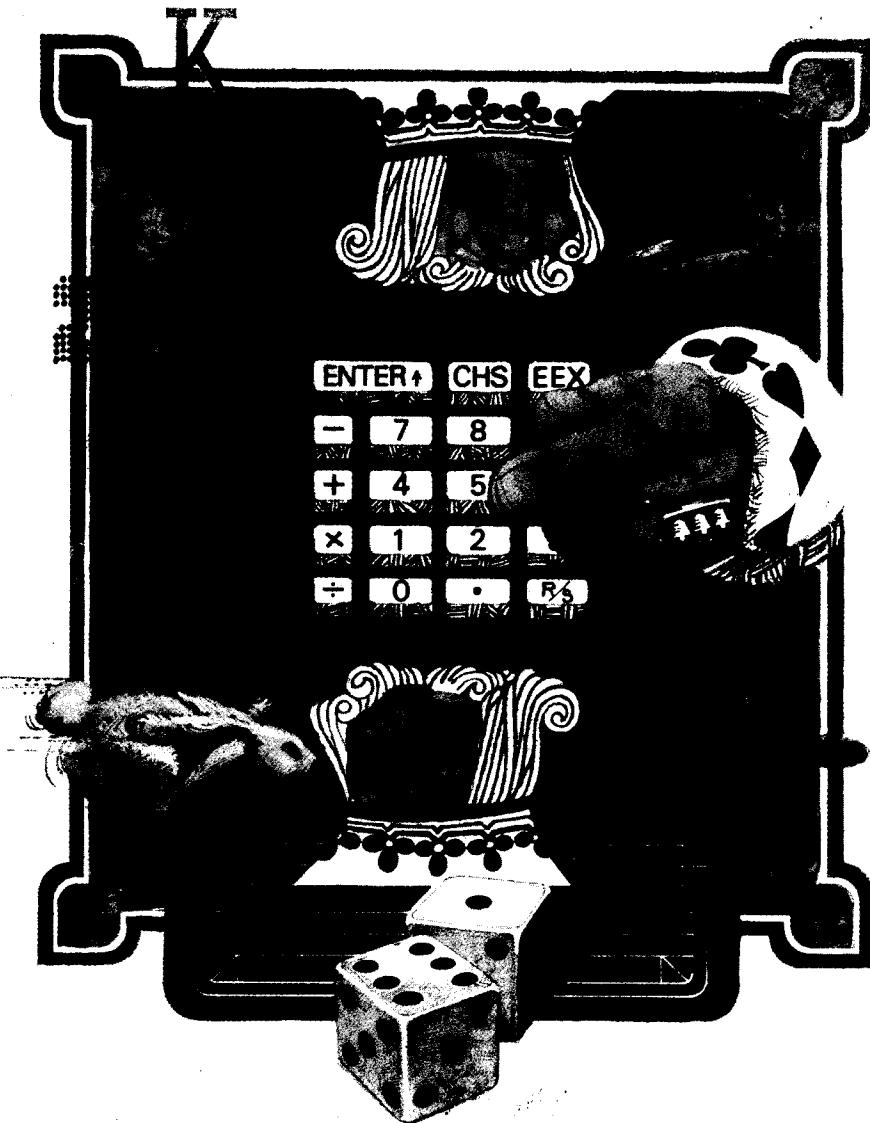


HEWLETT-PACKARD

HP-67/HP-97

Games Pac I



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WE NEED YOUR HELP

To provide better calculator support for people like you, we need your help. Your timely inputs will enable us to provide high quality software in the future and improve the existing application pacs for your calculator. Your early reply will be extremely helpful in this effort.

1. Pac name: 67/97 Games
2. How important was the availability of this pac in making your decision to buy a Hewlett-Packard calculator? Would not buy without it. Important Not important
3. Did you buy this pac and your calculator at the same time? Yes No
4. In deciding to buy this Games Pac, which three programs seemed most fun or useful to you? Program numbers 1. ____ 2. ____ 3. ____
5. Which three programs in this application pac seemed least fun or useful to you? Program numbers 1. ____ 2. ____ 3. ____
6. In the list below, please select up to three application areas for which you use your calculator between games. Please indicate the order of importance by 1, 2, 3 (1 represents the most important area).

Engineering	Business
____01 Chemical	____51 Accounting
____02 Civil/Structural	____52 Banking
____03 Electrical/Electronic	____53 Insurance
____04 Industrial	____54 Investment Analysis
____05 Mechanical	____55 Real Estate
____06 Surveying	____56 Securities
____10 Other (Specify) _____	____57 Sales
	____58 Marketing
Science	____59 Other (Specify) _____
____31 Biology	Other
____32 Chemistry	____71 Architecture
____33 Earth Sciences	____72 Aviation
____34 Mathematics	____73 Computer Science
____35 Medical Sciences	____74 Education
____36 Physics	____75 Navigation
____37 Statistics	____79 Other (Specify) _____
____39 Other (Specify) _____	

Thank you for your time and cooperation.

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ATTENTION: APPLICATIONS

Introduction

The 19 programs of Games Pac I are designed primarily to provide fun, and also to help teach principles of math, physics and logic. Included are card games, dice games, mathematical puzzles, outdoor sports and war games. Characteristics of each program are shown below.

We hope that Games Pac I will provide you with pleasure and education. We would very much appreciate knowing your reactions to the programs in this pac, and to this end we have provided a questionnaire inside the front cover of this manual. Would you please take a few minutes to give us your comments on these programs? It is in the comments we receive from you that we learn how best to increase the usefulness of programs like these.

**PROGRAM
CHARACTERISTICS**

	SOLITAIRE	2 PLAYERS	2 OR MORE PLAYERS	EASY TO WIN	HARD TO WIN	VARIABLE TO WIN	CHANCE	SOME DIFFICULTY	TWO SKILL	NOT A GAME	NO CALCULATORS	PLAY EACH OTHER
1 GAME OF 21	●	●	●			●						
2 DICE	●		●			●						
3 SLOT MACHINE	●			●		●						
4 SUBMARINE HUNT	●				●			●	●			
5 ARTILLERY	●					●	●	●	●			
6 SPACE WAR	●				●			●	●			
7 SUPER BAGELS	●					●		●	●			
8 NIM _k	●					●		●	●	●		
9 QUEEN BOARD	●			●				●	●			
10 HEXAPAWN	●				●			●	●	●		
11 TIC-TAC-TOE	●				●			●	●			
12 WARI	●	●			●			●	●	●		
13 RACETRACK	●		●		●			●	●			
14 TEASER	●				●			●	●			
15 GOLF	●	●				●		●	●			
16 THE DEALER	●		●							●		
17 BOWLING SCOREKEEPER	●		●							●		
18 BIORHYTHMS	●									●		
19 TIMER	●									●		

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1. Game of 21	01-01
This card game is also known as blackjack.	
2. Dice	02-01
This includes the game of "Craps" as well as a dice roller.	
3. Slot machine	03-01
The familiar one armed bandit.	
4. Submarine Hunt	04-01
Find and then sink the moving submarine with your depth charges.	
5. Artillery	05-01
Can you locate and destroy the moving target before it destroys you?	
6. Space War	06-01
Your mission: Search out and annihilate the 3 evil Alglogs before time and energy are gone.	
7. Super Bagels	07-01
Based on "Mastermind." How fast can you guess the secret number?	
8. Nim _k	08-01
Who will pick the last object from the last pile, you or the machine?	
9. Queen Board	09-01
You and the calculator take turns moving a chess queen to its target. The one who moves last, wins.	
10. Hexapawn	10-01
You and the 67/97 command armies of 3 chess pawns each. Caution: The calculator learns from its mistakes.	
11. Tic-Tac-Toe	11-01
Your best hope is to play the machine to a draw.	
12. Wari	12-01
You have a reasonable chance of beating the HP-67/97, but beware of a smart human. This ancient game is also known as Man-Kalah.	
13. Racetrack	13-01
Up to 5 players can race. Be alert to the differences between velocity and acceleration.	
14. Teaser	14-01
Changing from one pattern to the other looks easy, but ...	
15. Golf	15-01
The HP Country Club course is challenging, but a duffer with his handicap can beat a champion.	
16. The Dealer	16-01
This shuffles and deals a deck of cards to 4 people; it also calls Bingo.	
17. Bowling Scorekeeper	17-01
Tired of keeping score and missing the game? Here's your answer for up to 10 bowlers.	

18. Biorhythms	18-01
Calculates cycle values for any date, and tells which of the next 33 days are critical, maximum or minimum days.	
19. Timer	19-01
Offers 2 visible timers, a count-up and count-down timer, and allows splits to be taken.	
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A WORD ABOUT PROGRAM USAGE

Each program in this pac is represented by one or more magnetic cards and a section in this manual. The manual provides a description of the program, a set of instructions for using the program, and one or more example problems, each of which includes a list of the actual keystrokes required for its solution. Program listings for all the programs in the pac appear at the back of this manual. Explanatory comments have been incorporated in the listings to facilitate your understanding of the actual working of each program. Thorough study of a commented listing can help you to expand your programming repertoire since interesting techniques can often be found in this way.

On the face of each magnetic card are various mnemonic symbols which provide shorthand instructions to the use of the program. You should first familiarize yourself with a program by running it once or twice while following the complete User Instructions in the manual. Thereafter, the mnemonics on the cards themselves should provide the necessary instructions, including what variables are to be input, which user-definable keys are to be pressed, and what values will be output. A full explanation of the mnemonic symbols for magnetic cards may be found in Appendix A.

This application pac has been designed for both the HP-97 Programmable Printing Calculator and the HP-67 Programmable Pocket Calculator. The most significant difference between the HP-67 and the HP-97 calculators is the printing capability of the HP-97. The two calculators also differ in a few minor ways.

Most of the computed results in this pac are output by PRINT statements: either by the statement PRINTx or by the command PRINT STACK. On the HP-97 these results will be output on the printer. On the HP-67 each PRINT command will be interpreted as a PAUSE: the program will halt, display the result for up to five seconds, then continue execution. The term "PRINT/PAUSE" is used to describe this output condition.

The lists of keystrokes required to solve example problems indicate the resulting outputs. Those outputs indicated by *** are printed by the HP-97 with the printer in MANUAL mode. These *** outputs are shown by PAUSE on the HP-67. Outputs without stars are displayed on both the HP-97 and HP-67.

If you own an HP-67, you may want more time to copy down the number displayed by a PRINT/PAUSE. All you need to do is press any key on the keyboard. If the command being executed is PRINTx (eight rapid blinks of the decimal point), pressing a key will cause the program to halt. If the command being executed is PRINT STACK (two slow blinks of the decimal per value), the number in the display will remain there until the depressed key is released;

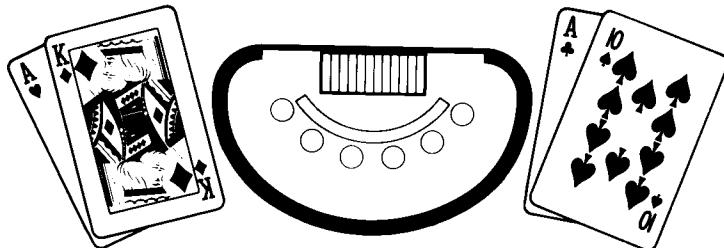
then the next register in the stack will be displayed, and so on. After display of all four registers, the program will halt execution if a key was pressed at any time during the display of the stack contents. In both cases execution of the halted program may be re-initiated by pressing **R/S**.

HP-97 users may also want to keep a permanent record of the values input to a certain program. A convenient way to do this is to set the Print Mode switch to NORMAL before running the program. In this mode all input values and their corresponding user-definable keys will be listed on the printer, thus providing a record of the entire operation of the program.

Another area that could reflect differences between the HP-67 and the HP-97 is in the keystroke solutions to example problems. It is sometimes necessary in these solutions to include operations that involve prefix keys, namely, **f** on the HP-97 and **f**, **g**, and **h** on the HP-67. For example, the operation **[10^x]** is performed on the HP-97 as **f [10^x]** and on the HP-67 as **g [10^x]**. In such cases, the keystroke solution omits the prefix key and indicates only the operation (as here, **[10^x]**). As you work through the example problems, take care to press appropriate prefix keys (if any) for your calculator.

If you have already worked through a few programs in the Standard Pac, you will understand how to load a program and how to interpret the User Instructions form. If these procedures are not clear to you, take a few minutes to review the sections, Loading a Program and Format of User Instructions, in your Standard Pac.

Game of 21 (Blackjack)



You make your bet, and the calculator, as dealer, deals two cards to you and two to itself. You see the dealer's first card face up, then his second face down (the calculator shows 0). Your two cards are then shown face up, one at a time. Next, you see a number in the form XXX.YY, where XXX is your bet and YY is the number of points in your hand.

You and the dealer may draw additional cards. Your goal is to finish with a hand whose total count is 21 or below, but closer to 21 than the dealer's. If your hand totals over 21, you lose (you're "busted").

The King is indicated by 13, the Queen by 12, and the Jack by 11, but all count 10 points each. The other cards always count their face values except the Ace. The Ace counts 1 unless you decide to change it to an 11 (press **D**). (If you have chosen 11 for an Ace, and want it counted 1, press **E**). If the next card you draw makes your score over 21, the calculator will automatically check for an Ace and make it count 1 if you have chosen 11 for its value. Note that an Ace always counts 1 for the dealer, except for a blackjack. A blackjack is a 2 card hand totalling 21, made up of a 10, Jack, Queen, or King plus an Ace with a value of 11. Your best win is a blackjack, since you win 1.5 times your bet rather than the bet itself. If both you and the dealer get blackjack, you neither win nor lose, it's a "push."

After the initial deal, and provided neither you nor the dealer have blackjack, you may ask the dealer to give you another card ("hit") by pressing **B**. If you don't want to draw, you may "stand" by pressing **C**. The calculator will then show the dealer's two cards. If the dealer's (calculator's) hand counts 16 or less, it draws. It continues to draw until its hand totals 17 or more, then it stands.

The calculator then determines if you've won or lost, and blinks your winnings (XXX) or losses (-XXX) and your final score (YY) in the form XXX.YY.

Next it shows your total account (the sum of your winnings and losses for all the games you've played this session).

Terms for HP-67/97 Game of 21 (Blackjack)

1. BLACKJACK: Any Ace (1) with 10, Jack (11), Queen (12) or King (13).
2. BUST: When your points are 22 or more.
3. HIT: Signify that you wish another card by pressing **B**.
4. STAND: You wish no more cards. Press **C**.
5. PUSH: You have the same points as HP-67/97. Blinking 0.000000000 when both have blackjack; blinking 0.00 for ordinary push.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load sides 1 and 2.			
2	Shuffle cards.		f A	
3	Stop shuffle and cut deck.		R-S	Ignore output
4	Input your bet (whole even dollars only—no cents nor odd dollars). Please do not bet over \$100,000,000.	Bet	A	Dealer's cards; your cards; Bet.points
5	Hit (draw a card).		B	Bet.points
6	Repeat step 5 until you are busted or you want to stand.			
7	If you want your Ace scored as 11:		D	Bet.points
8	If you want your Ace changed from 11 to 1:		E	Bet.points
9	Stand.		C	Win or loss
10	If you had not chosen to stand, what would have been your next card?		f E	Card

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
11	For a new game, go to step 2.			
12	For a new player: Reset account to zero, and go to step 11.		f C	0.00

Example:

Load sides 1 and 2.

Keystrokes:**f** **A** →**Outputs:**Display will not stabilize until **R/S** is pressed.

Wait 20 or 30 seconds.

R/S →

Ignore output.

To reproduce the example below, store .9103987 in register **E**.100 **A** →9. *** Dealer's 1st card
0. *** Dealer's 2nd card (face down)12. *** Your 1st card is a Queen, worth 10 points.7. *** Your 2nd card

100.17 100 is your bet, 17 is your score.

4. *** Your 3rd card

100.21 Bet. Score

B →9. *** Dealer's 1st card7. *** Dealer's 2nd card12. *** Dealer's 3rd card**C** →

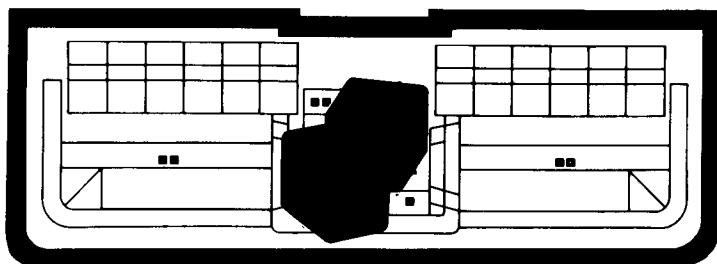
100.21	Your win. score Display blinks to indicate end of game. Positive number means you win.
100.00	Your account
100 [A] →	6. *** Dealer's 1 st card 0. *** Dealer's 2 nd card 1. *** Your 1 st card 7. *** Your 2 nd card
[D] →	100.08 Your bet. score 100.18 Your bet. score
C →	6. *** Dealer's 1 st card 12. *** Dealer's 2 nd card 4. *** Dealer's 3 rd card -100.18 Your loss. score 0.00 Your account

Your Ace is now counted as 11.
You decide to stand.

Dealer's 20 beats your 18, so you lose the \$100 you won the first game.
Care to try your luck again?

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

DICE



There are many games that can be played with dice. One of the most popular of these games is "CRAPS."

Two dice are used. One player, by general consent, becomes the first "shooter."

A bet is placed. The shooter then throws the dice. If on the first roll the total is a 7 or 11, this is called a "natural" and the shooter wins. If the throw is a 2, 3, or 12, it is a "crap" and all that is bet is lost.

If any other number appears, it is called a "point." The shooter then continues to throw the dice until the point is matched, in which case all that is bet is won; but if a 7 appears first, all that is bet is lost. Another player then becomes the shooter.

To play craps using this program, a seed (any number between 0 and 100) is input to key **A**. Then a bet is placed (key **B**). The program will then display generated rolls of the dice until the shooter wins or loses. The shooter's winnings are updated and appear on the display. If another player is to become the shooter, press key **C**.

Another feature of this program is as a dice roller. A seed (any number between 0 and 100) is input to key **A**. The roll of the dice is then generated by pressing key **D**. After each roll the result is displayed. This process can be repeated as many times as you like.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 only.			
2	Key in seed (any number between 0 and 100).			
3	For dice roll, go to step 6. For craps, go to step 4.		A	0.00
	CRAPS			
4	Input bet, and roll dice until you win or lose.		B	Display*
5	For new player, reset; then go to step 4.		C	0.00
	DICE ROLL			
6	Roll dice.		D	x.y zz†
7	Repeat step 6 as often as you wish.			
	*Each roll of the dice is displayed in succession as x.y zz†. When the player wins or loses, his updated winnings (or losses) are then displayed. A minus sign is used for losses.			
	†x = value of first die.			
	y = value of second die.			
	zz = sum of both dice.			

Example 1:

Load sides 1 and 2.

Keystrokes:

Set seed.

9 **A** →**Outputs:**

0.00

Place bet.

10 **B** →

5.1 06

6.3 09

3.6 09

1.4 05

6.4 10

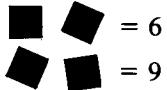
6.6 12

2.6 08

2.4 06

10.00

WIN!



Place bet.

10 **B** →

3.2 05

3.2 05

20.00

WIN!

Place bet.

10 **B** →

6.6 12

10.00

LOSE!

Place bet.

10 **B** →

5.6 11

20.00

WIN!

Place bet.

10 **B** →

1.4 05

3.3 06

4.5 09

6.6 12

3.1 04

5.2 07

10.00

LOSE!

Another shooter

C →

0.00

Example 2:**Keystrokes:**

Set seed.

1 **A** →**Outputs:**

0.00

Roll dice.

D →

5.3 08

D →

1.2 03

D →

1.1 02

D →

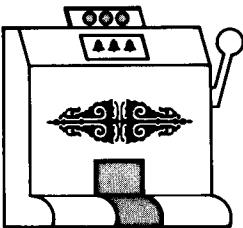
3.1 04

D →

2.6 08

etc.

Slot Machine



This electronic slot machine deducts one dollar from your bank account with each "spin" and pays up to one hundred dollars for a jackpot. To begin, input a seed consisting of a decimal point followed by a string of digits using the **E** key.* Then merely press the **A** key time-after-time to spin the wheels. Your bank account may be seen at any time by pressing **B**.

Any combination of three digits may be seen in the display in the format $0.D_1D_2D_3$. Only the following combinations, however, result in a payoff:

COMBINATIONS	PAYOUT
0.1XY	\$ 2.00
0.11X	\$ 5.00
0.ZZZ ($Z \geq 2$)	\$ 10.00
0.ZZ0 ($Z \geq 2$)	\$ 10.00
0.000	\$100.00

Good luck!

*The string of digits should be long and should contain an assortment of values.

Reference:

This program is based on an HP-65 Users' Library program by Craig A. Pearce.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1.			
2	Enter seed (a many digit number between 0 and 1).	Seed	E	0.
3	Play.		A	Combination
	Winning combinations:			
	0.1XY \$ 2.00			
	0.11X \$ 5.00			
	0.ZZZ \$10.00			
	(where Z is 2 or more)			
	0.ZZ0 \$10.00			
	(where Z is 2 or more)			
	0.000 \$100.00			
4	Recall winnings or losses at any time (optional).		B	Winnings
5	Repeat step 3 any number of times.			
6	To start over, go to step 2.			

Example:

Load side 1.

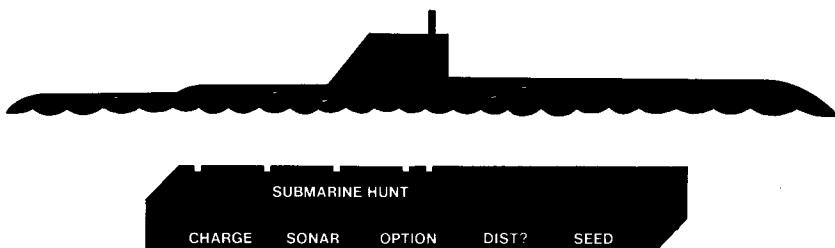
Keystrokes:

.963258741 E →
 A →
 A →
 A →
 B →
 A →
 B →
 A →
 A →
 A →
 A →
 A →
 B →

Outputs:

0.
 0.450
 0.001
 0.000 → JACKPOT!
 97.00
 0.173 → A \$2 WINNER
 98.00
 0.991
 0.026
 0.902
 0.999 → A \$10 WINNER
 104.00

Submarine Hunt



Using your destroyer, you try to locate the position of the enemy submarine in a 10×10 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 **B**. If the submarine is in one of the 8 adjacent squares (or directly 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. Blinking “1's” indicate 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.

You can make the hunt easier or more difficult. For an easier game, press **D**. This increases the sensitivity of your sonar, allowing you to detect the submarine as far away as 2 squares in any direction (you cover a square region of the ocean 5 squares on a side). **D** is a toggle switch—you can switch from 1 to 2 square sensitivity or from 2 to 1 square sensitivity as often as you like during the game.

To make a more challenging game, press **C** immediately after inputting the seed. This allows the submarine to move after each sonar echo as well as after each depth charge miss. The submarine always moves randomly to an adjacent square in the same row or column.

A depth charge has a range of 0.9. When you position your destroyer for a depth charge drop, 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 squares (2, 6) (2, 7) (3, 6) and (3, 7).

Try to destroy the submarine using no more than 10 sonar readings and 1 depth charge, playing a regular game with regular sensitivity. You can check your status any time the display is steady by pressing **f E**.

Status format is XX.YY

where: XX = Number of depth charges fired.
 YY = Number of sonar readings.

Reference:

This program is based on an HP-65 Users' Library program written by Moshe Breiner.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load sides 1 and 2.			
2	Input seed (any number between 0 and 100).		E	0.
3	For regular game, go to step 5.			
4	Select difficult game (sub- marine always moving).		C	1.
5	To change sonar sensitivity: "2" means sensitivity distance is 2 squares.		D	2. or 1.
	"1" means sensitivity distance is 1 square.			
6	SONAR	Row	ENTER	
	"0" means no echo.	Col.	B	0. or 1.
	"1" means echo received. or			
	DEPTH CHARGE	Row	ENTER	
	"0" means miss.	Col.	A	0. or
	Blinking "1's" means HIT!			blink
7	Repeat step 6 until sub- marine is hit.			
8	To review status at any time: XX = number of depth charges fired.		F E	XX.YY
	YY = number of sonar readings.			
9	For a new game, go to step 2.			

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 boards for Submarine Hunt and Space War.
You might wish to use copies of this page for your games.

Example 1:

Load sides 1 and 2.

Keystrokes:58 **E** →**Outputs:**

0.

First move:

2 **ENTER** 1 **B** →

1. Echo

You now know your enemy is in one of the "x" squares below.

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

Diagram of 1st move

Second move:

1 **ENTER** 2 **B** →

0. No echo

The submarine cannot be in the **☒** squares below.

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

Diagram of 2nd move

Third move:

3 **ENTER** 0 **B** → 0. No echo

You've narrowed down the submarine's location to just 2 squares, those containing an "x" with no circle.

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

Diagram of 3rd move

Fourth move:

1 **ENTER** 0 **B** → 1. Echo

This eliminates (3, 2) as a submarine location, so you've found it!

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

Diagram of 4th move

Fifth move:

1 **ENTER** 0 **A** → 0.111
 0.11111
 0.1111111
 0.11111111
 0.111111111

A hit!

Example 2:

Keystrokes:

60 **E** →
C →

Outputs:

0.
 1.

Submarine will now move on sonar echos as well as on depth charge misses.

First move:

7 **ENTER** 4 **B** → 1. Echo

The submarine is in one of the "x" squares in the left diagram below. But the submarine moves, so now it could be in any of the "x" squares in the right diagram below.

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

Diagrams of 1st move

04-07

Second move:

8 **ENTER** 4 **B** →

0. No echo

You've eliminated some positions (left diagram: \otimes), but new possible positions have been created by the enemy's random move (right diagram).

	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	
9			\otimes	\otimes	\otimes						9			x			x				9
8		x	\otimes	\otimes	\otimes	\otimes	x				8	x	x	x		x	x	x	x		8
7		x	\otimes	\otimes	\otimes	\otimes	x				7	x	x	x	x	x	x	x	x		7
6		x	x	x	x	x	x				6	x	x	x	x	x	x	x	x		6
5		x	x	x	x						5	x	x	x	x	x	x	x			5
4											4			x	x	x					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	

Diagrams of 2nd move

Third move:

7 **ENTER** 5 **B** →

1. Echo

This eliminates many possible positions (left diagram), but again, new ones are created (right diagram).

	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	
9		\otimes			\otimes						9			x	x						9
8		\otimes	\otimes	\otimes	x	x	\otimes				8			x	x	x	x				8
7		\otimes	\otimes	\otimes	x	\blacksquare	\otimes				7			x	x	x	x				7
6		\otimes	\otimes	\otimes	x	x	x	\otimes			6			x	x	x	x				6
5		\otimes	\otimes	\otimes	\otimes	\otimes	\otimes				5			x	x	x	x				5
4			\otimes	\otimes	\otimes						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	

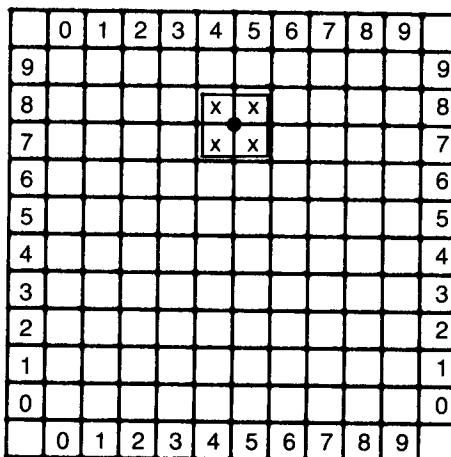
Diagrams of 3rd move

Fourth move: You try a depth charge.

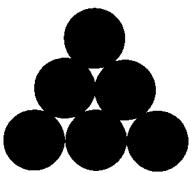
7.5 **ENTER** 4.5 **A** → 0.111
0.11111
0.1111111
0.111111111
0.1111111111 A hit!

It pays to be lucky.

The submarine used to be in one of these 4 squares:



Artillery



This program simulates the firing of an artillery round at a moving target whose initial position has been randomly selected. Feedback to the gunner is via a spotter plane weaving in and out of clouds over the battle area.

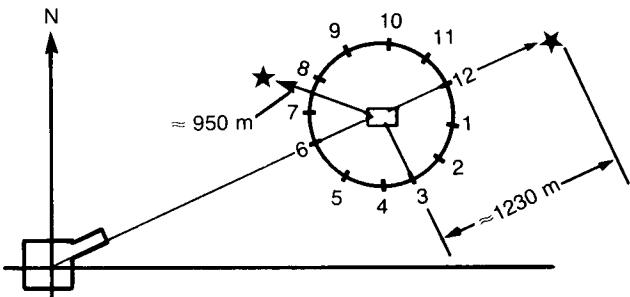
- (1) Initial display for each new battle is one of the 8 main compass directions: 0 (North), 45, 90 (East), 135, 180 (South), 225, 270 (West), or 315. The target lies in that *general* direction from the hidden gun and is 5 to 10 kilometers away.
- (2) The gunner fires by bearing and elevation parameters. A spotter (poor to perfect) relays information by displaying hh.DDDD :

hh (0 to 12) = the shell hit as an hour position on a relative clock face with the target at center and 6 o'clock in line with the gun.

DDDD = the *estimated* range from target to shell hit.

Thus: 8.0950 = shell was a bit short, left, and 950m away.

12.1230 = shell passed over target and hit 1230m beyond.



(3) If shell lands within KILL range of target, the gunner wins. If not destroyed, and target has closed within 500 meters, target blasts gun to pieces—player loses!

Win is indicated by PRINT/PAUSE display of stack:

T = spotter rating

Z = maximum axial movement of target (SPEED)

Y = KILL range

X = proximity of shell hit to target

Loss is indicated by flashing 500.0.

(4) Between one-minute shots, target randomly moves (up to maximum SPEED both N-S and E-W) but usually closes toward gun. Accurate information on where target *was* when last shell was fired can be obtained via **C** in format bbb.DDDD (true bearing and distance from gun).

(5) After loading program, initialization (**1 A**) sets the following parameters:

- a) Maximum gun range = 10,000 meters. (Thus, the formula for any shell's range = $10,000 \times \text{Sin}(2 \times \text{elevation})$.)
- b) Target KILL range = 100 meters.
- c) Target SPEED = 500 meters/minute (along each axis).
- d) Spotter rating = 3.0 (1 = poor, 4 = perfect).
- e) Random number seed = 0.5284163

Remarks:

Remember, information from a less than perfect spotter may be incorrect by as much as 3 hours in either circular direction and as much as $\pm 60\%$ of the "miss" distance. A perfect (4.0) spotter will report to the nearest hour and within 10 meters. Target movement along axes (SPEED), spotter rating (SPOTR), and lethal radius of a shell blast (KILL) may all be altered by the player even during a battle. Distinguished indeed will be the first player to win a battle under the following conditions: SPEED = 1000, SPOTR = 1.0, and KILL = 0!

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load sides 1 and 2 of card.			
2	Initialize parameters: (Random seed = 0.5284163)		I A	10000.00
	(Axial movement of target,			
	SPEED = 500)			
	(Spotter rating, SPOTR = 3.0)			
	(KILL range = 100)			
	(Maximum gun range			
	= 10,000)			
3	Optional—			
	Set target SPEED.	Speed	I B	Speed
	Set spotter rating (1 = poor,			
	4 = perfect).	Spot	I C	Spot
	Set KILL range (1000 = easy,			
	10 = tough).	Kill	I D	Kill
4	Reset target for new battle.		A	BBB.*
5	FIRE!	Bearing	ENTER	
		Elevation	E	
	or	or	I E	hh.DDDD*
6	Repeat step 5 until decision:			
	WIN—Stack is output.			
	LOSS—Flashing 500.0			
7	Display bearing & distance to			
	last target (Opt).		C	bbb.DDDD*
8	Recall rounds fired.		RCL I	Rounds

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
9	Go to step 3.			
	*Outputs:			
	BBB: Bearing in			
	degrees.			
	hh.DDDD:			
	hh = Estimate of hour			
	position of hit relative to			
	target. 6 is nearest gun.			
	DDDD = Estimate of dis-			
	tance from hit to target.			
	bbb.DDDD = Correct			
	bearing and distance to			
	last target position.			

Example 1:

Load sides 1 and 2.

Keystrokes:[**A**] →**Outputs:**

10000.00

(This initialization need be done only on a freshly loaded program. SPEED = 500, SPOTR = 3.0, and KILL = 100 meters.)

[**A**] (Starts the battle) →

180. (Approximate target bearing)

201 [**ENTER**] 33 [**E**] →

201.0000000 ***

33.0 ***

11.0130 ***

(Spotter has reported that round landed left, long and missed by 130m.)

201.5 [**ENTER**] 32 [**E**] →

201.5000000 ***

32.0 ***

2.0670 ***

199 **ENTER** 30 **f E** → 199.0000000 ***
 30.0 ***
 1.0570 ***

196 **ENTER** 27 **E** → 196.0000000 ***
 27.0 ***

Target destroyed!

3.0 *** T Spotter rating
 500.0 *** Z Target max.
 movement
 100.0 *** Y Kill range
 79.1 *** X "Miss" distance

Example 2:

Select SPEED = 100, SPOTR = 4.0 (perfect), and KILL = 20.

100 f B →	100.0
4 f C →	4.0
20 f D →	20.0
A →	315. Approximate target bearing

315 **ENTER** 30 **E** → 315.0000000 ***
 30.0 ***
 3.3230 ***

295 **ENTER** 25 **E** → 295.0000000 ***
 25.0 ***
 1.0530 ***

293 **ENTER** 22.5 **f E** → 293.0000000 ***
 22.5 ***
 4.0050 ***

292.5 **ENTER** 22.2 **E** → 292.5000000 ***
 22.2 ***

Gotcha!

4.0 *** T Spotter rating
 100.0 *** Z Target max.
 movement
 20.0 *** Y Kill range
 10.4 *** X "Miss" distance

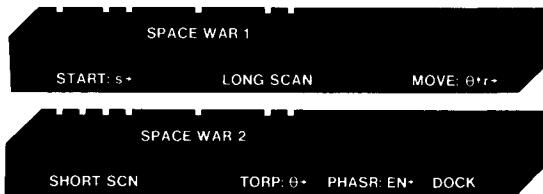
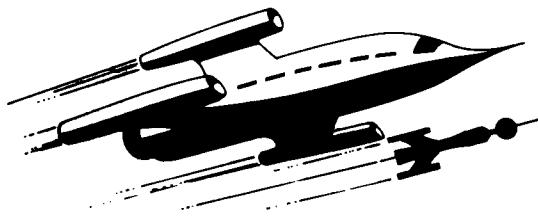
Example 3:

Select 1000 meter SPEED and KILL range.

1000.0	f	B	f	D	→	1000.0
A	→	90.				
90	ENTER	30	E	→	90.000000 ***	
					30.0 ***	
					1.2400 ***	
85	ENTER	20	E	→	85.000000 ***	
					20.0 ***	
Ridiculously easy!					4.0 *** T	
					1000.0 *** Z	
					1000.0 *** Y	
					881.0 *** X	

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

Space War



You are the commander of the Nuclear Powered Reconnoiterer (NPR) Kittyhawk. The NPR Kittyhawk is the sole guardian of justice in a vast galaxy that measures 10 quadrants by 10 quadrants. Within the galaxy somewhere, anchored among the blazing stars, lie three agents of evil: the vile Alglogs, known throughout space as interstellar thieves and creators of cosmic mischief. Your mission as commander of the NPR Kittyhawk is to search out and destroy the fearsome Alglogs within 18 stardays.

Also within the galaxy somewhere is a Base, a haven to which your ship may return in order to resupply itself. The weapons carried by the Kittyhawk are torpedos, which are fired in a straight line, and phasers, which send out an omnidirectional burst of energy. In addition, your starship is equipped with short- and long-range sensors which can detect the presence of Alglogs or the Base in nearby space. One starday is used whenever the Kittyhawk changes its position, i.e., when a move is made. Details of the operation of the NPR Kittyhawk are given below.

POWER ON (Card 1)

The Kittyhawk is started by supplying a seed s ($0 \leq s \leq 1$) to the routine START (Card 1). This routine positions the three Alglogs, the Base, and the Kittyhawk randomly in the galaxy. For best results, the seed s should contain all the digits but 0 and end in a 1, 3, 7, or 9. Remember that the galaxy is a 10×10 grid of quadrants; within each quadrant is a 10×10 grid of smaller areas called sectors. The quadrants are numbered 00 through 99, as are the sectors. The position of an object, then, may be specified by giving its quadrant and sector (QQ.SS). Examples of allowable positions are 23.68, 10.99, 7.01, and 85.00. No two objects may occupy the same position. At the end of the routine START, the calculator displays the starting position of the NPR Kittyhawk.

LONG-RANGE SCAN (Card 1)

The long-range scan covers all quadrants adjacent to and including that of the Kittyhawk itself. This scan will detect and report the presence of Alglogs or the Base in those quadrants. Suppose objects are located in the quadrants as below.

62	63	64	65
		B	A
52	53	54	55
A	KH		
42	43	44	45

The long-range scan would include the quadrants adjacent to quadrant 53 (Q53). The output of the scan would be three lines as follows:

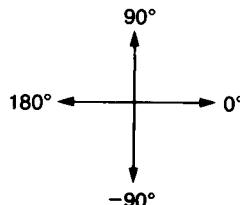
63.00400401
53.10400400
43.00400400

The first line shows the contents of quadrants 62, 63, and 64. Two digits are allocated to each quadrant, with the "4's" merely indicating separation of the quadrants. The Base would appear in the right-hand of the two digits, an Alglog in the left-hand digit. Notice that the Base appears in the top line (Q64) and an Alglog in the second line (Q52). The Alglog in quadrant 65 is beyond the range of the sensors and does not show up. The numbers 63, 53, and 43 refer to the middle quadrant of each line.

The contents of nine squares are displayed with each long-range scan. If the Kittyhawk is at or near the edge of the galaxy, some of this information may be meaningless.

MOVE (Card 1)

If the Kittyhawk were in the position shown in the long-range scan above, a logical move would be to go to quadrant 52 to attack the Alglog. To make a move, one specifies the angle θ and distance r to be covered. Orientation of angles is shown in the diagram below. Angles must be input in degrees.



The distance is specified in terms of quadrants. To move exactly one quadrant's width, specify an r of 1. To move from Q53 to Q52, then, select $\theta = 180^\circ$ and $r = 1$. Suppose one wished to move from Q53 to Q64. This would require an angle of 45° and a distance of $\sqrt{2}$. The output at the end of the move routine is the Kittyhawk's new position.

Each move uses 1 starday. If a move is taken when no stardays remain, the display will flash zeros to indicate that the mission has failed.

Caution must be observed near the edges of the galaxy. Moving beyond an edge can result in the Kittyhawk's being lost in space.

SHORT-RANGE SCAN (Card 2)

The short-range scan gives a detailed picture of the quadrant the Kittyhawk is presently in. The output is 10 lines of information output by PRINTx commands, each line representing a row of the quadrant. The rows are output in the order 9, 8, 7, ..., 0. Each line consists of 10 digits that represent the ten sectors in the row. A "0" in a line means that that sector is unoccupied; a "3" marks the location of the Kittyhawk, a "4" an Alglog, and a "7" the Base. Suppose the output of a short-range scan were as shown below:

Row 9	0.0000000000
Row 8	0.0400000000
Row 7	0.0000000000
Row 6	0.0000000000
Row 5	0.0000000003
Row 4	0.0000000000
Row 3	0.0000000000
Row 2	7.0000000000
Row 1	0.0000000000
Row 0	0.0004000000

This scan indicates the presence of Alglogs in sectors 04 and 82, the Kittyhawk in sector 59, and the Base in sector 20.

TORPEDO (Card 2)

The Kittyhawk begins its mission with 3 torpedos. A torpedo may be fired at an Alglog within the same quadrant. If the torpedo passes within 1° of the Alglog, the Alglog is destroyed and the torpedo is spent. To fire a torpedo, simply specify the angle of fire in degrees.

If no torpedos remain and you attempt to fire a torpedo, the display will show "Error."

PHASERS (Card 2)

At the start of the mission, 1000 units of energy are available for firing phasers. Unlike torpedos, phasers fire equally in all directions and can destroy as many Alglogs as are within range. Only Alglogs within the same quadrant as the Kittyhawk may be fired on. The closer the Alglog, the less energy is required to destroy it. A minimum of 105 units and a maximum of 275 units may be needed to destroy an Alglog. To fire phasers, simply specify the amount of energy to be used.

Whenever an Alglog is fired on with phasers, there is a danger that the fire will be returned. Accordingly, the Kittyhawk uses another 100 units of energy to maintain shields against each Alglog within the quadrant.

If more energy is needed than is available, flashing zeros will be displayed to indicate that the mission has failed.

DOCK (Card 2)

The Kittyhawk may dock at the Base by moving into a sector adjacent to that of the base and executing the routine DOCK. If the docking is successful, the Kittyhawk's supply of torpedos and energy are replenished to their initial level: 3 torpedos, 1000 units of energy. The display at the end of this routine shows the current supply of energy and torpedos.

STATUS

Two routines are available for providing information on the status of the mission. Either of these routines may be executed at any time.

The first, on card 1, shows the number of days remaining in the mission. Simply press **f A** and the number of days will be displayed.

The second, on card 2, shows the remaining energy and torpedos. Both values are output in a single display as Energy.Torpedos. For example, a supply of 500 energy units and 2 torpedos would be displayed as 500.2. This information is available by pressing **f A** on card 2.

MAP OF GALAXY

A map of the galaxy (playing board) is located on page 04-03 in the game of Submarine Hunt.

Reference:

This program is based on an HP-65 Users' Library program written by Lee Gregory, Jr.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2 of <i>Space War 1.</i>			
2	To initialize, key in a seed s $(0 \leq s \leq 1)$. Output is the starting position of Kittyhawk.	s	A	QQ.SS
3	You have 18 stardays. Your options are outlined below. Be sure the appropriate card is loaded for each option.			
	LONG RANGE SCAN (Card 1)			
4	Output 3 lines of scan. KH is in center. QQ refers to middle quadrant of each line. Digits AB refer to Alglogs and Base.		C	QQ.AB4AB4AB
	MOVE (Card 1)			
5	Key in direction and distance (in quadrants) of desired move; output new position of Kittyhawk. (Flashing zeros means all stardays used; mission failed.)	θ	ENTER+	
		r	E	QQ.SS
	SHORT RANGE SCAN (Card 2)			
6	Output 10 rows of present quadrant in order 9, 8, ..., 0. Kittyhawk = 3, Alglog = 4, Base = 7.		A	X.XXXXXXXXXX
	TORPEDO (Card 2)			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
7	To fire a torpedo, key in angle or fire; output number of Alglogs remaining. ("Error" means no torpedos remain; use phasers.)	θ	C	# Alglogs
	PHASER (Card 2)			
8	To fire phasers, key in units of energy expended in fire; output number of Alglogs remaining. (Flashing zeros mean all energy used; mission failed.)	Energy	D	# Alglogs
	DOCK (Card 2)			
9	You may dock from any square adjacent to Base. Output is present			
	Energy.Torpedos.		E	En.Torp
	STATUS			
10	With Card 1, display number of days remaining.	(Card 1)	F A	Days
11	With card 2, display present Energy. Torpedos.	(Card 2)	f A	En.Torp

Example:

From the log of the NPR Kittyhawk:

Load side 1 and side 2 of Space War 1.

Keystrokes:

.63154897 **A** →
C →

Outputs:

50.53 (KH position)
 60.00400400 ***
 50.00400400 *** (Long scan)
 40.00400400 ***

Current map of galaxy:

	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	KH	●									5				3						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

Quadrants**Sectors**

Dots indicate quadrants known to contain neither Alglogs nor Base.

Move in direction -45° .

45 CHS ENTER \downarrow 5.5 E \longrightarrow 14.62 (New position)
 C \longrightarrow 24.00400400 ***
 14.00400401 *** (Long scan)
 4.00400410 ***

Current map of galaxy:

	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			3							6
5	●	●									5										5
4	●	●									4										4
3											3										3
2			●	●	●						2										2
1			●	KH	B						1										1
0			●	●	A						0										0
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9

Quadrants**Sectors**

Move to Q05 to attack.

45 CHS ENTER \downarrow 2 \sqrt{x} E \longrightarrow 5.62 (Now in Q05)

Load side 1 and side 2 of Space War 2.

A \longrightarrow 0.000000000 *** (Short scan)
 0.000000000 ***
 0.000000000 ***
 0.030000000 *** (KH in S62)
 0.000000000 ***
 0.000000000 ***
 0.000000000 ***
 0.000000000 ***
 0.000000000 ***
 0.004000000 *** (Alglog in S03)

Current map of galaxy:

	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			3							6
5	●	●									5										5
4	●	●									4										4
3											3										3
2			●	●	●						2										2
1				●	●	B	KH				1										1
0					●	●	A				0			4							0
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	

Quadrants

Sectors

Fire a torpedo in direction -80° .

80 CHS C \longrightarrow 2.000000000 (2 Alglogs left)

Return to Base and dock.

Load side 1 and side 2 of SW1.

90 ENTER \downarrow 1 E \longrightarrow 15.62 (New position)

Load side 1 and side 2 of SW2.

A → 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***
 0.0300000007 *** (KH in S62, Base
 in S69)
 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***

Current map of galaxy:

	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			3								7	6
5	●	●									5												5
4	●	●									4												4
3											3												3
2		●	●	●							KH			2									2
1			●	●							B			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		

Quadrants

Sectors

Move to S68.

Load side 1 and side 2 of SW1.

0 **ENTER** .6 **E** → 15.68

Current map of galaxy:

	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									3	7	6
5	●	●								5										5	
4	●	●								4										4	
3										3										3	
2		●	●	●	●					KH			2							2	
1		●	●	●	●					B	←		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	

Quadrants

Sectors

Dock.

Load side 1 and side 2 of SW2.

E → 1000.3 (Energy, torpedos replenished)

Load side 1 and side 2 of SW1.

90 **ENTER** 5 **E** → 65.68 (New position)

Current map of galaxy:

	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	●	●								KH			6						3	6
5	●	●											5							5
4	●	●											4							4
3													3							3
2		●	●	●									2							2
1		●	●	●	B								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

Quadrants

Sectors

C →

75.00400400 ***
 65.00410400 *** (Note Alglog in
 Q65)
 55.00400400 ***

Load side 1 and side 2 of SW2.

A →

0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***
 0.0000000030 *** (KH in S68)
 0.0000000000 ***
 0.0040000000 *** (Alglog in S43)
 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***
 0.0000000000 ***

Current map of galaxy:

	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	
9											9									9	
8												KH									8
7					●	●	●						7								7
6	●	●			●	●	●						6						3	6	
5	●	●			●	●	●						5								5
4	●	●						A					4		4						4
3													3								3
2			●	●	●								2								2
1			●	●	B								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	

Quadrants

Sectors

Use phasers. Try 200 energy units.

200 D → 1.0000000000 (1 Alglog left)

The rest of the mission will be left as an exercise for the cadet.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

Super Bagels

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

SUPER BAGELS

SEED # DIGITS MAX DIG (-# GUESS) GUESS +

The object of the game of Super Bagels is for the player to guess an integer number which the calculator has chosen. Clues are given after each guess to tell the player how close his guess is to the hidden number. To make the game more interesting, the hidden number can be specified by the user to be from 1 to 8 digits, where each digit can range from zero to a maximum specified by the user. When the proper number is finally entered, the number of guesses required to discover the hidden number is displayed.

Play begins by first keying in a seed (any number) and pressing **A**. The display will return with a 2-digit code as shown: 4.5. This output shows the type of number which the machine will pick for the player to guess unless requested otherwise. The 4.5 game is a game of moderate difficulty where the number is a 4 digit number with each digit having any value from 0 to 5. Thus the minimum possible number is 0000, and the maximum 5555.

After the game has been started by pressing **A**, the number to be guessed can be changed by pressing **B** or **C**. To change the number of digits in the hidden number, key in the number of digits and press **B**. The number of digits must be at least 1 and not greater than 8. To change the maximum digit found in the hidden number, the maximum digit is keyed in and **C** is pressed. The range of legal maximum digits is from 0 to 9. After **B** or **C** is pressed, the display returns with a display in the same format as after pressing **A**. This makes sure the user knows the type of number he is trying to guess.

Once the hidden number has been specified, the game begins with the player entering his first guess and pressing **E**. The returned output is of the form CW.Guess where C is the number of digits of the guess that exactly match digits in the hidden number both in value and location. W is the number of digits of the guess that match digits of the hidden number in value, but not in location. Digits are not counted twice; that is, digits counted as C digits are not counted again as W digits. If C is 0 there will be a blank in place of C.

For example, if the hidden number is 12251, a guess of 12345 would yield 21.12345, meaning that 2 numbers (the 1 and 2) match exactly the hidden number, but that 1 number (5) is out of place.

A guess of 21125 would give 5.21125 meaning all of the digits of the guess are in the hidden number, but none of them are in the right place.

When the guess finally matches the hidden number, the number of guesses used is output. At any time during the game, the current number of guesses taken can be displayed by pressing **D**.

To play again, enter a new seed and press **A**. Super Bagels is written to run as fast as possible, but when numbers with many digits are selected, the time to analyze a guess will be significantly slower than with a simpler number. For those who want to discover the hidden number in some manner other than by using the clues given, you are invited to try. Super Bagels has been written to hide the number as much as possible. Good Luck.

Reference:

This game was inspired by the popular game *Mastermind*.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	To start game, key in a seed (any number); output is in the form D.M.*	Seed	A	4.5
3	To change number of digits to be guessed in the number, key in the number ($1 \leq D \leq 8$).	D	B	D.M*
4	To change the maximum digit found in the number to be guessed, key in the number ($0 \leq M \leq 9$).	M	C	D.M *
5	To display current number of guesses already taken		D	Guesses
6	Guess a number containing D digits with the maximum digit $\leq M$. The output returns the guess and also codes C and W which signify the number of digits of the guess correct and in the right location (C), and the number of other			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	digits of the guess correct but in the wrong location (W).			
7	Repeat step 6 until a match is made between the guess and the number stored in the machine. The output shows the number of guesses required to make the match.	Guess	E	CW.Guess
8	To play again return to 2.			no. of guesses
	*D = number of digits in hidden number.			
	M = maximum allowed value of any digit in hidden number.			

Example 1:

Play a game with 4 digits, each in the range 0-5.

Load sides 1 and 2.

Keystrokes:

1.23456987 EEX CHS 12 A →
 3214 E →
 3015 E →
 5234 E →
 5203 E →
 5223 E →
 5253 E →

Outputs:

4.5
 11.3214 *** (1 right, 1 in right place)
 2.3015 *** (2 right)
 21.5234 *** (1 right, 2 in right place)
 30.5203 *** (3 in right place)
 30.5223 ***
 40.5253 *** (Correct)
 6. *** (6 guesses)

Example 2:

The original game of Bagels uses a hidden number of 3 digits, each in the range of 0-9. Play a game of Bagels.

Keystrokes:

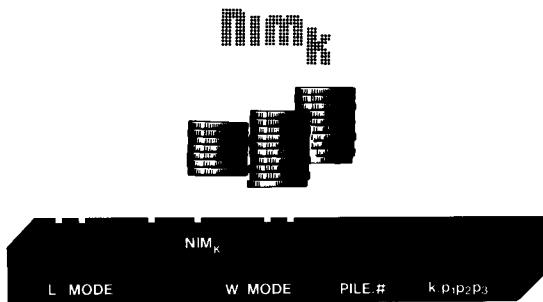
1.23456987 **A** →
3 **B** →
9 **C** →
512 **E** →
702 **E** →
217 **E** →
236 **E** →
235 **E** →
239 **E** →
238 **E** →

Outputs:

4.5
3.5
3.9
1.512 ***
1.702 ***
10.217 ***
20.236 ***
20.235 ***
20.239 ***
30.238 ***

7. *** (Number of
guesses)

***Shown by PRINT on HP-97 and by PAUSE on HP-67.



According to Martin Gardner, one of the oldest and most engaging of all two person mathematical games is known today as Nim. The game, perhaps Chinese in origin, is played with counters (often pennies) arranged in piles, and two players alternate in removing one or more objects from one pile at a time. The player taking the last counter or counters wins or loses according to the mode of play.

Nim_k is a generalization of this Nim, first proposed by Prof. E. H. Moore of the University of Chicago in 1910. Nimb is an abbreviated version of Nim provided for the HP-65 and HP-25.

A number of objects or counters (from one to nine) is placed in a desired number of separate piles (from one to nine). You and the calculator take turns removing any number of counters (but at least one) from up to k piles. You choose whether the player taking the last counter wins (W mode) or loses (L mode).

The number k may be from one to eight. It is set at the beginning of the game and does not change during the game. You select both k and the initial arrangement of counters and piles.

To illustrate, choose k = 1 and let 2, 4, 5, and 6 counters be placed in pile numbers 1, 2, 3, 4 as shown below:

$$k = 1$$

Pile number: 1 2 3 4

Number of counters in each pile: 2 4 5 6

This will be shown in the calculator display as

1.2456

After the calculator's move, the display

1.2453

tells how many piles you may reduce and how many counters remain. The left-most digit keeps track of how many piles may yet be reduced.

You respond with a pile number, and the number of counters to be removed. Your response is displayed as:

3.1

That is, from pile 3 take 1 counter. The display then shows 0.2443, the zero indicating your move is finished (there are no more piles left from which to remove counters until your next move).

The moves continue back and forth until the last counter or counters are taken by the winner, or in the L mode of play, by the loser.

The game's complete mathematical analysis for $k = 1$ was first published by C.L. Bouton in 1901. In 1910 E.H. Moore described this generalization which he named Nim_k. As Moore described it, for n piles containing respectively

c_1, c_2, \dots, c_n counters,

represent these numbers

$$c_i \ (i = 1, \dots, n)$$

in the binary scale of notation with

$$c_{ij} \left(\begin{array}{l} i = 1, \dots, n \\ j = 0, 1, \dots \end{array} \right) \text{each 0 or 1}$$

$$\text{where } c_i = c_{i0} + c_{i1} 2^1 + c_{i2} 2^2 + \dots + c_{ij} 2^j \\ (i = 1, 2, \dots, n).$$

The combination is safe when

$$\sum_{i=1}^n c_{ij} = 0 \pmod{k+1} \quad (j = 0, 1, 2, \dots).$$

That is, for every place j the sum of the n digits c_{ij} ($i = 1, \dots, n$) is exactly divisible by $k + 1$. The L mode in which the player taking the last counter or counters loses, requires a change in strategy toward the end of the game. When the number of piles with two or more counters is from 1 to k inclusive, make

$$\sum_{i=1}^n c_{i0} = 1 \pmod{k+1} \text{ and } \sum_{i=1}^n c_{ij} = 0 \pmod{k+1} \ (j = 1, 2, \dots).$$

This strategy is continued till the end of the game. A lengthy execution time is required to implement the above expressions.

The present game can be used as a teaching device to achieve an intuitive grasp of the strategy of play since at any time the play can be turned over to the calculator to reveal how it would play. For example, it is clear that if there are fewer than $k + 1$ piles, your opponent can win by taking all the counters. Such an arrangement is an "unsafe" combination (according to the

W mode of play). A “safe” combination would be $k + 1$ piles of one counter each. At least one counter must be taken by the calculator. That leaves k counters that you can take and win. If instead, k counters had been taken there would still be one left for you to take and win. Similarly, for all other options it is a safe situation for you.

References:

Bouton, Charles L., “Nim, a Game with a Complete Mathematical Theory.”, *Annals of Mathematics*, Series 2, Vol. 3, pages 35-39, 1901.

Moore, Eliakim H., “A Generalization of the Game called Nim.”, *Annals of Mathematics*, Series 2, Vol. 11, pages 93-94, 1910.

Redheffer, Raymond M., “A Machine for Playing Generalized Nim.”, B.S. Thesis in Mathematics, 1943, Massachusetts Institute of Technology.

Gardner, Martin, *Mathematical Puzzles & Diversions*, Simon and Schuster, 1959.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2 of card.			
2	Input choice of k followed by the number of objects in each pile.	$k.p_1p_2p_3\dots$	E	$k.p_1p_2p_3\dots$
3	Choose either W or L mode of play: W: player taking last object wins.		C	32.
	L: player taking last object loses.		A	-32.
	Pressing C or A also generates calculator's move.			$k.p_1p_2p_3\dots$
4	Input choice of pile and number of objects to be removed. m = the number of piles yet available to choose objects from this turn.	pile.#	D	pile.# $m.p_1p_2p_3\dots$

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
5	Repeat step 4 until k piles have been chosen—(or less than k piles if desired) then go to step 3 for calculator's turn.			
6	Continue playing till the last object or objects are taken by the winner (or loser if in L mode).			k.000...
7	For another game, go to step 2.			
8	To learn good move habits, have the calculator play itself. After step 2, repeat step 3 until all piles are empty.			

Example 1:

Load sides 1 and 2.

Keystrokes:

7.478379895 **E** → 7.478379895 ***

You have chosen 9 piles, where counters from up to 7 piles may be removed each turn. The number of counters in each pile is:

Pile number:	1	2	3	4	5	6	7	8	9
Number of counters:	4	7	8	3	7	9	8	9	5

C → 32. ***

You've chosen the W mode, where the player taking the last counter wins.

7.455155555 ***

After the calculator moves (unfortunately for you, it does a lot of thinking), it leaves the above pile arrangement.

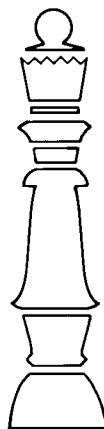
Queen Board

QUEEN BOARD
GA1-09A

MOVE →

This game is based on the moves of a chess queen. A queen will be allowed to move only to the left, down, or diagonally to the left. The object of the game is to be the first player to move the queen to the lower left-hand corner of the chess board (square 158), by alternating moves between you and the calculator. You start by placing the queen on any square on the top row or right-hand column. This is your first move. The play then alternates.

The playing board is numbered as follows:



Start Zone							
81	71	61	51	41	31	21	11
92	82	72	62	52	42	32	22
103	93	83	73	63	53	43	33
114	104	94	84	74	64	54	44
125	115	105	95	85	75	65	55
136	126	116	106	96	86	76	66
147	137	127	117	107	97	87	77
158	148	138	128	118	108	98	88

Start Zone

You tell the calculator your moves by keying in the number of the square you start on or move to. Press **A** and the calculator responds with the square it moves to. Square 158 is the winning square.

The magnetic card was recorded in DSP 0 mode, so only integers will be displayed.

Reference:

This program is based on an HP-65 Users' Library program by Jacob R. Jacobs.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1.			
2	Key in your starting position (first move).	Move	A	Calculator's move
3	Repeat step 2 until someone wins.			

Example:

Load side 1.

Keystrokes:

55 **A** →

75.

(You start on 55, and the calculator, after deep and careful thought, moves to 75).

97 **A** →

127.

(You respond with 97, and the calculator, showing no mercy, moves to 127).

148 **A** →

158.

(You try 148, hoping the calculator's batteries run down before it can respond, but no luck—it wins by moving to 158).

Hexapawn

HEXAPAWN

BOARD MOVE PUNISH CALC FIRST

Hexapawn is a game which is programmed to learn from its mistakes. The game is played with chess pawns on a 3×3 board. Pawns may advance one square at a time or capture the opponent's pawns by moving diagonally one square. The game starts with the pawns positioned as follows:

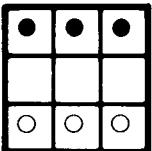


Figure 1. Starting position of pawns

The two allowed opening moves for the first player (in this example, white) are A and B:

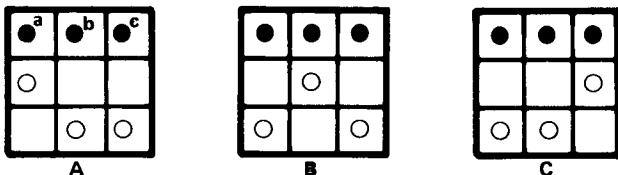


Figure 2. Opening moves

Since position C is a mirror image of A, it is not used. Black's three possible responses to white's A move are D, E and F.

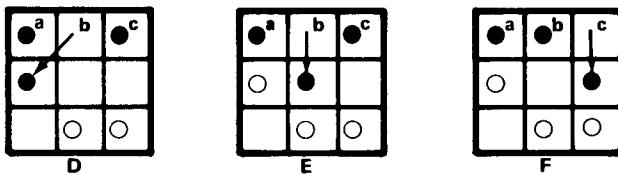


Figure 3. Black's responses to white's A move

Black can move diagonally and capture white (D), or he can move either b or c straight ahead one square. Black pawn at a is blocked. Note that the only way a pawn can move to an open square is straight ahead. Also, the only way a pawn can capture is by moving diagonally.

The game is won by advancing a pawn to the third row, capturing all of the opponent's pawns, or creating a position in which the opponent cannot move.

Moves are made by keying in a board position selected from the set of board positions shown in Figure 4 or Figure 5). The numbered arrows in each diagram indicate the possible choices the machine has for its replies. A reply of "0.00" indicates that the calculator has decided to forfeit the game. The machine selects its move at random, but whenever it is punished, it forgets the previous move. Thus, if the machine makes a poor move and is punished, it will not repeat the mistake.*

Since it is not easy for a human to visualize the changing game board, it is suggested that you follow your game on the playing board on page 10-03. You might use silver colored coins for white and pennies for black.

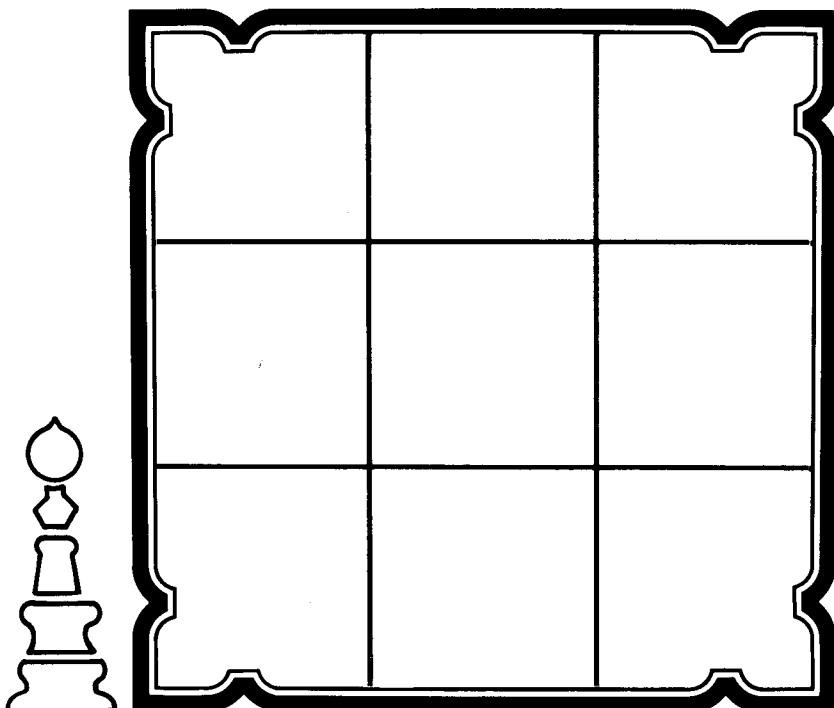
*Similarly, if you punish the machine for making good moves, it will eventually lose consistently—the calculator is your slave.

Reference:

This program was published in *65 Notes*, Vol. 2, No. 3. The HP-65 version was written by John R. Rausch.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Initialize:			
	Human moves first		f C	
	or Calculator moves first.		C	
	Then, after waiting a few			
	seconds, stop the random			
	number generator.		R/S	
3	Input the board position which			
	exists after your move.	Position	A	Response
4	Update your own board and			
	repeat step 3 until the game			
	is over.			
5	If the machine lost, punish it.		B	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	To play another game:			
	a) If the same player plays			
	first, go to step 3.			
	b) If the other player plays			
	first, go to step 2.			

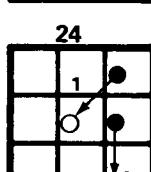
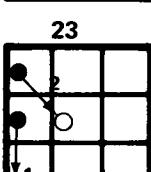
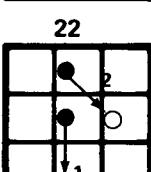
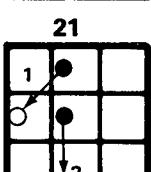
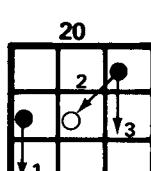
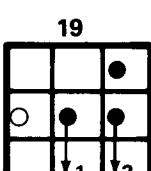
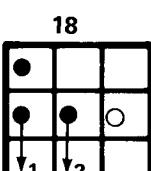
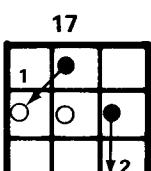
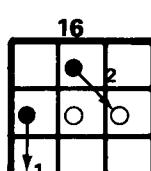
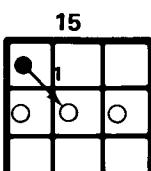
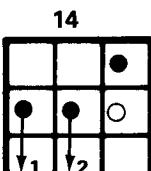
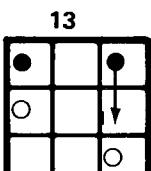
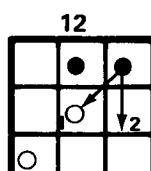
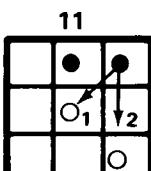
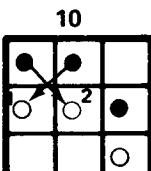
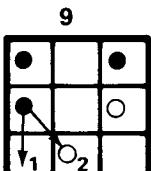
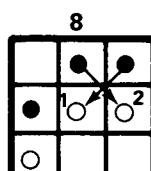
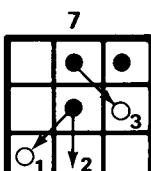
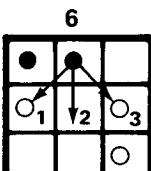
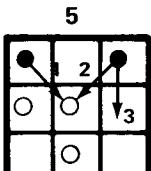
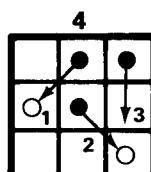
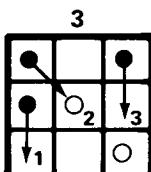
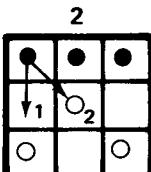
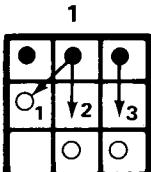


Playing Board for Hexapawn

Board Positions and Responses

You move first:

You are white (○)



Board Positions and Responses

You move second:

You are white (○)

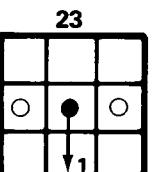
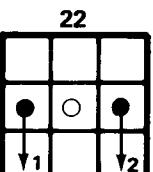
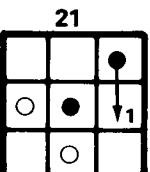
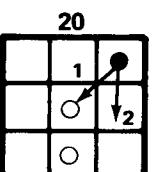
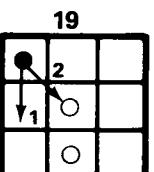
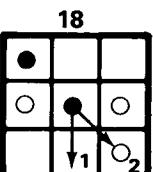
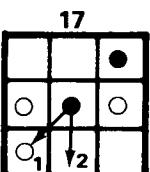
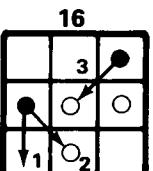
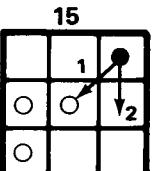
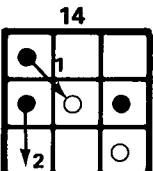
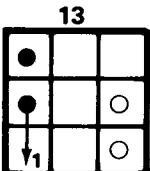
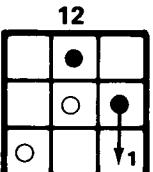
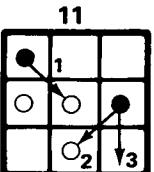
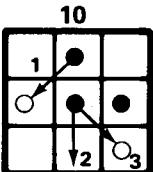
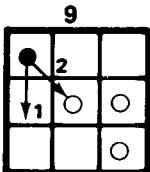
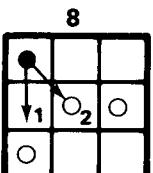
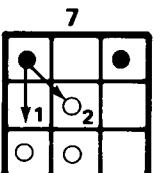
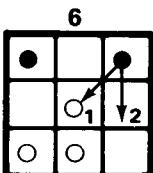
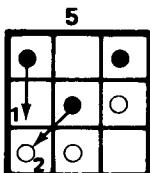
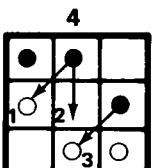
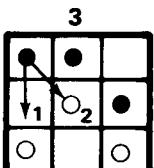
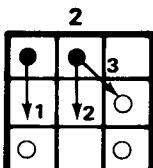
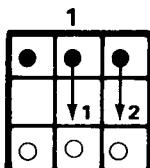


Figure 5

Example 1:

Load sides 1 and 2.

Keystrokes:

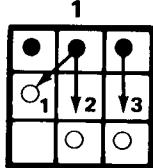
You move first.

f C (Wait a few seconds.)

R/S → Ignore display.

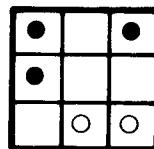
If you store .70879 in register 6, the game will proceed as follows:
 You start by moving your left pawn, giving board position 1. The calculator responds with move 1.

1 **A** →



Board position 1

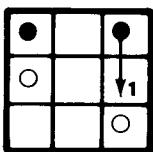
1.00



Board after calculator's response

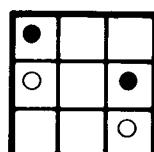
You capture, resulting in board position 13. In response, the calculator makes the only possible move.

13 **A** →



Board position 13

1.00



Board after calculator's response

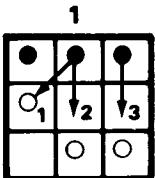
You can't move, so the calculator wins.

Example 2:

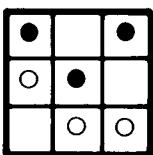
You start again by making the same opening move (board position 1). This time the calculator chooses move 2.

1 A →

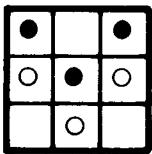
2.00



Board position 1



Board after calculator's response



Your winning board position

Since the calculator's move was a foolish one, you punish it.

B → Ignore output.

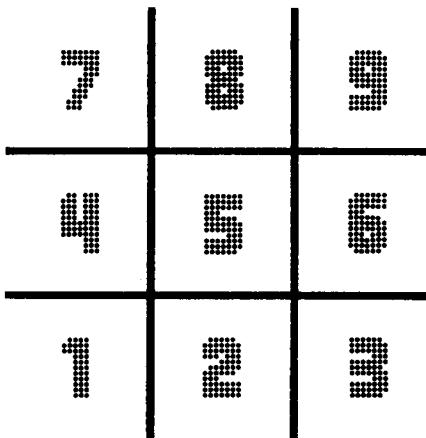
Now the calculator will not respond to board position 1 with move 2, unless you scramble its brain by removing the Hexapawn program from its memory and then reloading it.

By continuing to punish the calculator for unwise moves, it will soon play without error. Then be prepared for some tough games.

Tic-Tac-Toe

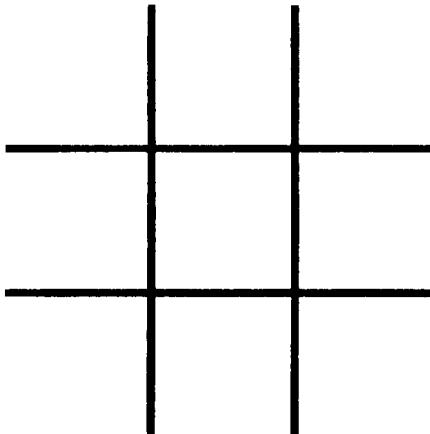


The game of tic-tac-toe hardly needs any introduction. In this one, you play versus the calculator. Moves are entered by keying in the appropriate position number selected from the diagram shown below. The calculator moves first at (2) so you will have a better chance to draw.



If you make any bad moves, the calculator will win; otherwise, the game will end in a tie.

You can use copies of the playing board below to follow your games.



Reference:

This program is based on an HP-65 Users' Library submittal by Delmer D. Hinrichs.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Initialize.		F A	0.000000000
3	To start a game		A	Board*
4	Repeat step 5 until the end of the game.			
5	Your turn. Enter position number (see diagram above). The calculator will move, and the resulting position will be output.	$1 \leq x \leq 9$	R S	Board*
6	To start a new game, go to step 3.			
	*For instance, this PRINT/ PAUSE output: 4.121, 4.112, 4.212, 7.212112121 cor- responds to this board position:			
	1 2 1 1 1 2 2 1 2			
	Your moves are shown by 2's, the calculator's moves are shown by 1's. The 4. in each PAUSE display means you have finished your 4 th move.			
	The 7 means the calculator has just moved into position 7 (see diagram above).			

Example:

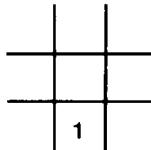
Load sides 1 and 2.

Keystrokes:

f **A** → 0.000000000

The calculator starts by making the move it will always make when a new game begins:

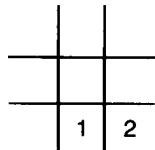
A → 0.000 ***
 0.000 ***
 0.010 ***
 0.010000000



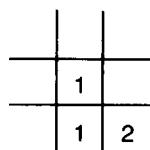
Board position 1A
Calculator's opening move

You put your "2" in square 3, and the calculator responds with square 5.

3 R/S → 1.000 ***
 1.010 ***
 1.012 ***
 5.012010000



Board position 1B
You move to square 3



Board position 2A
The calculator moves to square 5

8 R/S →

2.021 ***
 2.010 ***
 2.012 ***
 9.012010021

	2	
1		
	1	2

	2	1
1		
	1	2

Board position 2B
You move to square 8

Board position 3A
The calculator moves to square 9

1 R/S →

3.021 ***
 3.110 ***
 3.212 ***
 4.212110021

	2	1
1		
	2	1

	2	1
1		
	2	1

Board position 3B
You move to square 1

Board position 4A
The calculator moves to square 4

6 R/S →

4.121 ***
 4.112 ***
 4.212 ***
 7.212112121

	2	1
1	1	2
	2	1

1	2	1
1	1	2
2	1	2

Board position 4B
You move to square 6

Board position 5A
The calculator moves to square 7

11-05

You've battled the calculator to a tie, which gives you a moral victory.

Flushed with success, you decide to play another game:

A	→	0.000 ***
		0.000 ***
		0.010 ***
		0.010000000
5 R/S	→	1.000 ***
		1.020 ***
		1.110 ***
		1.110020000

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

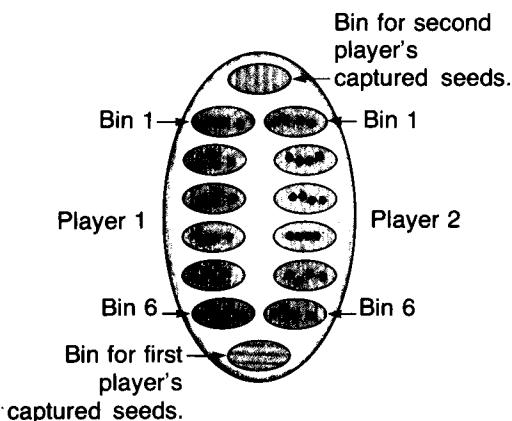
You might wish to continue this game. The calculator is a very good Tic-Tac-Toe player, so be careful!

Wari



Wari* is a board game which has been played for at least several centuries in various forms throughout Africa. The game is played on a board containing (generally) twelve small pits or bins, and two large pits. Forty-eight beads, seeds, or other counters are moved and captured according to certain rules.

The Wari board is shown here set up to begin a game.



Bin 1	4.04	Bin 1
	4.04	
Player 1	4.04	Player 2
	4.04	
	4.04	
	4.04	
Bin 6	4.04	Bin 6

**HP-97 Wari Printout
at start of game****

Wari Board at start of game

Each player in turn removes all the counters from one bin on his side and distributes them one-at-a-time into successive bins moving counterclockwise, skipping the two bins which are for storing captured counters. If the last counter drops into an opponent's hole containing one or two counters, the contents of that hole are captured and placed in the player's scoring pit. Counters in an unbroken sequence of two- and three-counter bins on the opponent's side clockwise from the captured bin are also captured. If a bin contains twelve counters or more, that bin is skipped when the counters from that bin are distributed.

The above rules are implemented in the calculator program. Special rules, such as prohibiting moves which remove all of the opponent's counters, were deemed to be variations of the basic game and were not programmed. It is possible to come to a situation where a few counters will circulate forever. In this case each player claims the counters on his side.

* Also known as Man-Kalah, Awari, and many other names.

**The HP-67 displays this information in PRINT/PAUSE mode.

To make a play on the calculator Wari board, the player specifies the bin he wants to move by keying in a number from 1 to 6 and then pushing either **A** or **E**. The machine then moves the counters from the specified bin according to the rules, prints the resulting position and displays the updated score. If you play this game on an HP-67, you must copy down the position as it is print/paused. To review the position, press **B**. To redisplay the score, press **D**.

An elementary strategy is also implemented in this program so that a player may match his wits against the machine. The machine is able to make obvious, though not brilliant, captures. The machine does not attempt to avoid having its counters captured, so it is a relatively poor opponent.

A special situation exists (covered by the Example) when one side (say side 1) has no counters. If player 1 is a human, he or she passes until consecutive moves by player 2 puts counters on side 1. If player 2 is the calculator, player 1 presses **f E** to cause the calculator to move.

If the calculator is playing the side that is temporarily without counters, move your counters in the usual way (Move **A**), and then press **R/S** anytime after the board is print/paused. Next, make your next move (Move **A**), and so on until the board shows a counter on the calculator's side. At that time, let the calculator make its move.

References:

Zaslavski, Claudia, *Africa Counts—Number and Pattern In African Culture*, Prindle, Weber & Schmidt, Inc., Boston, 1973.

Rules for Man-Kalah!, Skor-Mor Corp., 1970.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Start.		C	Board**, 0.00
3	Player 1: Select move (choose bin number from 1 to 6).	Move	A	Board, score
4	If 2 humans are playing, go to step 5.			
	If a human is playing the calculator, go to step 9.			
	**See text and example.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
5	Player 2: Select move.	Move	E	Board, Score
6	If one player cannot move (no counters), he skips his turn and the other player plays again.			
7	Repeat steps 3, 5 and 6 until the game is finished.			
8	For another game, go to step 2.			
9	Human: Tell calculator to be your opponent, and instruct it to move automatically after each of your moves.			
	For HP-67:		E CF	
			E f	
			E	Move, Board, Score
	For HP-97:		E CLF	
			E f	
			E	Move, Board, Score
10	Select move (choose bin number from 1 to 6).	Move	A	Board, Move, Board, Score

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
11	If you cannot move (no counters), tell calculator to move again.		f E	Board, Score
12	If the calculator cannot move (no counters), stop calculator's automatic move. And move your counter(s) again.	Move	R/S A	
13	Repeat steps 10, 11 and 12 until the game is finished.			
14	For another human/calculator game, press START, and go to step 10.		C	
15	For a human/human game, tell calculator politely that it is no longer playing: For HP-67		h SF O	
	For HP-97		f STF O	
	and go to step 2.			
16	To review position		B	Board
17	To review score		D	Score

Example:

You have decided to challenge the calculator.

Load sides 1 and 2. To reproduce this example, completely clear all registers.

Keystrokes:

C →

Outputs:

4.04	***	Starting board
4.04	***	
4.04	***	
4.04	***	
4.04	***	
4.04	***	
0.00		Score

Move 1:

You choose to move your counters out of bin 2:

2 A →

4.04	***	Board after your 1 st move
0.04	***	
5.04	***	
5.04	***	
5.04	***	
5.04	***	
0.00		Score

For HP-67: h CF 0 f E

For HP-97: f CLF 0 f E

3.00 *** Calculators 1st move

5.05	***	Board after Cal's 1 st move
1.05	***	
5.00	***	
5.04	***	
5.04	***	
5.04	***	
0.00		Score

After you dropped each of your 4 counters from your bin 2 into your bins 3, 4, 5 and 6 (moving counterclockwise), the calculator decided to move its counters from its bin 3. Note that bins are numbered from top to bottom for both sides and that both sides move counterclockwise.

Move 2:

5 A →

5.05	***	Board after your 2 nd move
1.05	***	
5.01	***	
5.05	***	
0.05	***	
6.05	***	
4.00	***	Cal's 2 nd move

6.06 ***	}
0.06 ***	
5.02 ***	
5.00 ***	
0.05 ***	
6.05 ***	

0.02 Score

Board after Cal's
2nd move

The calculator has struck the first blow. The 5 counters from its bin 4 went to its bins 3, 2, 1 and your bins 1 and 2. Since the last bin reached (your bin 2) contained only one lonely counter, both your counter and the attacking counter were removed, making the score 0 to 2, the calculator leading. If your bin 2 had contained 2 counters, they would have been captured, and the score would have been 0 to 3. Had your bin 2 contained 3 or more counters, you would have been safe.

You and the calculator continue moving as follows:

Move no.	Your move	Cal's move	Score
3	6	5	0-2
4	4	6	3-4

Here's the board after Cal's move 4:

8.09 ***	}
0.09 ***	
5.05 ***	
0.01 ***	
1.02 ***	
1.00 ***	
3.04 Score	

Board after your
5th move

Move 5:

1 A →

0.09 ***	}
1.09 ***	
6.05 ***	
1.00 ***	
2.00 ***	
2.01 ***	

6.00 *** Cal's 5th move

0.09 ***	}
1.09 ***	
6.05 ***	
1.00 ***	
2.01 ***	
2.00 ***	Board after Cal's
8.04 Score	

5th move

2.01 ***

2.00 ***

8.04 Score

You moved the 8 counters from your bin 1 around the board counterclockwise, ending up in Cal's bin 4. Looking clockwise from Cal's bin 4, note that Cal's bin 5 has only 2 counters. So you take the single counter in 4 (plus your counter) and the 2 counters in 5 (plus your counter), giving you a take of 5 counters. If Cal's bin 6 had contained 1 or 2 counters (before you added yours), you would have added another 2 or 3 to your score.

The game continues:

Move no.	Your move	Cal's move	Score
6	6	3	10-4
7	5	2	12-4
8	6	1	16-4
9	6	4	18-4
10	3	5	18-4
11	6	3	20-4
12	4	1	20-4
13	5	2	27-4
14	1	1	27-4
15	1	6	27-4
16	3	5	27-4
17	6	6	29-4
18	2	5	29-4
19	6	2	31-4
20	1	3	31-4
21	2	1	31-4
22	3	4	31-4
23	1	3	31-4
24	2	2	31-4
25	1	1	31-4

After Cal's 25th move, the board looks like this:

1.00 ***
2.00 ***
1.00 ***
5.00 ***
4.00 ***
0.00 ***

31.04 Score

Move 26:

3 **A** →

1.00 ***
2.00 ***
0.00 ***
6.00 ***
4.00 ***
0.00 ***

Since there are no counters on the calculator's side, it cannot move. You therefore stop its otherwise endless search for the nonexistent counter for it to move.

R/S →

Hold key until
display stabilizes.
Ignore output.

You then move again (5 **A**), and the game then proceeds normally. The calculator's succeeding moves depend on how long you wait before pressing **R/S**, since the program's random number generator runs during the calculator's search for a counter. Therefore, the rest of this example shows one of several possible outcomes.

Move no.	Your move	Cal's move	Score
27	5	5	31-4
28	6	4	33-4
29	4	5	35-4
30	6	4	37-4
31	1	2	37-4
32	1	1	37-4
33	1	3	37-4
34	2	6	37-4
35	3	5	37-4
36	5	4	37-4
37	4	3	37-4
38	6	4	37-4
39	5	5	37-4
40	6	4	40-4

The board looks like this after Cal's half of the 40th move:

0.00 ***
 0.02 ***
 0.02 ***
 0.00 ***
 0.00 ***
 0.00 ***

You have no counters and cannot move. So you ask the calculator to move again:

Move 41:

f E → 3.00 *** Cal's move
 0.01 *** }
 0.03 *** }
 0.00 *** } Board after Cal's
 0.00 *** } 41st move
 0.00 *** }
 0.00 *** }

Ruthless in victory, you seek even more victims:

Move no.	Your move	Cal's move	Score
42	No move	2	40-4
43	2	1	40-4
44	1	No move	40-4
45	2	No move	40-4
46	4	No move	40-4
47	3	No move	40-4
48	5	6	40-4
49	6	6	42-4

This is the final board following Cal's last move:

0.00 ***
 0.00 ***
 0.00 ***
 1.00 ***
 0.01 ***
 0.00 ***

Since these two counters would chase each other forever, the game is called. Each remaining counter is counted for the side in whose bin it lies, making the final score:

Human: 43
Machine: 5

The machines have not taken over yet, but don't underestimate this opponent. It can give you trouble.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

Racetrack

RACETRACK



This program is based on a pencil-and-paper game published in Martin Gardner's "Mathematical Games" column in *Scientific American* (May, 1973). Up to five contestants race on a superelliptical track. Players take turns inputting acceleration (direction and magnitude) and the machine updates the velocity and position of each racer and checks for collision, shown by flashing the ID number(s) of the other racer(s) involved. Racers are considered to have collided if they approach within 2 units of each other. All racers involved in a collision are penalized by having their velocities reduced to zero. A racer that leaves the track or is off the track is similarly penalized. Thus, a racer leaving the track at high velocity might require several moves to get back on—so watch out!

The track is bounded by two superellipses:

outer boundary

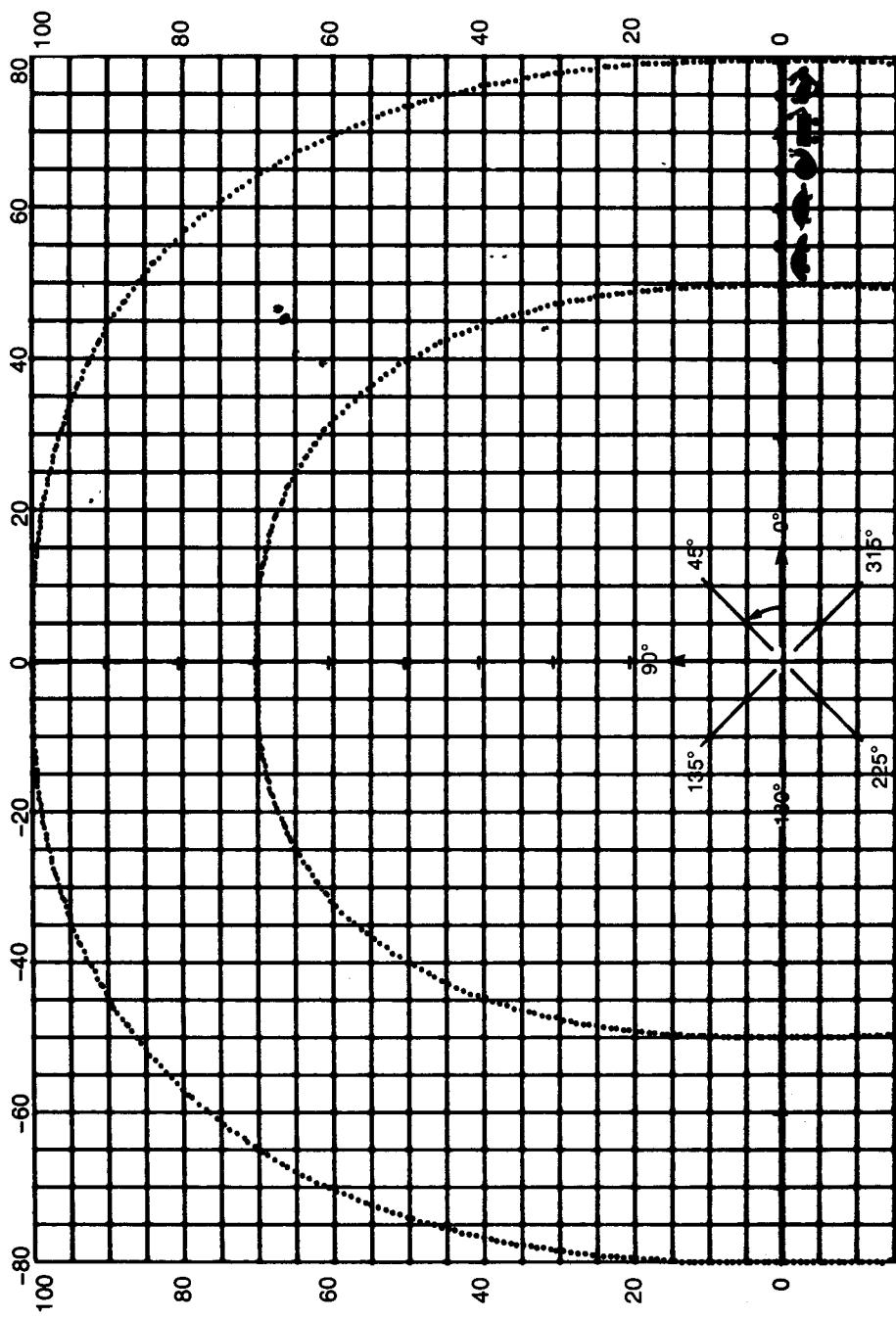
$$\left(\frac{x}{80}\right)^{5/2} + \left(\frac{y}{100}\right)^{5/2} = 1$$

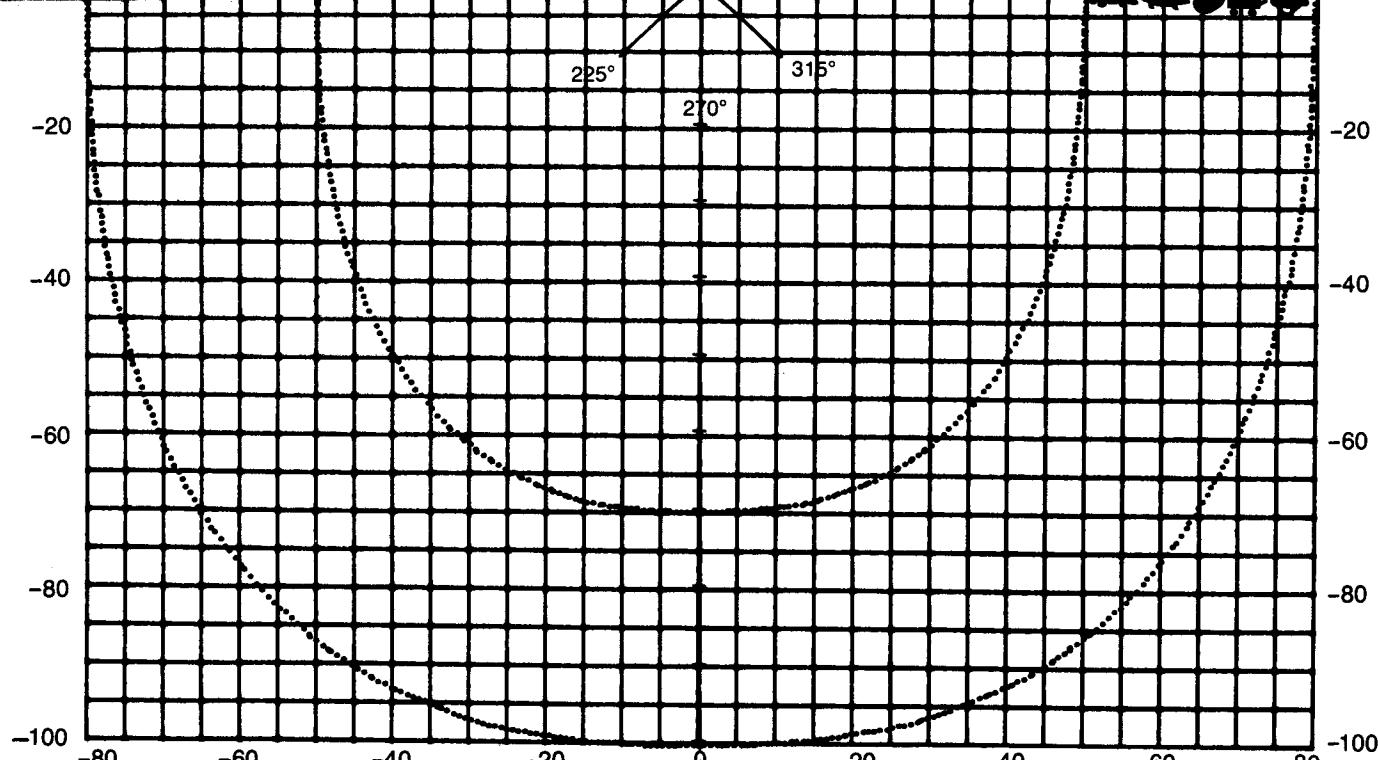
inner boundary

$$\left(\frac{x}{50}\right)^{5/2} + \left(\frac{x}{70}\right)^{5/2} = 1$$

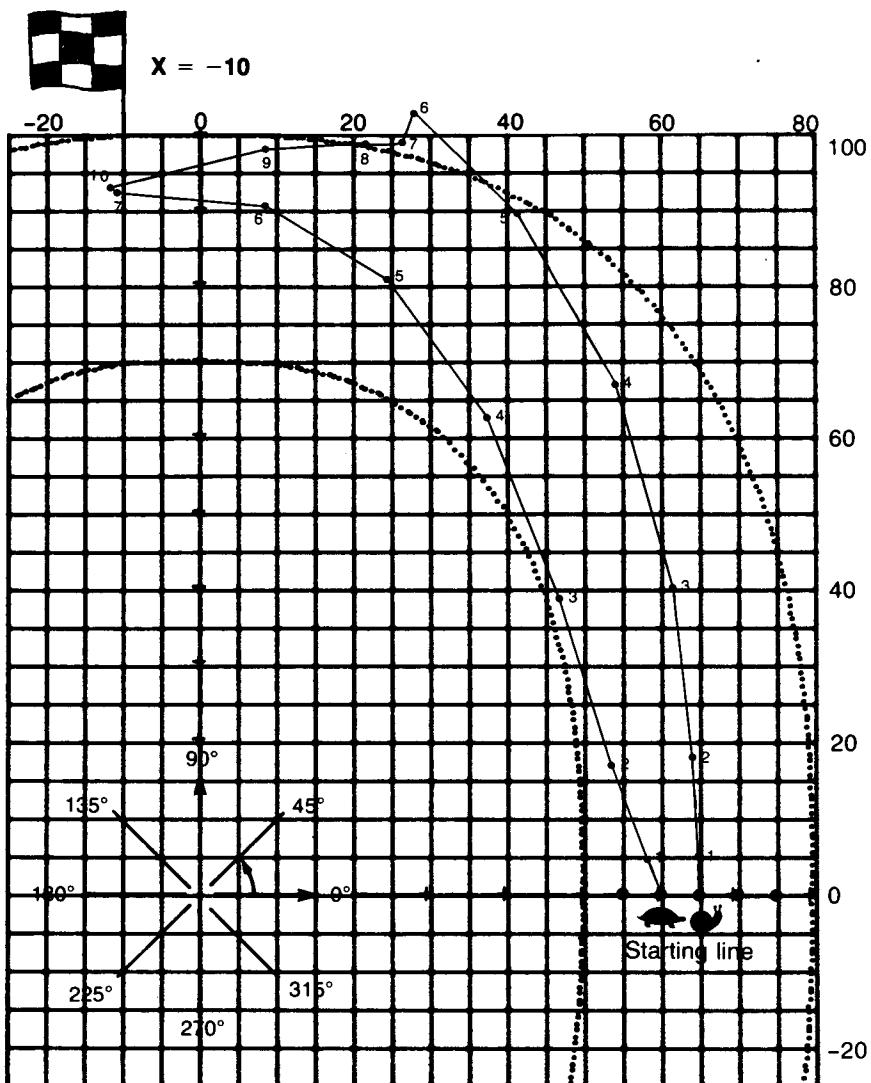
At the start, the five racers are located as shown on the racetrack at the points (55, 0), (60, 0), (65, 0), (70, 0), and (75, 0). Moves are made by placing direction in the y-register, acceleration in the x-register, and pressing **A**, **B**, **C**, **D**, or **E** as appropriate for the desired racer. The direction convention used is shown on the racetrack. To simulate frictional effects, the maximum acceleration is 9 units per second per second.

It is convenient to keep track of the progress of the race by plotting the positions of the racers on a copy of the accompanying racetrack. By observing the changing positions of the racers, it is easier to determine what the next move should be.





Racetrack
Shows grid and starting positions



Race between snail and turtle

Reference:

This program was first programmed for the HP-65 Users' Library by Delmer D. Hinrichs.

The superellipse is described in the following article:

Gardner, Martin, "The Superellipse: a Curve that lies between the Ellipse and the Rectangle," *Scientific American*, Sept. 1965, 222-234.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Start.		f C	Ignore output.
3	Move racers in turn.			
	Car: Input angle	θ	ENTER	
	and acceleration.	a	A	1, stack*
	Turtle: Input angle	θ	ENTER	
	and acceleration.	a	B	2, stack*
	Snail: Input angle	θ	ENTER	
	and acceleration.	a	C	3, stack*
	Wagon: Input angle	θ	ENTER	
	and acceleration.	a	D	4, stack*
	Rabbit: Input angle	θ	ENTER	
	and acceleration.	a	E	5, stack*
4	To check the position of any			
	racer, input ID.	$1 \leq ID \leq 5$	f A	ID y, x
	*The contents of the the			
	stack are			
	angle of velocity T			
	velocity Z			
	y-coordinate Y			
	x-coordinate X			

Example:

A race is proposed between the turtle and the snail. They decide to race around the first turn to the finish line shown. By watching how they race, we might learn some tricks.

Load sides 1 and 2.

Keystrokes:

Initialize.

f C → -3.00 (Ignore this display.)

The racers start by accelerating in the directions 110 and 90 at the maximum acceleration.

110 [ENTER] 9 B	→	2.00 *** Turtle's I.D. 110.00 *** T Direction of Turtle 9.00 *** Z Speed of Turtle 4.32 *** Y y-position of Turtle 58.46 *** X x-position of Turtle
90 [ENTER] 9 C	→	3.00 *** Snail's I.D. 90.00 *** T Direction of Snail 9.00 *** Z Speed of Snail 4.50 *** Y y-position of Snail 65.00 *** X x-position of Snail

Turtle now speeds on in the same direction and Snail begins a slow left turn.

110 [ENTER] 9 B	→	2.00 *** Turtle's I.D. 110.00 *** Direction of Turtle 18.00 *** Speed of Turtle 16.91 *** y-position of Turtle 53.84 *** x-position of Turtle
100 [ENTER] 9 C	→	3.00 *** Snail's I.D. 95.00 *** Direction of Snail 17.93 *** Speed of Snail 17.93 *** y-position of Snail 64.22 *** x-position of Snail

100 **ENTER** 9 **B** →

2.00 *** Turtle
 106.67 *** Direction
 26.91 *** Speed
 38.26 *** y
 46.91 *** x
 3.00 *** Snail
 96.67 *** Direction
 26.91 *** Speed
 40.23 *** y
 61.87 *** x

100 **ENTER** 9 **C** →

Turtle now begins to turn left a little more...

225 **ENTER** 5 **B** →

2.00 *** Turtle
 116.84 *** Direction
 24.93 *** Speed
 62.27 *** y
 37.42 *** x

... and so does Snail.

180 **ENTER** 9 **C** →

3.00 *** Snail
 114.40 *** Direction
 29.35 *** Speed
 66.95 *** y
 54.25 *** x

250 **ENTER** 9 **B** →

2.00 *** Turtle
 136.12 *** Direction
 19.89 *** Speed
 80.28 *** y
 24.63 *** x

260 **ENTER** 9 **C** →

3.00 *** Snail
 127.46 *** Direction
 22.50 *** Speed
 89.25 *** y
 41.34 *** x

250 **ENTER** 9 **B** →

2.00 *** Turtle
 162.99 *** Direction
 18.21 *** Speed
 89.84 *** y
 8.75 *** x

Snail realizes he is going too fast and he turns sharply left, but...

270 **ENTER** 9 **C** → 3.00 *** Snail
 0.00 *** OOPS! Snail
 0.00 *** crashes
 102.61 *** through the fence.
 27.65 ***

Turtle roars across the finish line.

220 **ENTER** 9 **B** → 2.00 *** Turtle
 -178.92 *** Direction
 24.31 *** Speed
 92.28 *** y
 -12.11 *** x is less than -10,
 so Turtle has won.

Even though he has lost, Snail would like to try to get back on the track and finish the race.

250 **ENTER** 9 **C** → 3.00 *** Snail
 0.00 *** Still off the track,
 0.00 *** but closer
 98.38 *** y
 26.11 *** x
 3.00 *** Snail

180 **ENTER** 9 **C** → 180.00 *** Hooray! Snail
 9.00 *** made it back to the
 98.38 *** racetrack.
 21.61 ***

190 **ENTER** 9 **C** → 3.00 *** Snail
 -175.00 *** Direction
 17.93 *** Speed
 97.60 *** y
 8.18 *** x

Now Snail should be able to cross the finish line only three moves after Turtle.

250 **ENTER↑ 9 C** →

3.00 *** Snail
2.00 (flashing) Snail
crashed into Turtle!
0.00 *** Direction
0.00 *** Speed
91.81 *** y
-11.22 *** x

Well, folks, that's it from the HP racetrack: Snail came in second and Turtle was next to last.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

TEASER

TEASER

MOVE→

START

PRINT?

The object of this game is to convert the pattern

$$\begin{matrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{matrix}$$

To the pattern

$$\begin{matrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{matrix}$$


by changing 1's to 0's. The only legal move is changing a 1 to a 0. Consequently, the only allowable opening move is changing the 1 in the center of the board to a 0. When a 1 is changed to a 0, certain other 1's and 0's also change according to these rules:

1. A move in a corner causes all 1's and 0's in a 2×2 box containing the corner to change state.

$$\begin{matrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

→ a move here yields:

$$\begin{matrix} 1 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

2. A move in the center of an edge causes all 1's and 0's on that edge to change state.

$$\begin{matrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \end{matrix}$$

→ a move here yields:

$$\begin{matrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 1 \end{matrix}$$

3. A move in the center causes all 1's and 0's in a "+" to change state.

$$\begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{matrix}$$

→ a move here yields:

$$\begin{matrix} 1 & 1 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{matrix}$$

References:

Nico, Willard I., "Shooting Stars," *Byte*, May, 1976, pp. 42-48.

People's Computer Center, *What To Do After You Hit Return*, People's Computer Company, Menlo Park, 1975, p.54.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Initialize.		<input type="checkbox"/>	Board*
3	Move.	$1 \leq \text{moves} \leq 9$	<input type="checkbox"/>	Board
4	Repeat step 3 until the pattern			
	1 1 1			
	1 0 1			
	1 1 1			
	is reached.			
5	To suppress printing		<input type="checkbox"/>	0**
6	To reinstate printing		<input type="checkbox"/>	1**
	*The board is both print/paused			
	in the form			
	0.789			
	0.456			
	0.123			
	and displayed as			
	9.123456789 xx			
	where xx is the number of			
	moves you've completed.			
	**If you don't get the desired			
	output, press <input type="checkbox"/> again.			

Example:

Load sides 1 and 2.

Keystrokes:

C →

Outputs:
 0.000 ***
 0.010 ***
 0.000 ***

9.000010000 00

5 A →

 0.010 ***
 0.101 ***
 0.010 ***

This is the only possible move.

9.010101010 01

6 A →

 0.011 ***
 0.100 ***
 0.011 ***

9.011100011 02

The game continues. We pick up the action several moves later.

4 A →

 0.100 ***
 0.011 ***
 0.100 ***

9.100011100 09

6 A →

 0.101 ***
 0.010 ***
 0.101 ***

9.101010101 10

5 A →

 0.111 ***
 0.101 ***
 0.111 ***

9.111101111 11

All you have to do is fill in the missing moves and you've got the solution.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

GOLF

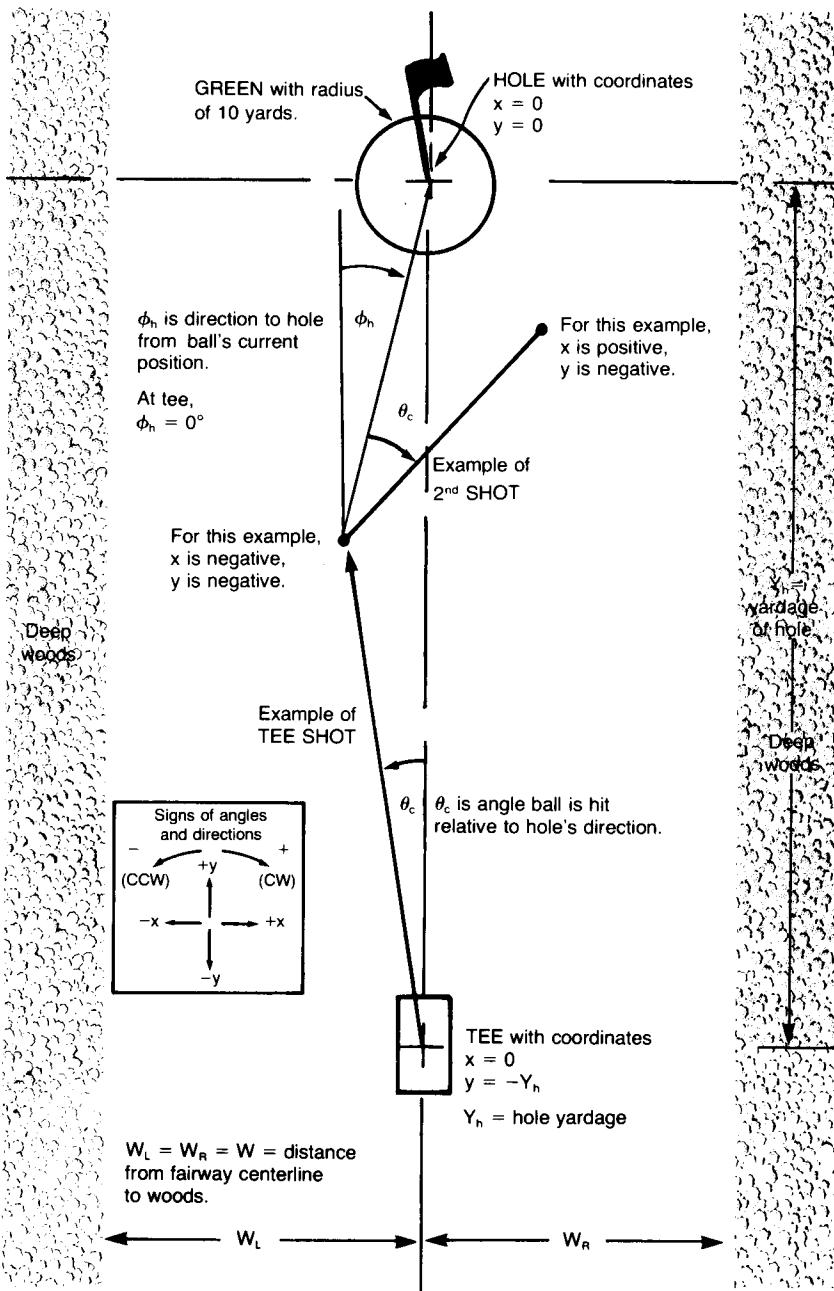


You choose your handicap, design your course, select and swing your club, and hope your ball escapes the woods. One or two people can play.

After you design each hole (actually, your HP-67/97 designs each hole for you), the hole number, hole yardage, par, and distance to the woods are output. After each shot, you are given the distance the ball was hit, the angle the ball was hit relative to the hole's direction, the coordinates of the ball's position, the remaining distance to the hole, and the angle between the ball-hole line and the direction from tee to hole.

The woods are called the deep woods, because that's the kind of trouble you may be in if your ball lands there. If such bad luck befalls you, you have the option of taking a penalty stroke and hitting a second ball from the same spot, or slashing your way through the brambles to find and hit your ball where it lies. The woods are not only thick, but also magic. You can see the flag from every position in the woods, and consequently you always aim directly for the flag. However, if your aim is less than excellent, your ball will hit from one to many trees. Your distance will be sharply reduced, and you may even find yourself moving away from the flag rather than towards it.

Think twice before following your ball into the woods and hitting it from there, since if you do, you have no choice but to club your way out. The example with two players shows what can happen.



General Hole Layout

All clubs may be swung with a full swing or less, allowing you to adjust your swing according to the distance to the hole.

The distance and angle achieved with each hit varies randomly about a mean value. The ball is always aimed directly at the hole, and the deviation from this direction tends to get worse as your handicap increases. The maximum possible distance with each club is independent of handicap, but the means and minimum possible distances decrease as handicap increases. When using a particular club, the number of yards between maximum and minimum possible yardage remains the same, regardless of whether full or partial swing is used. It is generally wise, therefore, to use a full swing whenever possible.

Table 1 gives the mean distances achieved with each club for a 0 handicap player:

TABLE I

Club	Mean Distance	Club	Swing Factor	Mean Distance
1 Wood	260 yds.	10 Iron	1	100
2 Wood	240 yds.	10 Iron	.5	50
3 Wood	220 yds.	11 Iron	1	90
4 Wood	200 yds.	11 Iron	.5	45
1 Iron	190 yds.	Putter	1	10
2 Iron	180 yds.	Putter	.5	5
3 Iron	170 yds.			
4 Iron	160 yds.			
5 Iron	150 yds.			
6 Iron	140 yds.			
7 Iron	130 yds.			
8 Iron	120 yds.			
9 Iron	110 yds.			

The course near each green is treacherous. Tall grass, traps, and other undefined problems will reduce your chipping accuracy. The greens are also challenging. Only the best golfers can do well.

In spite of the championship nature of this course, a duffer can beat the best because of the method of scoring. After each hole is completed, the player's adjusted score is given. This compares the total strokes less handicap against total par for the number of holes completed. While an 18 handicapper may have more trouble with woods, approach shots and green, his score is reduced by 1 stroke per hole before being compared against par. A negative adjusted score means you're beating par.

When playing 2 person golf, it is easy to keep track of whose storage register bank is active (Did I press **f P>S** or didn't I?). One way is to recall R7 and see whose handicap is displayed. Another way is to use R6 in each bank to hold an identifying number (such as 1 or 2) for each player. Recalling R6 could then display the player number whose bank was active.

If you want to simplify the game by moving the woods further away for all holes (or make it more difficult by moving the woods closer), change the woods constant as follows:

1. Choose minimum and maximum woods distances ($W_{\max} = 3W_{\min}$). The standard range is from 60 to 20 yards from the fairway centerline.
2. Determine the midpoint of this range (must be a 2 digit integer). This is your new woods constant.
3. Press **GTO** .018.
4. Switch to PRGM. The display will show 018 00.
5. Remove old woods constant by pressing **DEL** two times. The display will show 016-55 (HP-97) or 016 61 (HP-67).
6. Key in new woods constant. This must be a 2 digit integer, such as 70 or 55. The display will show 018 OX (where X is the second digit of your new constant).
7. Switch to RUN.

When you've inserted your woods constant into program memory, you might wish to preserve the revised program by recording it on a magnetic card.

TABLE II

Symbols

u_0	Initial random number seed.
H	18 hole handicap.
h	Hole number.
Y_h	Hole yardage.
W	Distance from centerline of fairway to right and left woods.
C#	Club number.
Y_c	Distance ball hit (club yardage).
θ_c	Angle ball hit relative to hole direction. A 0° angle means the ball is hit directly towards the hole.
y	y coordinate of ball's position after hit.
x	x coordinate of ball's position after hit.
D_h	Distance from ball to hole after hit.
ϕ_h	Direction to hole after hit. If $\phi = 0^\circ$, the ball lies on the fairway's centerline, the line between tee and hole.
S	Adjusted score. This equals the sum of pars for the holes played subtracted from total strokes reduced by adjusted handicap (adjusted for number of holes played).

In symbols:

$$S = \left(\text{Total strokes} - \frac{hH}{18} \right) - \Sigma \text{ par}$$

A negative S means you're beating par.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Clear registers.		CL REG	
			P ₆ S	
			CL REG	
3	Choose and store a six digit random number seed u_0 , between 0 and 1 such as .345762. To change the character of each game, store a different random number.		STO A	
4	For one person golf, go to step 5. For two people golf, go to step 13.			
	ONE PERSON GOLF			
5	Store your 18 hole handicap (handicap may not be negative).	H	STO 7	H
6	Design hole.		A	h, Y _n , Par, W [*]
7	Choose club and enter club number:			
	<i>Either:</i>			
	Wood (Club #1, 2, 3 or 4),	C#	B	0
	or:			
	Iron (Club #1, 2, 3, 4, ..., 10			
	or 11),	C#	C	0
	or:			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	Putter (use only if hole distance (D_h) is 10 yds or less).			
8	Choose and enter swing factor s , where s is from 0 to 1.	s	D R/S	0 See below for output.
9	If you want to take a penalty stroke and hit another ball from the same place, go to step 29. Otherwise, go to step 10.			
10	Repeat steps 7, 8 and 9 until ball is holed.			
11	When ball is holed, start next hole at step 6.			
12	For new game, start at step 2 (you may omit step 3).			
TWO PEOPLE GOLF				
13	Store 18 hole handicaps (must be zero or positive).			
	Player 1:	H_1	STO 7	
			f PxS	H_1
	Player 2:	H_2	STO 7	
			f PxS	H_2
14	Design hole.		A	h, Y_h Par, W^*
15	Player 1, make your mark.	1	SPACE	
			PRINT X	1†*
16	Player 1, choose club and enter club number: <i>Either:</i>			
	Wood (Club #1, 2, 3 or 4),	$C\#$	B	0
	or:			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	Iron (Club #1, 2, 3, ..., 10			
	or 11),	C#	C	0
	or:			
	Putter (use only if hole dis-			
	tance (D_h) is 10 yds or less).		D	0
17	Player 1, choose and enter swing factor s, where s is from 0 to 1.	s	R/S	See below for output.
18	Player 1, if you want to take a penalty stroke and hit another ball from the same place, go to step 29. Otherwise, go to step 19.			
19	Player 1, has player 2 finished this hole? Yes: Repeat steps 16, 17 and 18 until you finish this hole. Then go to step 14. No: Allow player 2 to hit his ball.		I P+S	
	Note: Steps 20, 21, 22 and 23 are identical to steps 15, 16, 17 and 18, except player 2 is playing instead of player 1.			
20	Player 2, make your mark.	2	SPACE	
			PRINT X	2†*
21	Player 2, choose club and enter club number: Either:			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	Wood (Club #1, 2, 3 or 4), or: Iron (Club #1, 2, 3, ..., 10 or 11), or: Putter (Use only if $D_h = 10$ yds or less).	C#	B	0
22	Player 2, choose and enter swing factor s, where s is from 0 to 1.	C#	C	0
		s	R/S	See below for output.
23	Player 2, if you want to take a penalty stroke and hit another ball from the same place, go to step 29. Otherwise, go to step 24.			
24	Player 2, has player 1 finished this hole? Yes: Repeat steps 21-23 until ball is holed. Then go to step 26. No: Allow player 1 to hit his			
	ball.		f P+S	
25	Player 1, go to step 15.			
26	Player 2, allow player 1 to hit his tee shot.		f P+S	
27	Player 1, go to step 14.			
28	For new game, go to step 2 (you may omit step 3).			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
29	To take penalty stroke:		1 STO	
			+ 1	
		previous y	STO 2	
		previous x	STO 3	
		previous D_h	STO 4	
		previous ϕ_h	STO 5	
	Then go to next step (10, 19 or 24).			
	Output: After choosing and inputting club number and swing factor, the following output is provided:			
	<i>Either:</i>			
	If ball is not sunk in hole:			$Y_c, \theta_c,$
				$y, x,$
				D_h, ϕ_h^*
	Note: A six decimal output for D_h and ϕ_h show that ball has landed in woods.			
	<i>Or:</i>			
	If ball is holed:			0.0000000000,
				S^*
	*After obtaining this output, player may review his situation as follows:			
	18 hole handicap		RCL 7	H
	Total strokes (not reduced by handicap)		RCL 1	S'

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	Total par of holes played or			
	started		RCL 9	Σ par
	†These steps are optional.			

Example 1:

One player game.

This records the first hole fortune of Ken Brambles, a moderately accomplished Sunday afternoon golfer carrying an 18 hole handicap of 18.

Load side 1 and side 2.

Keystrokes:

f **CL REG** **f** **PrS** **f** **CL REG**
.637914 **STO** **A** **→**

Outputs:

1. u_0 Seed

Since the program is run in DSP 0 format, numbers are rounded to the nearest whole number.

18 **STO** **7** **→**

18.

A **→**

1. *** h Hole no.

2 **B** **→**

241. *** Y_h Hole yd.

1 **R/S** **→**

4. *** Par

20. *** W Woods dist.

0.

229. *** Y_c Club yd.

10. *** θ_c Club angle

-15. *** y }

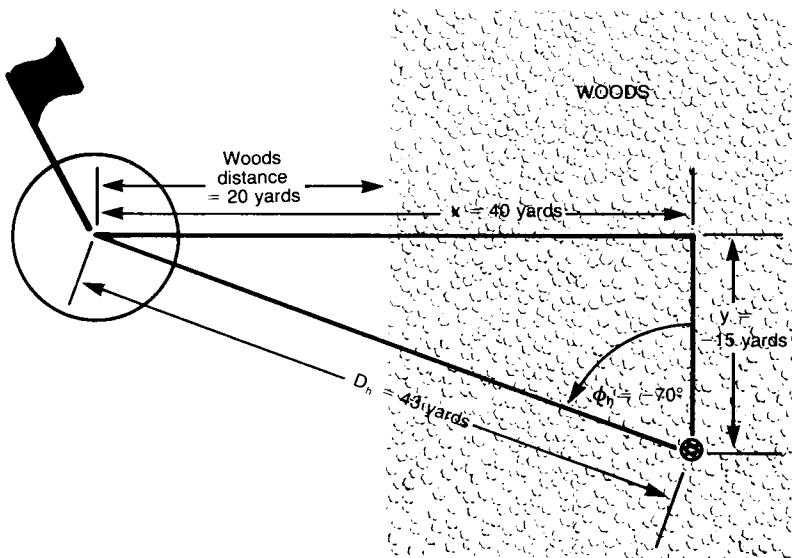
40. *** x } Ball location

42.981363 *** D_h Hole dist.

-69.671474 *** ϕ_h Hole angle

A six decimal place output for D_h and ϕ_h shows ball has landed in woods.

Ken's tee shot covered 229 yards with a very acceptable 10° slice. His ball is now located as follows:



Ken, a cautious man, elects to take a penalty stroke rather than fight the woods, especially since he's 20 yards from the fairway at the nearest point. Note that -229 and 0 are input as previous y and x, since these are the coordinates of the tee (see drawing on page 15-02).

1 **STO** + **1** 229 **CHS** **STO** **2**
 0 **STO** **3** 229 **STO** **4** 0
STO **5** 2 **B** →
 1 **R/S** →

11 **C** →
 .2 **R/S** →

0.
 211. *** Y_c Club yd.
 -2. *** θ_c Club angle
 -19. *** y } Ball location
 -6. *** x }
 19. *** D_h Hole dist.
 18. *** ϕ_h Hole angle
 0.
 4. *** Y_c Club yd.
 -11. *** θ_c Club angle
 -15. *** y } Ball location
 -5. *** x }
 16. *** D_h Hole dist.
 20. *** ϕ_h Hole angle

11 C → .2 R/S →

0.
20. *** Y_c Club yd.
1. *** θ_c Club angle
4. *** y
2. *** x } Ball location
5. *** D_h Hole dist.
-154. *** ϕ_h Hole angle

Since D_h is less than 10 yards, the distance from the edge of the green to the hole, Ken has made the green. A D_h of 10 yards also means "on the green."

D → .6 R/S →

0.
5. *** Y_c Club yd.
-3. *** θ_c Club angle
-1.613743000-02 *** y
2.725378030-01 *** x } Ball location

In DSP 0 format, a number smaller than .5 is presented by the 67/97 in scientific notation. Look for these scientific notation numbers. They mean your hit has excellent directional accuracy, or (as here) you're very close to the hole, or you're very near the center of the fairway.

2.730151474-01 *** D_h Hole dist.
-87. *** ϕ_h Hole angle

D → .1 R/S →

0.000000000 *** Holed!
2. *** S Score

Because of bad luck, Ken is 2 over par, even including his 1 stroke/hole handicap.

A →

2. *** h Hole no.
130. *** Y_h Hole yd.
3. *** Par
33. *** W Woods dist.

A poor start, but perhaps if we stop looking over Ken's shoulder, he'll do better.

Example 2:

Two player game.

This match pits D.C. Divot against Janet Birdie, one of the leading lady golfers of our time. Janet carries a 0 handicap, while D.C. stumbles around the course under a 34. As you will see, however, D.C.'s spirit is as high as his handicap. He is a charger and a scrambler.

Load side 1 and side 2.

Keystrokes:

Outputs:

f CL REG	f PR S	f CL REG	
.385246	STO	A	3.852460000-01
0	STO	7	f PR S
34	STO	7	f PR S
A			→
1	f	SPACE	PRINT X

This step is optional.

1	B	→	0.
1	R/S	→	246. *** Y_c Club yd.
			2. *** θ_c Club angle
			-325. *** y } Ball location
			11. *** x }
			325. *** D_h Hole dist.
			-2. *** ϕ_h Hole angle

f	PR S		
2	f	SPACE	PRINT X
1	B	→	2.
1	R/S	→	D.C.'s I.D. no.
			0.
			204. *** Y_c Club yd.
			-8. *** θ_c Club angle
			-369. *** y } Ball location
			-29. *** x }
			370.509734 *** D_h Hole dist.
			4.455967 *** ϕ_h Hole angle

f **PR****S**

Janet outdrove D.C. by 42 yards, and she has a good fairway lie compared to D.C.'s 5 yard penetration of the left woods.

1	f	SPACE	PRINT X	→	1. Janet
1	B	→			0.
1	R/S	→			276. *** Y_c Club yd.
					1. *** θ_c Club angle
					-49. *** y } Ball location
					9. *** x }
					50. *** D_h Hole dist.
					-10. *** ϕ_h Hole angle

f PzS

2 f SPACE PRINT x →
 1 B →
 1 R/S →

2. D.C.
 0.
 25. *** Y_c Club yd.
 -65. *** θ_c Club angle
 -357. *** y } Ball location
 -51. *** x }
 360.811319 *** D_h Hole dist.
 8.046678 *** ϕ_h Hole angle

f PzS

Since D.C. could see the flag from his lie in the woods, he decided to make a try for it rather than take a penalty shot. The window out of the woods proved too narrow, however, and D.C.'s gutsy #1 wood shot hit many trees, and finally came to rest only 10 yards closer to the hole and 22 yards further into the woods.

1 f SPACE PRINT x →
 10 C →
 .5 R/S →

1. Janet
 0.
 48. *** Y_c Club yd.
 1. *** θ_c Club angle
 -1. *** y } Ball location
 1. *** x }
 2. *** D_h Hole dist.
 -52. *** ϕ_h Hole angle

f PzS

Janet now finds herself only 2 yards from the hole. An excellent approach shot from 50 yards out.

2 f SPACE PRINT x →
 1 B →
 1 R/S →

2. D.C.
 0.
 30. *** Y_c } Result of
 -53. *** θ_c } D.C.'s swing
 -337. *** y }
 -72. *** x }
 344.037744 *** D_h } Hole location
 12.002730 *** ϕ_h } from ball

f PzS

D.C. gained another 16 yards on the hole, but he's now buried 48 yards into the woods.

1 **f** **SPACE** **PRINT x** →
D →
.3 **R/S** →

1. Janet
0.
3. *** Y_c
-7. *** θ_c } Result of
1. *** y } Janet's swing
-1. *** x
1. *** D_h } Hole location
114. *** ϕ_h } from ball

f **PRS**

Too bad, Janet missed a good birdie chance.

2 **f** **SPACE** **PRINT x** →
1 **B** →
1 **R/S** →

2. D.C.
0.
32. *** Y_c
100. *** θ_c
-348. *** y
-42. *** x
350.755487 *** D_h
6.898699 *** ϕ_h

f **PRS**

1 **f** **SPACE** **PRINT x** →
D →
.2 **R/S** →

1. Janet
0.
0.000000000 ***
0. S

f **PRS**

Janet made her par.

2 **f** **SPACE** **PRINT x** →
1 **B** →
1 **R/S** →

2. D.C.
0.
246. *** Y_c
-1.803671685-01 *** θ_c
-104. *** y
-13. *** x
105. *** D_h
7. *** ϕ_h

The rewards of try, try again. D.C. found the window.

9 C →

0.

1 R/S →

98. *** Y_c

1. *** θ_c

-7. *** y

1. *** x

7. *** D_h

-10. *** φ_h

D.C. is on the green.

D →

0.

.8 R/S →

8. *** Y_c

-12. *** θ_c

2.430006000-03 *** y

-2. *** x

2. *** D_h

90. *** φ_h

D →

0.

.3 R/S →

0.000000000 ***

1. S

f P>S

D.C.'s struggles in the woods gave him an 8 on this hole, but considering his nearly 2 strokes/hole handicap, he stands only 1 over par, 1 stroke behind Janet. It looks like a close match.

A →

2. *** h

399. *** Y_h

4. *** Par

22. *** W } layout

Hole no. 2

You might wish to continue to see who wins.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

The Dealer



The Dealer is capable of drawing from a numerical deck or bin without replacement. That is, once a card or number has been selected, it will not be selected again until a shuffle is performed.

If the "Cards" mode is selected, numerical cards of 4 suits, containing 13 cards each, are dealt as follows:

S. Digit position	CC Exponent position
----------------------	-------------------------

In this display format, S is the suit (digit from 1-4) and CC is the card of the indicated suit (digit from 1-13). The following convention is used for a standard deck of 52 cards:

Suit Convention	Card Convention
Spade = 1.	Ace = 01
Heart = 2.	2-10 = 02-10
Diamond = 3.	Jack = 11
Club = 4.	Queen = 12
	King = 13

The bingo mode simply selects numbers between 1. and 75. without replacement.

In both card mode and bingo mode, it is possible to draw one value at a time using **A** or many values automatically using **C**. To use the automatic feature, key in the number of values wanted before pressing **C**.

A shuffle may be performed at any time by pressing **f** **C**. An automatic shuffle is performed after all cards or numbers have been dealt.

The Dealer will start the same sequence of cards or numbers each time the card or bingo mode is selected unless the seed used to start the sequence is keyed in by the player(s). A seed is any number between 0 and 1. The seed must be keyed in after selecting card or bingo mode and **R/S** is used to store it. A fair way to select a seed in a multiplayer game is to have the dealer key a decimal point and the first digit and have each player key in a subsequent digit until the display is full. Press **R/S** to store the seed.

Remarks:

It is possible to modify the dealer to deal up to 100 numbers in bingo mode. Steps 109 and 110 control the number of objects dealt. If you wish to deal 85 numbers instead of 75 numbers replace the 23 (steps 109 and 110) with 33 (23 + (85 - 75)). Similarly a joker could be added to the card dealer by replacing the 51 at steps 112-113 with 52. The Joker would be displayed as the first card of the fifth suit.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	For bingo-type dealer (deals numbers without repetition), go to step 10.			
3	Select card dealer.		f A	0.
4	Optional: input seed (0 < seed < 1).	seed	R/S	seed
5	Deal one card, or deal a specified number of cards.	n	A	"suit. card"
6	Optional: Review cards dealt.		E	"suit. card"
7	Go back to step 5 for more cards or go to step 8 for shuffle.			
8	Shuffle.		f C	0. 00
9	Go to step 5 and deal cards.			
10	Select bingo dealer.		f E	0.
11	Optional: input seed (0 < seed < 1).	seed	R/S	seed

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
12	Draw one number		A	"#."
	or draw a specified number			
	of numbers.	n	C	"#."
13	Optional: Review numbers drawn.		E	"#."
14	Go back to step 12 for more numbers or go to step 15 for a new game.			
15	Shuffle.		f C	0.
16	Go to step 12 for more numbers.			

Example 1:

Deal two poker hands of five cards. First use the program's seed, then use a seed of .896348.

Load sides 1 and 2.

Keystrokes:

f A →
5 C →

5 C →

Outputs:

0.
4. 04 *** (4C)
3. 02 *** (2D)
2. 01 *** (AH)
1. 02 *** (2S)
1. 10 *** (10S)
0. 00
3. 09 *** (9D)
3. 12 *** (QD)
4. 03 *** (3C)
3. 04 *** (4D)
3. 01 *** (AD)
0. 00

f A →
 .896348 R/S →
 5 C →
 5 C →

0. 00
 9. -01
 3. 08 ***
 4. 10 ***
 1. 10 ***
 1. 01 ***
 1. 06 ***
 0. 00
 1. 03 ***
 2. 11 ***
 2. 02 ***
 1. 11 ***
 2. 13 ***
 0. 00

Example 2:

Generate 10 bingo numbers, one at a time and then review the numbers automatically. Then shuffle, and deal 10 more numbers automatically.

Keystrokes:

f E →
 A →
 A →
 A →
 A →
 A →
 A →
 A →
 A →
 A →
 E →

Outputs:

0. 00
 62.
 41.
 20.
 3.
 14.
 52.
 57.
 64.
 45.
 74.
 62. ***
 41. ***
 20. ***
 3. ***
 14. ***
 52. ***

f **C**
10 **C**

57. ***
64. ***
45. ***
74. ***
0.
17. ***
54. ***
36. ***
55. ***
6. ***
21. ***
33. ***
3. ***
61. ***
64. ***
0.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

Bowling Scorekeeper



This program keeps score for up to 10 bowlers. Each bowler is identified by a number (ID). Using his identification number, a player may input the pin count for each ball, and access his score.

To score a frame, key in the bowler's ID number, a decimal point, and a one digit pin count (P) for each ball. For instance, if bowler 6 knocked down three pins on the first ball and 5 pins on the second ball, the keystrokes would be as follows:

6.3 **A**
6.5 **A.**

A strike for player 3 (10 pins on the first ball) is indicated by:

3 **C.**

Similarly, if player 4 knocked down 9 pins on the first ball and then picked up the spare, the score would be indicated by:

4 **B.**

The score is displayed after each player's pin count is input. The format is shown below:

S.FS NF
or
-S.FS NF

where:

– (if present) = bowl another ball this frame.

S = Score calculated through frame FS.

FS = Frame number containing most recent score (frames scored).

NF = Frame in which next ball will be bowled (next frame).

By pressing **DSP** 6, the pin count (PC) for the last ball is displayed in the last 2 digits:

S.FS NF PC

A player's score may be displayed at any time by keying in the player's ID number and pressing **D**.

Remarks:

Players need not bowl in order. It is not necessary to complete a particular bowler's frame before input of another bowler's score. This allows two lanes to be scored simultaneously.

Other variables used in listing (pages L17-01, -02)

SSS = Score

CS = Current sum within a frame.

S1 = Strike one frame earlier.

S2 = Strike two frames earlier.

PS = Spare previous frame.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Initialize.		I A	0.0000
3	Input each ball's score:			
	a) For frame's first ball (no strike), key in player's ID number, decimal point, and single digit pin count.	ID.P	A	-S.FSNF*
	b) For frame's second ball leaving open frame	ID.P	A	S.FSNF
	c) For spare	ID	B	S.FSNF
	d) For strike	ID	C	S.FSNF
4	For next ball or another bowler, go to step 3.			
5	Display score (at any time).	ID	D	
6	Optional: Increase display to show pin count of last ball. Step 3 output will become S.FSNFPC (PC = last ball pin count).		DSP 6	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
7	For a new game, go to step 2.			
	*S = Score			
	FS = Frame associated with			
	score			
	NF = Frame in which next			
	ball will be bowled			
	Minus sign means a second			
	ball should be bowled this			
	frame.			

Example:

Score the games below using the calculator.

Player 1

8	7 2	54	73	8 1	8	7 1	8
17	26	54	73	82	102	122	140
7 1					148	168	
8	38	68	97	117	137	155	163

9	2	8	9	6	2	9	9
1							-
8	38	68	97	117	137	155	163

Player 2

Load sides 1 and 2.

Keystrokes:

1 **A** →

1.8 **A** →

Outputs:

0.0000

-0.0001 ***

The minus sign means a second ball should be bowled this frame. There is no score, and the next ball will be bowled in frame 1.

1 **B** →

0.0002 ***

Player 1's next ball will be in frame 2.

2.7 **A** →

-0.0001 ***

2.1 **A** →

8.0102 ***

Player 2's score is 8 in frame 1, and his next ball will be bowled in frame 2.

1.7 A → -17.0102 ***

Player 1's score in frame 1 is 17, and he has another ball to bowl in frame 2.

1.2 A → 26.0203 ***

Since frame 2 is open, player 1's score (26) can be calculated up to the current frame (2). His next ball will be in frame 3.

2 C	→	8.0103 ***
1 C	→	26.0204 ***
2 C	→	8.0104 ***
1 C	→	26.0205 ***
2 C	→	38.0205 ***

The strike in frame 2 can now be scored, since two more balls have been bowled.

1.8 A	→	-54.0305 ***
1.1 A	→	82.0506 ***
2 C	→	68.0306 ***
1 C	→	82.0507 ***
2.9 A	→	-97.0406 ***
2 B	→	117.0507 ***

Recall score of player 1.

1 D	→	82.0507
1.8 A	→	-82.0507 ***
1 B	→	102.0608 ***
2 C	→	137.0608 ***
1 C	→	122.0709 ***
2.6 A	→	-137.0608 ***
2.2 A	→	163.0809 ***
1.7 A	→	-122.0709 ***
1.1 A	→	148.0910 ***
2.8 A	→	-163.0809 ***
2 B	→	163.0810 ***

The players would like to have each ball's pin count displayed:

DSP 6 → 163.081010

17-05

For a spare and a strike, the pin count is shown as 10.

1 C → 148.091110

Here, the "11" (xxx.xx11xx) means another ball should be bowled in the 10th frame.

1.8 A → -148.091108

Now a minus sign calls for the 3rd 10th frame ball.

1 B → 168.100000 ***

Player 1's final score

2.9 A → -182.091009 ***

2.0 A → 191.100000 ***

Player 2 wins easily.

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

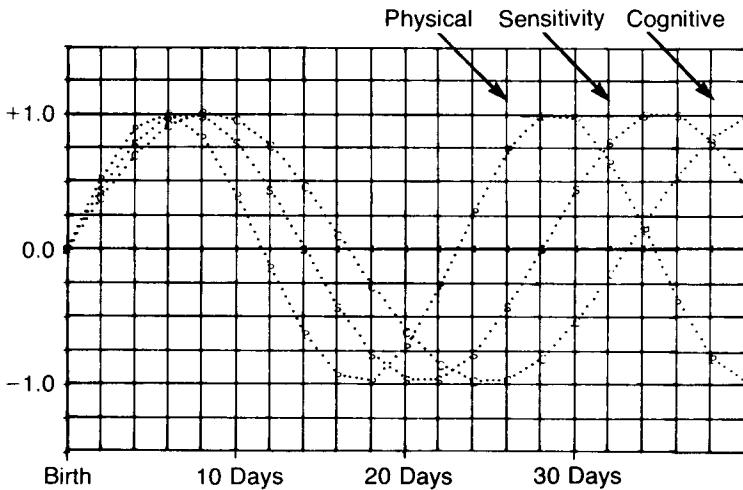
Biorhythms



From the ancient of days, philosophers and sages have taught that human happiness lies in the harmonious integration of body, mind, and heart. Now a twentieth-century theory claims to be able to quantitatively gauge the functioning of these three aspects of ourselves: the physical, sensitive, and cognitive.

The biorhythm theory is based on the assumption that the human body has inner clocks or metabolic rhythms with constant cycle times. Currently, three cycles starting at birth in a positive direction are postulated. The 23-day or physical cycle relates with physical vitality, endurance and energy. The 28-day or sensitivity cycle relates with sensitivity, intuition and cheerfulness. The 33-day or cognitive cycle relates with mental alertness and judgement.

For each cycle a day is considered either high, low, or critical. The high ($0 < x \leq 1$) times are regarded as energetic times, you are your most dynamic in the cycle. The low ($-1 \leq x < 0$) times are regarded as the recuperative periods. The critical days ($x = 0$) are regarded as your accident prone days especially for the physical and sensitivity cycles.



Operating Limits and Warnings:

The birthdate and biodate must occur between January 1, 1901 and December 31, 2099.

The date format for input is MM.DDYYYY (March 3, 1976 is keyed in as 3.031976). The program does not check input data. Thus, if an improper format or an invalid date (e.g., February 30) is keyed in, erroneous answers will result.

Reference:

This program is based on an HP-65 Users' Library program by Grant Munsey.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	(Optional) To cancel PRINT/PAUSE mode			
			f E	0*
	Later for automatic output of results set PRINT/PAUSE mode.			
			f E	1*
3	Key in the following:			
	Birthdate	MM.DDYYYY	A	
	Biodate	MM.DDYYYY	B	P**
				S**
				C**
4	To calculate the cycles for Biodate + 1, 2, ...			
			C	P (day+1)
				S (day+1)
				C (day+1)
				P (day+2)
				S (day+2)
				C (day+2)
	To stop cycle		R/S	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
5	To calculate which of the next 33 days after biodate are critical days			
			E	# days P
				# days S
				# days C
6	To calculate which of the next 33 days after biodate are max days			
			f D	# days P
				# days S
				# days C
7	To calculate which of the next 33 days after biodate are min days		D	# days P
				# days S
				# days C
	*If you don't get the desired output, press f E again.			
	**Physical, Sensitivity, Cognitive			

Example:

Calculate the Bio values for the month of June 1976 if birthdate is June 7, 1948.

Load sides 1 and 2.

Keystrokes:

6.071948 **A** →

Outputs:

6.07

By using May 31 for biodate (5.311976 **B**), instruction steps 5, 6 and 7 give correct day numbers for month of June.

5.311976 **B** →

0.82 *** P

0.00 *** S

-0.95 *** C

These are the values of the three cycles for May 31, 1976.

C →

0.63 *** P
0.22 *** S
-0.99 *** C

0.40 *** P
0.43 *** S
-1.00 *** C

0.14 *** P
0.62 *** S
-0.97 *** C

-0.14 *** P
0.78 *** S
-0.91 *** C

-0.40 *** P
0.90 *** S
-0.81 *** C

-0.63 *** P
0.97 *** S
-0.69 *** C

R/S →

Ignore output

Listing stops.

f D →

20.75 *** P

7.00 *** S

18.25 *** C

The one maximum for the physical cycle during June (and the first 3 days of July) is June 20. Similarly, the sensitivity and cognitive cycles have one maximum each in this period, June 7 and June 18.

E →

3.50 *** P
15.00 *** P
26.50 *** P

14.00 *** } S
28.00 *** }

10.00 *** } C
26.50 *** }

There are 3 critical days in June for the physical cycle, June 3, 15, and 26. The other two cycles have 2 critical days each.

D → 9.25 *** } P
32.25 *** }

21.00 *** S

1.75 *** C

Only the physical cycle has more than one minimum day during this 33 day period.

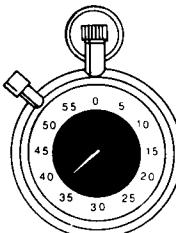
***Shown by PRINT on HP-97 and by PAUSE on HP-67.

TIMER



This program contains five different timers:

1. Five-second interval visible timer
2. Minimum interval visible timer
3. Count-Up timer
4. Count-Down timer
5. Splits



Calibration routines are also included to accomodate differences between calculators and different environments. The clock circuits in the HP-67 and HP-97 are designed for calculator use, not for accurate time keeping. Consequently, highly stable performance should not be expected.

In addition to the primary calibration constants whose adjustments are covered below, a secondary constant K_a , is also used for the 5 second timer. This determines how fast the calibration routine "zeros in" on the best value for the 5 second primary constant. K_a generally should require no user adjustment. These constants are named in Table I and are indicated in the listings.

TABLE I

CALIBRATION CONSTANTS

C_a	Primary for 5-Second Timer
C_b	Primary for Minimum Interval Timer
C_c	Primary for Count-Up Timer
C_d	Primary for Count-Down Timer
C_e	Primary for Splits Timer
K_a	Secondary for 5-Second Timer

A split is a time measurement which is preserved without stopping the clock. The split routine allows up to 16 splits to be taken during one continuous running of the count-up timer. If the count-up timer is properly calibrated, 10 splits taken over a few minutes should introduce no more than a few seconds error.

CALIBRATION ROUTINES

5-Second Timer

1. Initialize (A), and note sweep second hand time R/S is pressed.
2. When timer reaches chosen time T_p (program time), note sweep second hand finish time.

3. Stop timer (**RTN**), and enter sweep second hand finish time (H.MS **ENTER**).
4. Enter sweep second hand start time (H.MS **ENTER**).
5. Key in T_p and calculate new C_a (H.MS **f** **A**).
6. Enter the displayed C_a into program as follows:
 - a. Press **GTO** .016.
 - b. Switch to PRGM. Display should show 016 0X (X = last digit of old C_a).
 - c. Remove old C_a by pressing **DEL** 6 times. Display should show 010 35 15 (HP-97) or 010 33 15 (HP-67).
 - d. Key in new C_a . Display should show 016 0X (X = last digit of new C_a).
 - e. Switch to RUN.
7. Repeat steps 1-2 to check calibration, and if necessary, repeat steps 3-7.

Minimum Interval Timer

1. Initialize (**B**), and note sweep second hand time **R/S** is pressed.
2. When timer reaches chosen time T_p (program time), note sweep second hand finish time and SIMULTANEOUSLY stop timer (**RTN**). Timer will not stop unless display is steady when **RTN** is pressed.
3. Enter sweep second hand finish time (H.MS **ENTER**).
4. Enter sweep second hand start time (H.MS **ENTER**).
5. Key in T_p and calculate new C_b (H.MS **f** **B**).
6. Enter the displayed C_b into program as follows:
 - a. Press **GTO** .008.
 - b. Switch to PRGM. Display should show 008 0X (X = last digit of old C_b).
 - c. Remove old C_b by pressing **DEL** 4 times. Display should show 004 16-53 (HP-97) or 004 31 43 (HP-67).
 - d. Key in integer portion (4 digits) of new C_b . Display should show 008 0X (X = last digit of new C_b).
 - e. Switch to RUN.
7. Repeat steps 1-2 to check calibration, and if necessary, repeat steps 3-7.

Count-Up Timer

1. Initialize (**C**), and note sweep second hand time **R/S** is pressed.

2. When sweep second hand reaches desired finish time, stop timer by pressing any key until display stabilizes.
3. Enter sweep second hand finish time (H.MS **ENTER**).
4. Key in sweep second hand start time and display elapsed time T_p (program time) measured by count-up timer (H.MS **f D**).
5. Calculate new C_c (**R/S**).
6. Enter the displayed C_c into program as follows:
 - a. Press **GTO** .027.
 - b. Switch to PRGM. Display should show 027 0X (X = last digit of old C_c).
 - c. Remove old C_c by pressing **DEL** 4 times. Display should show 023 35 13 (HP-97) or 023 33 13 (HP-67).
 - d. Key in integer portion (4 digits) of new C_c . Display should now show 027 0X (X = last digit of new C_c).
 - e. Switch to RUN.
7. Repeat steps 1-4 to check calibration, and if necessary, repeat steps 5-7.

Count-Down Timer

1. After initialization (**D**), enter start time, which equals elapsed time T_p (program time) as measured by timer (H.MS **R/S**).
2. Start timer, and note sweep second hand time **R/S** is pressed.
3. Note sweep second hand finish time the instant timer displays 0.0000.
4. Enter sweep second hand finish time (H.MS **ENTER**).
5. Key in sweep second hand start time and calculate new C_d (H.MS **f E**).
6. Enter displayed C_d into program as follows:
 - a. Press **GTO** .033.
 - b. Switch to PRGM. Display should show 033 0X (X = last digit of old C_d).
 - c. Remove old C_d by pressing **DEL** 4 times. Display should show 029 35 14 (HP-97) or 029 33 14 (HP-67).
 - d. Key in integer portion (4 digits) of new C_d . Display should now read 033 0X (X = last digit of new C_d).
 - e. Switch to RUN.
7. Repeat steps 1-3 to check calibration, and if necessary, repeat steps 4-7.

Splits

1. The following procedure should be followed only after the count-up calibration constant has been adjusted to give acceptable timer performance.
2. Initialize (C), and note sweep second hand time R/S is pressed.
3. At chosen sweep second hand time intervals, take a series of from 10 to 16 splits (E E—see instruction steps 19 and 20).
4. When sweep second hand reaches desired finish time, stop timer by pressing any key until display stabilizes.
5. Display and note total elapsed time (F C).
6. Display and note splits (press R/S repeatedly).
7. Program steps 158, 159, 160 and 161 contain the split calibration constant, whose form is X.XX. If the split times are too small, this constant is too small, and visa versa. Key a new split constant into program memory and repeat steps 2-6. Increasing the split constant 0.10 will increase the displayed time after 16 splits roughly one second or so.

Normally, several runs through this calibration procedure should allow you to "zero in" on a value for this constant which gives an accuracy over 16 splits of one or two seconds (plus whatever error might be introduced by the count-up timer itself over the total time interval measured).

After you have entered your new calibration constants into program memory, you may wish to record the timer program on a different card to preserve your new constants.

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
	For 5-second interval visible			
	timer:			
	Go to step 2.			
	For minimum interval			
	visible timer:			
	Go to step 6.			
	For count-up timer:			
	Go to step 10.			
	For count-down timer:			
	Go to step 14.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
	For splits:			
	Go to step 17.			
	5-SECOND VISIBLE TIMER			
2	Initialize.		A	0.0000
3	If you want timer to start at a time other than zero, key in time.	H.MMSS		H.MMSS
4	Start 5-second timer.		R/S	H.MMSS
	Each PAUSE begins at the time displayed.			
5	Stop 5-second timer. Press RTN during time display.		RTN	H.MMSS
	MINIMUM INTERVAL VISIBLE			
	TIMER			
6	Initialize.		B	0.0000
7	If you want timer to start at a time other than zero, key in time.	H.MMSS		H.MMSS
8	Start minimum interval timer.		R/S	H.MMSS
	Even when accurately calibrated, displayed time can vary ± 1 second from correct time.			
9	Stop minimum interval timer.			
	Press RTN during time display.		RTN	H.MMSS
	COUNT-UP TIMER			
10	Initialize.		C	0.0000
11	Start count-up timer.		R/S	
12	Stop count-up timer: Depress any key until display stabilizes.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
13	Display elapsed time.		f C	H.MMSS
	COUNT-DOWN TIMER			
14	Initialize.		D	0.0000
15	Enter starting time.	t_s H.MMSS	R/S	t_s H.MMSS
16	Start count-down timer.		R/S	
	When starting time interval			
	has elapsed, flashing display			
	is replaced by 0.0000.			
	SPLITS			
17	Initialize.		C	0.0000
18	Start count-up timer.		R/S	
19	Take a split: For HP-97, press E twice, in rapid succession.			
	For HP-67, press E and hold			
	it down just long enough to			
	obtain a steady display. Then			
	press E again quickly.			
20	Take another split: Repeat			
	step 19. Up to 16 splits may			
	be taken. At least 4 seconds			
	must separate adjacent splits.			
21	Stop count-up timer:			
	Depress any key until display			
	stabilizes.			
22	Display total elapsed time.		f C	H.MMSS
23	Display last split.		R/S	H.MMSS
24	Display next-to-last split.		R/S	H.MMSS
25	Display each earlier split in			
	turn:			
	Repeatedly press		R/S	H.MMSS

Example 1:

Operate the 5-second interval visible timer.

Load side 1 and side 2.

Keystrokes:**A** →**R/S** →**RTN** →**Outputs:**

0.0000

0.0000

0.0005

0.0010

0.0015

⋮

0.0055

0.0100

0.0100

H.MS

Example 2:Calibrate the 5-second timer. (You'll probably generate a different calibration constant C_a with your calculator.)**Keystrokes:****A** →**R/S** →Start time $t_s = 9:28:45$.Finish time $t_f = 9:30:48$.**RTN** →9.3048 **ENTER**, 9.2845 **ENTER** ↴.02 **f** **A** →**GTO** .016

Switch to PRGM. →

DEL **DEL** **DEL** **DEL** **DEL** **DEL** →

4.4347 →

Switch to RUN. →

A →**R/S** →**Outputs:**

0.0000

0.0000

0.0005

H.MS

⋮

0.0155

0.0200

0.0200

4.4347 *** C_a

016 00

010 35 15

(HP-97)

010 33 15

(HP-67)

016 07

4.4347

0.0000

0.0000

Start time $t_s = 9:36:35$.	0.0005	H.MS
	⋮	
	0.0155	
Finish time $t_f = 9:38:34$.	0.0200	
RTN	0.0200	

***Shown by PRINT on HP-97 and by PAUSE on HP-67.

Example 3:

Take 6 splits, 10 seconds apart, and stop the count-up timer at 70 seconds.

Keystrokes:	Outputs:
C	0.0000

Start count-up timer.

R/S

On 10 second mark: **E** **E**

On 20 second mark: **E** **E**

⋮

On 60 second mark: **E** **E**

On 70 second mark: **f** →

f C	0.0110	Ignore display.
R/S	0.0100	Elapsed time, H.MS
R/S	0.0050	Last split
⋮	⋮	Previous split
R/S	0.0010	First split
R/S	0.0000	

PROGRAM LISTINGS

The following listings are included for your reference. A table of keycodes and keystrokes corresponding to the symbols used in the listings can be found in Appendix E of your Owner's Handbook.

Program	Page
1. Game of 21	L01-01
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Game of 21

051 *LBLM		057 0		
052 SPC		058 ST+7		11 for Ace
053 SPC		059 RCL7		-----
054 CFE		060 GS83		
055 CF1		061 RTN		
056 ST04		062 *LBL6		
057 1		063 CFE		-----
058 ST01		064 1		
059 GS80		065 0		1 for Ace
060 ST08		066 ST-7		
061 GS85		067 RCL7		
062 GS89		068 GS83		
063 ST01	Bet,	069 RTN		
064 ST03		070 *LBL4		
065 1	New game	071 FB?		-----
066 ST01		072 GT0E		
067 GS80		073 RCLA		
068 ST0C		074 CHS		player lose
069 GS89		075 ST+9		
070 STC2		076 RCL7		
071 ST+3		077 EEX		
072 0		078 2		
073 GS85		079 -		
074 SPC		080 -		
075 GS8e		081 GT06		
076 ST05		082 *LBL2		
077 ST07		083 RCL1		
078 GS8e		084 RCL2		
079 ST06		085 X		
080 ST+7		086 RCL3		HP BJ?
081 RCL5		087 +		
082 X		088 RCL0		
083 RCL7		089 X=Y?		
084 +		090 GT07		
085 2		091 F1?		
086 1		092 RTN		
087 ST00		093 *LBL8		
088 X=Y?		094 -		
089 GT02		095 2		
090 RCL7		096 1		
091 GS83		097 RCLA		player BJ!
092 R-S		098 1		
093 *LBLB		099 -		
094 GS8e		100 5		
095 ST+7		101 X		
096 RCL7		102 ST0A		
097 RCL0		103 ST+9		
098 X=Y	Hit	104 +		
099 X=Y?		105 *LBL6		
100 GT04		106 PSE		
101 X=Y?		107 PSE		
102 GS83		108 PSE		
103 R-S		109 PSE		
104 *LBLD		110 RCL9		Display with blinks.
105 SF8		111 DSP2		
106 1		112 F1?		

REGISTERS

0	1	1 st D.	2 nd D.	3	ΣD.	4	5	1 st P.	6	2 nd P.	7	ΣP.	8	9	Σ Bet
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9						
A	Bet	B	1 st D.	C	2 nd D.	D	last K _i	E	u _i	I	Index				

113	R/S				169	GTOE		
114	RTN				170	RTN		
115	*LBL7				171	*LBLC		
116	F1?				172	CF0		
117	GTO4				173	SPC		
118	0	HP BJI			174	RCLB		
119	DSPP9				175	GSB5		
120	GTO6				176	RCLC		
121	*LBL9				177	GSB5		
122	1				178	SP1		
123	0				179	GSB2		
124	X#Y	10 for J, Q, K			180	CF1		
125	X#Y?				181	RCL3		
126	RTN				182	*LBL6		
127	X#Y				183	1		
128	RTN				184	7		
129	*LBL3				185	X#Y?		
130	EEX	Display			186	GTOd		
131	2				187	GSBe		
132	÷	Bet.point			188	ST+3		
133	RCLA				189	RCL3		
134	+				190	2		
135	RTN				191	2		
136	*LBL5				192	X#Y?		
137	DSPO				193	GTO1		
138	FRTX	print			194	RCL3		
139	DSP2				195	GTO6		
140	RTN				196	*LBLd		
141	*LBL6				197	RCL7		
142	0				198	RCL3		
143	STOI				199	-		
144	.				200	X#?		
145	5				201	GTO6		
146	2				202	X#?		
147	8				203	GTO4		
148	1				204	*LBL1		
149	1				205	RCLA		
150	6				206	ST+3		
151	3				207	RCL7		
152	STOE				208	GSB3		
153	*LBL0	Shuffle			209	GTO6		
154	RCLA				210	*LBL6		
155	9				211	1		
156	9				212	STOI		
157	7				213	GSB0		
158	X				214	GSB5		
159	FRC				215	GSB5		
160	STOE				216	RTN		
161	1				217	*LBLc		
162	3				218	0		
163	X				219	ST09		
164	INT				220	RTN		
165	1							
166	+							
167	ST00							
168	DSZ1							
LABELS								
FLAGS						SET STATUS		
^a Bet	^b Hit	^c Stand	^d 11 for Ace	^e 1 for Ace	^f 0 11 for Ace	^g FLAGS	^h TRIG	ⁱ DISP
^a Shuffle	^b Dealer	^c New P.	^d Used	^e Next card	^f HP BJ	ON OFF	DEG	FIX
0 R. No.	¹ P. Win	² HP BJ?	³ Display	⁴ P. lose	⁵ 2	0 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
⁵ Print	⁶ blinks	⁷ HP BJI	⁸ P. BJI	⁹ 10 for J,Q,K	¹⁰ 3	1 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	n <input type="checkbox"/>	2 <input type="checkbox"/>

Dice

001	*LBLA	Input seed.	057	6		
002	EEX		056	X		
003	CHS		059	1		
004	7		060	+		
005	X		061	INT		
006	.		062	RTN		
007	5		063	*LBL4		
008	2		064	3		
009	8		065	RCL5		
010	4		066	X=Y?		
011	1		067	GT07		
012	6		068	2		
013	+		069	X=Y?		
014	ST09	Store in R9.	070	GT07		
015	*LBLC	Reset Winnings (WIN) to 0.	071	R4		
016	0		072	1		
017	ST08		073	2		
018	*LBL1	Display Winnings (WIN).	074	X=Y?		
019	DSP2		075	GT07		
020	FIX		076	R4		
021	SF2	Set 1 st Roll Flag.	077	7	Win 7, 11.	
022	RTN		078	X=Y?		
023	*LBLB	Store Bet in R7.	079	GT06		
024	ST07		080	R4		
025	*LBL2	Get Dice Roll.	081	1		
026	GSBD		082	1		
027	FSE	1 st Roll?	083	X=Y?		
028	F2?		084	GT06		
029	ST04	Yes.	085	R4		
030	GT05	No.	086	ST04	Current Roll (C ROLL).	
031	*LBLD	Dice Roll Routine	087	GT02	Not 1 st Roll.	
032	GSB3	1 st die (1 DIE).	088	*LBL5		
033	ST06	Sum of 2 dice (2 DIE).	089	RCL5	Craps?	
034	ST05		090	7		
035	GSB3		091	X=Y?		
036	ST+5		092	GT07	YES	
037	1		093	R4		
038	0		094	RCL4		
039	÷		095	X=Y?		
040	RCL6		096	GT02	Match	
041	+		097	*LBL6	No	
042	RCL5		098	RCL7	Win!	
043	10*		099	RCL6	Increment Winnings (WIN).	
044	X		100	+		
045	DSP1		101	ST08		
046	SCI		102	GT01		
047	RTN		103	*LBL7	Lose!	
048	*LBL2	Random Number Generator.	104	RCL8		
049	3		105	RCL7		
050	RCL9		106	-		
051	9		107	ST08	Decrement Winnings (WIN).	
052	9		108	GT01		
053	7					
054	X					
055	FRC					
056	ST09					

REGISTERS

0	1	2	3	4 C ROLL	5 2 DIE	6 1 DIE	7 BET	8 WIN	9 SEED
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E					

LABELS					FLAGS		SET STATUS		
^A SEED	^B BET	^C RESET	^D ROLL	^E	0		FLAGS	TRIG	DISP
a	b	c	d	e	1		0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input type="checkbox"/>
0	¹ DISPLAY	² GET DIE	³ RANDOM	⁴ 1 ROLL	² 1 ST ROLL		1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input checked="" type="checkbox"/>
⁵ ≠ 1 ROLL	⁶ WIN	⁷ LOSE	8	9	3		2 <input checked="" type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
							3 <input checked="" type="checkbox"/> <input type="checkbox"/>		n _____

Slot Machine

001	*LBLB	Recalls winnings	057	X#?					
002	DSP2		058	GT02					
003	RCLB		059	1					
004	RTN		060	0					
005	*LBLB	Sets up new machine conditions.	061	ST+0					
006	CLRC		062	RCL2					
007	ST0E		063	X#?					
008	CLX		064	GT09					
009	DSP0		065	9					
210	RTN		066	0					
011	*LBLA	Play:	067	GT08					
012	DSP3	Removes dollar played from winnings.	068	*LBL2					
013	1		069	RCL2					
014	ST-0		070	RCL3					
015	RCLC		071	X#Y?					
016	EEX	Sets up wheels.	072	GT09					
017	3		073	1					
018	X		074	0					
019	COS		075	GT08					
020	ABS		076	*LBL1					
021	ST0E		077	2					
022	EEX		078	ST+0					
023	6		079	1					
024	+		080	0					
025	LSTX		081	RCL2					
026	-		082	X#Y?					
027	FRC		083	GT09					
028	ST04		084	3					
029	1		085	*LBL8					
030	0		086	ST+0					
031	ST05		087	*LBL9					
032	x		088	RCL1					
033	INT		089	1					
034	ST01		090	0					
035	CHS		091	÷					
036	LSTX		092	DSP1					
037	+		093	PSE					
038	RCL5		094	RCL2					
039	x		095	1					
040	INT		096	0					
041	ST02		097	0					
042	CHS		098	÷					
043	LSTX		099	+					
044	+		100	DSP2					
045	RCL5		101	PSE					
046	x		102	RCL3					
047	INT		103	EEX					
048	ST03		104	3					
049	1	Determine winnings.	105	÷					
050	RCL1		106	+					
051	X=Y?		107	DSP3					
052	GT01		108	RTN					
053	RCL2								
054	X#Y?								
055	GT09								
056	RCL3								

REGISTERS

0 Winnings	1 Wheel 1	2 Wheel 2	3 Wheel 3	4 Comb.	5 10	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E					

LABELS					FLAGS		SET STATUS					
A	Play	B	Winnings	C	D	E	Set up	0	1	FLAGS	TRIG	DISP
a	b	c	d	e				0	<input type="checkbox"/>	ON	<input checked="" type="checkbox"/>	OFF
0	1	Cherry loop	2	Used	3	4	5	2	<input type="checkbox"/>	DEG	<input checked="" type="checkbox"/>	FIX
5	6	7	8	Adds	9	End of play	3	3	<input type="checkbox"/>	GRAD	<input type="checkbox"/>	SCI
								2	<input type="checkbox"/>	RAD	<input type="checkbox"/>	ENG
								3	<input checked="" type="checkbox"/>		<input type="checkbox"/>	n 3

Submarine Hunt

001	*LBLC	Sets movement flag, 1 unit after sonar.	057	RTN	----- Sonar Reading
002	1		059	*LBLB	
003	ST0C	----- Sensitivity toggle switch 1.9-2.9→1.9 etc.	060	1	----- Submarine Move Routine
004	SPE		061	ST+8	
005	RTN	----- Start	062	R↓	----- Submarine Move Routine
006	*LBLD		063	DSP0	
007	RCLD	----- Determine initial position using input seed.	064	CF1	----- Submarine Move Routine
008	1		065	GSBc	
009	X=Y?	----- Start	066	RCLC	----- Submarine Move Routine
010	+		067	ST05	
011	ST0D	----- Determine initial position using input seed.	068	F0?	----- Submarine Move Routine
012	RTN		069	GSBa	
013	*LBLE	----- Start	070	RCL3	----- Submarine Move Routine
014	CLRC		071	RTN	
015	CF8	----- Determine initial position using input seed.	072	*LBLA	----- Submarine Move Routine
016	.		073	GSBd	
017	5	----- Start	074	4	----- Submarine Move Routine
018	2		075	X≡Y	
019	8	----- Start	076	X>Y?	----- Submarine Move Routine
020	4		077	GT08	
021	1	----- Start	078	RCL5	----- Submarine Move Routine
022	6		079	CHS	
023	X	----- Start	080	GT01	----- Submarine Move Routine
024	ST08		081	*LBL0	
025	GSBd	----- Start	082	RCL5	----- Submarine Move Routine
026	ST01		083	*LBL1	
027	GSBd	----- Start	084	ST06	----- Submarine Move Routine
028	ST02		085	GSBd	
029	DSP0	----- Start	086	5	----- Submarine Move Routine
030	1		087	X>Y?	
031	ST0D	----- Start	088	GT08	----- Submarine Move Routine
032	CLX		089	GT01	
033	RTN	----- Start	090	*LBL0	----- Submarine Move Routine
034	*LBLA		091	*LBL0	
035	1	----- Fire Depth Charge	092	RCL2	----- Submarine Move Routine
036	ST+7		093	*LBL1	
037	R↓	----- Move Submarine	094	RCL6	----- Submarine Move Routine
038	SF1		095	+	
039	GSBc	----- Move Submarine	096	X<0?	----- Submarine Move Routine
040	X<0?		097	GT08	
041	GT00	----- Move Submarine	098	9	----- Submarine Move Routine
042	1		099	X≡Y	
043	ST05	----- Move Submarine	100	X>Y?	----- Submarine Move Routine
044	GSBc		101	GT01	
045	RTN	----- Move Submarine	102	*LBL0	----- Submarine Move Routine
046	*LBL8		103	RCL6	
047	9	----- Display Hit!	104	2	----- Submarine Move Routine
048	1/X		105	X	
049	DSP3	----- Display Hit!	106	-	----- Submarine Move Routine
050	PSE		107	*LBL1	
051	DSP5	----- Display Hit!	108	F2?	----- Submarine Move Routine
052	PSE		109	GT08	
053	DSP7	----- Display Hit!	110	ST02	----- Submarine Move Routine
054	PSE		111	GT01	
055	DSP9	----- Display Hit!	112	*LBL0	
056	PSE				

REGISTERS

0 Seed	1 P ₁	2 P ₂	3 Response	4 d	5 Used	6 Used	7 Used	8 Used	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B		C	0, 1	D	1 or 2	E		I

<pre> 113 ST01 114 *LBL1 115 RCL3 116 DSP0 117 RTN 118 *LBLc 119 RCL2 120 - 121 X=Y 122 RCL1 123 - 124 +P 125 ST04 126 F1? 127 GT00 128 RCLD 129 - 130 *LBL0 131 . 132 9 133 - 134 XC? 135 GT00 136 0 137 GT01 138 *LBL0 139 1 140 *LBL1 141 ST03 142 RTN 143 *LBLd 144 RCL0 145 9 146 9 147 7 148 X 149 FRC 150 ST08 151 I 152 0 153 X 154 INT 155 RTN 156 *LBLe 157 DSP2 158 RCL7 159 RCL6 160 1 161 0 162 0 163 + 164 + 165 RTN </pre>						Determine Response and Calculate Distance.
^a Depth charge	B Sonar	C Option	D Dist	E Start	F Motion?	SET STATUS
^a Move sub	b	c d	d random ≠	e	1 Depth charge	FLAGS
0	1	2	3	4	2 P ₁ ?	ON OFF
5	6	7	8	9	3	DEG <input checked="" type="checkbox"/> GRAD <input type="checkbox"/> RAD <input type="checkbox"/> n <u>2</u>
						FIX <input checked="" type="checkbox"/> SCI <input type="checkbox"/> ENG <input type="checkbox"/>

Artillery

081	*LBLa	INITIALIZATION	057	EEX									
082	FIX		058	4									
083	DSP2		059	÷									
084	•		060	X \times Y									
085	5		061	X \times 8?									
086	2		062	GT02									
087	8		063	3									
088	4		064	6									
089	1		065	8									
090	6		066	+									
091	3		067	*LBL2									
092	STOB	$R_0 \leftarrow \text{seed} = .5284163$	068	DSP8									
093	3		069	RND									
094	STOC	$R_C \leftarrow \text{spot rating} = 3$	070	+									
095	5		071	DSP4									
096	8		072	RTN									
097	8		073	*LBLb									
098	STOB	$R_B \leftarrow \text{speed} = 500$	074	STOB									
099	EEX		075	RTN									
010	2		076	*LBLc									
011	X \times		077	STOC									
012	STOB	$R_D \leftarrow \text{kill range} = 100$	078	RTN									
013	2		079	*LBLd									
014	STOD	$R_D \leftarrow \text{kill range} = 100$	080	STOD									
015	5		081	RTN									
016	8		082	*LBL1									
017	8		083	CF8									
018	STOB	$R_B \leftarrow \text{speed} = 500$	084	X \times 8?									
019	EEX		085	SF8									
020	2		086	RCLB									
021	STOD	$R_D \leftarrow \text{kill range} = 100$	087	GSB8									
022	X \times		088	F8?									
023	STOB	$\text{Max. gun range} = 10000$	089	CHS									
024	RTN		090	-									
025	*LBLA	START NEW BATTLE	091	RTN									
026	SPC		092	*LBLe									
027	8		093	*LBL									
028	STOI	Rounds = 0	094	ISZI									
029	RCL9		095	X \times Y									
030	2		096	DSP?									
031	÷		097	PRTX									
032	ENT?		098	X \times Y									
033	GSB8		099	DSP1									
034	+	Generate target range.	100	PRTX									
035	3		101	EMT?									
036	6		102	+									
037	8		103	SIN									
038	GSB8	Generate target bearing.	104	RCL9									
039	STOB		105	X									
040	R \uparrow		106	+R									
041	+R		107	ST03									
042	ST01	Save target N-S.	108	X \times Y									
043	X \times Y		109	ST04									
044	ST02	Save target E-W.	110	RCL1									
045	4		111	GSB8									
046	5		112	ST01									
047	ST \div 8												
048	RCL8												
049	DSP8	Display target 45° sector.											
050	RND												
051	X												
052	RTN												
053	*LBLC	Routine to generate and display target's last position.											
054	RCL2												
055	RCL1												
056	+P												
REGISTERS													
0	Seed	1 Targ N-S	2 Targ E-W	3 Shell N-S	4 Shell E-W	5	6	7	Used	8	Used	9	Gun Range
S0		S1	S2	S3	S4	S5	S6	S7		S8		S9	
A	B	SPEED	C	Spot Rating	D	KILL Range	E		I	Rounds Fired			

Space War

001	*LBLA	Initialize. If seed = 0, use π .	057	SF2	Set flag 2 if position occupied.
002	CLRC		058	CLX	
003	X=0?	Point to R_A and prepare to compute random starting positions.	059	RCLC	Long Scan.
004	F1		060	X=Y?	
005	ST09	Compute a position. Check not occupied.	061	SF2	Store constant 0.00400400
006	1		062	CLX	
007	0	Store position.	063	RCLD	Scan line above KH.
008	ST04		064	X=Y?	
009	2	Exit loop after filling R_E .	065	SF2	Scan line with KH.
010	0		066	R↓	
011	ST01	Energy = 1000.	067	RTN	Scan line below KH.
012	*LBL9		068	*LBLC	
013	GSB1	Torpedoes = 3.	069	4	Routine scans one line, i.e., 3 quadrants.
014	GSB8		070	FIX	
015	F2?	Days = 18	071	9	First quadrant.
016	GT09		072	9	
017	ST01	Display position of <u>Kittyhawk</u> .	073	9	Middle quadrant.
018	ISZ1		074	÷	
019	RCLI	Generate one starting position of the form QQ.SS, where QQ is quadrant, SS is sector.	075	ST02	$R_1 \leftarrow QQ.00400400$, where QQ refers to middle quadrant.
020	2		076	DSP8	
021	5		077	SPC	
022	X=Y?	Routine tests to see if position in X-register is already occupied.	078	RCL4	
023	GT09		079	INT	
024	EEX		080	ST06	
025	3		081	RCL4	
026	ST06		082	+	
027	3		083	GSB3	
028	ST07		084	RCL8	
029	ST09		085	GSB3	
030	1		086	RCL8	
031	8		087	RCL4	
032	ST08		088	-	
033	RCL4		089	GSB3	
034	RTN		090	RTN	
035	*LBL1		091	*LBL3	
036	RCL9		092	RCL2	
037	9		093	ST01	
038	9		094	R↓	
039	7		095	ST03	
040	x		096	ST+1	
041	FRC		097	1	
042	ST09		098	-	
043	EEX		099	GSB8	
044	4		100	GSB5	
045	x		101	GSB5	
046	INT		102	ST+1	
047	GSB5		103	RCL3	
048	GSB5		104	GSB8	
049	RTN		105	EEX	
050	*LBL8		106	5	
051	RCLA		107	÷	
052	X=Y?		108	ST+1	
053	SF2		109	RCL3	
054	CLX		110	1	
055	RCL8		111	+	
056	X=Y?		112	GSB8	

REGISTERS

0 Used	1 Used	2 Used	3 Used	4 10	5 Used	6 Energy	7 Torpedoes	8 Days	9 Alglogs
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
^ Alglog 1	B Alglog 2	C Alglog 3	D Base	E Kittyhawk	I Pointer				

113	EEX		169	INT		
114	8	Last quadrant.	170	GSB5		
115	÷		171	FRC		
116	ST+1		172	+		
117	RCL1		173	+		
118	PRTx	Print line.	174	FRC		
119	RTN		175	LSTX		
120	*LBL0	Routine checks one quadrant for presence of Alglogs or Base.	176	INT		
121	0		177	GSB4		
122	ST05		178	+		
123	R↓		179	RCL2		
124	RCLA		180	FRC		
125	INT	Forms a two-digit number AB, where A is no. of Alglogs, B no. of Bases in quadrant.	181	RCL3		
126	X=Y?		182	FRC		
127	GSB1		183	GSB4		
128	CLX		184	INT		
129	RCLB		185	+		
130	INT		186	RCL0		
131	X=Y?		187	+		
132	GSB1		188	INT		
133	CLX		189	LSTX		
134	RCLC		190	FRC		
135	INT		191	GSB5		
136	X=Y?		192	+		
137	GSB1		193	*LBL7		
138	CLX		194	+		
139	RCLD		195	GSB8		
140	INT		196	F2?		
141	X=Y?		197	GT08		
142	GSB2		198	STOE		
143	RCL5		199	1		
144	RTN		200	ST-8		
145	*LBL1	Alglog detected—add 10 to R_s .	201	RCL8		
146	RCL4		202	X<0?		
147	ST+5		203	GT06		
148	RTN		204	RCL6		
149	*LBL2	Base found—add 1 to R_s .	205	RTN		
150	1		206	*LBL6		
151	ST+5		207	CLX		
152	RTN		208	PSE		
153	*LBL4		209	GT06		
154	+R	Move.	210	*LBL4		
155	FIX	Convert (r, θ) to $(\Delta x, \Delta y)$.	211	RCL4		
156	DSP1		212	X		
157	RND		213	RTN		
158	ST08	$\Delta Q_x, \Delta S_x$	214	*LBL5		
159	X \approx Y		215	RCL4		
160	RND	$\Delta Q_y, \Delta S_y$	216	÷		
161	DSP2		217	RTN		
162	RCL6		218	*LBL8		
163	GSB5		219	1		
164	ST03		220	1		
165	INT		221	GT07		
166	RCL6		222	*LBL6		
167	GSB4		223	RCL8		
168	ST02		224	RTN		
LABELS						
SET STATUS						
A Start	B	C Long Scan	D	E Move	F	G
^a → Days	^b	^c	^d	^e	^f	^g
0 Used	¹ Used	² Used	³ Scan line	⁴ 10x	⁵ Occupied	⁶
5 10 ÷	⁶ Flash zeros	⁷ Exit move	⁸ Occupied?	⁹ Start loop	¹⁰	¹¹
FLAGS						
FLAGS						
0	ON	OFF	DEG	<input checked="" type="checkbox"/>	FIX	<input checked="" type="checkbox"/>
1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	GRAD	<input type="checkbox"/>	SCI	<input type="checkbox"/>
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	RAD	<input type="checkbox"/>	ENG	<input type="checkbox"/>
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	n	2		

001	*LBL4	Short Scan.	057	CW5		
002	FIX		058	10*		
003	DSP9		059	X		
004	SPC	A "3" marks KH, "4" marks Alglog, "7" marks Base.	060	ST+i	3, 4, or 7 times $10^{**}(-S_x)$ Add to register S _y .	
005	PIS		061	RTN		
006	9		062	*LBL6		
007	STOI		063	CF0		
008	0		064	ST08	Torpedo.	
009	*LBL9		065	RCL7	Save angle.	
010	STO1	Clear R ₁₀ - R ₁₉ to hold scans of rows 0 thru 9, respectively.	066	1	If no torpedoes remain, display "Error".	
011	DS2J		067	X#Y?	Otherwise subtract one from no. torpedoes.	
012	GT09		068	GT08		
013	ST00		069	-		
014	3		070	ST07		
015	RCLE	Locate KH in quadrant.	071	1		
016	GSB0		072	9		
017	4		073	ST01		
018	RCLA	Check Alglog 1.	074	GSB1		
019	GSB0		075	GSB1		
020	4		076	GSB1		
021	RCLB	Check Alglog 2.	077	RC19		
022	GSB0		078	CF0		
023	4		079	RTN		
024	RCLC	Check Alglog 3.	080	*LBL1		
025	GSB0		081	ISZI	Routine tests if Alglog will be hit by torpedo.	
026	7		082	F0?	If FO set, an Alglog has been hit—return.	
027	RCLD	Check for Base.	083	RTN	If Alglog not in same quadrant as KH, return.	
028	GSB0		084	RCLI		
029	9		085	INT		
030	STOI		086	RCLE		
031	*LBL8	Print R ₁₉ , R ₁₈ , ..., R ₁₀ as rows 9, 8, ..., 0.	087	INT		
032	RCLI		088	X#Y?	Find angle to Alglog.	
033	PRTX		089	RTN	Compare to angle of fire.	
034	DS2J		090	GSB7		
035	GT08		091	CLX		
036	RCLB		092	RCL0		
037	PRTX		093	-		
038	PIS		094	ABS		
039	RTN		095	1	If Alglog 1° or more away, no hit.	
040	*LBL8	Routine tests whether an object is in KH's quadrant.	096	X#Y?		
041	ENT†		097	RTN	If hit, store -1 as Alglog's position.	
042	INT		098	1		
043	RCLE		099	CHS	F0 set to indicate torpedo is spent.	
044	INT		100	STOI	Decrement no. Alglogs.	
045	X#Y?	If not, return.	101	SF0		
046	RTN		102	1		
047	R4		103	ST-9	Routine finds angle and distance from KH to Alglog.	
048	R4	If so, locate 3, 4, or 7 in proper sector of proper row, represented by R ₁₀ -R ₁₉	104	RTN		
049	FRC		105	*LBL7		
050	GSB5		106	RCLI		
051	INT		107	FRC		
052	STOI		108	GSB5		
053	CLX		109	STOI		
054	LSTK		110	INT		
055	FRC		111	RCLE		
056	GSB5		112	FRC		

REGISTERS

0	Used	1	Used	2	3	4	10	5	6	Energy	7	Torpedos	8	Days	9	Alglogs			
S0	Row 0	S1	Row 1	S2	Row 2	S3	Row 3	S4	Row 4	S5	Row 5	S6	Row 6	S7	Row 7	S8	Row 8	S9	Row 9
A	Alglog 1	B	Alglog 2	C	Alglog 3	D	Base	E	Kittyhawk	F	Pointer								

LABELS						FLAGS			SET STATUS									
A Short scan	B	C Torpedo	D Phaser	E	F	G	H	I	ON OFF	DEG	FIX							
0→En.torp	b	c	d	e	f	0	Torpedo		0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>							
0 Used	1	Torp hit?	2	3	4	Phaser hit?	2		1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>							
5 10x	6	Flash zeros	7 KH to Alglog	8 Print reg.	9	Clear reg.	3		2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>							
									3 <input type="checkbox"/> <input checked="" type="checkbox"/>	n 2								
113 GSB5 114 INT 115 - 116 RCLI 117 FRC 118 RCLE 119 GSB5 120 FRC 121 - 122 GSB5 123 +P 124 RTN 125 *LBL0 126 ST08 127 ST-6 128 1 129 9 130 ST01 131 GSB4 132 GSB4 133 GSB4 134 RCL9 135 RTN 136 *LBL4 137 RCL6 138 X?Y? 139 GT06 140 ISZI 141 RCL1 142 INT 143 RCLE 144 INT 145 X?Y? 146 RTN 147 EEX 148 2 149 ST-6 150 GSB7 151 X ² 152 EEX 153 2 154 + 155 RCL0 156 X?Y? 157 RTN 158 1 159 CHS 160 ST01 161 1 162 ST-9 163 RTN 164 *LBL6 165 CLX 166 PSE 167 GT06 168 *LBL6						169 RCLD 170 INT 171 RCLE 172 INT 173 X?Y? 174 GT06 175 RCLD 176 FRC 177 GSB5 178 ST08 179 INT 180 RCLE 181 FRC 182 GSB5 183 ST01 184 INT 185 - 186 ABS 187 2 188 X?Y? 189 GT06 190 RCL0 191 FRC 192 GSB5 193 RCL1 194 FRC 195 GSB5 196 - 197 ABS 198 2 199 X?Y? 200 GT06 201 EEX 202 3 203 ST06 204 3 205 ST07 206 GT00 207 *LBL4 208 RCL6 209 RCL7 210 *LBL0 211 1 212 0 213 \div 214 X?Y 215 INT 216 + 217 FIX 218 DSP1 219 RTN 220 *LBL5 221 1 222 0 223 x 224 RTN	If Base and KH not in same quadrant, display same En.Torp.			KH must be within 1 sector of Base in Y-direction.			Also must be within 1 sector of Base in X-direction.			If successful, get 1000 units energy and 3 torpedoes.		
Return r in X, θ in Y.						If failed, display old energy and torpedoes.			Form display Energy.Torpedoes.									
Phaser. Save energy and subtract from total.						Multiply by 10.												
Check if Alglogs 1, 2, and 3 are in range.																		
Display no. Alglogs left.																		
Test if Alglog hit by phaser.																		
If energy < 0, exit.																		
If Alglog not in KH's quadrant, return.																		
Deduct 100 for shields.																		
Find distance r to Alglog.																		
Energy input must be greater than $r^2 + 100$.																		
If hit, store -1 as Alglog's position.																		
Decrement no. Alglogs.																		
Out of energy - flash zeros.																		
Dock.																		

Super Bagels

001	#LBLB	Number of digits.	057	LSTX		
002	INT		058	LH		
003	X=0?		059	EEX		
004	GT0b		060	7		
005	8		061	X		
006	X ² Y		062	ABS		
007	X>Y?		063	D+R		
008	GT0b		064	1/X		
009	RCLB		065	STOE		
010	FRC		066	R4		
011	+	Maximum digit.	067	#LBLa		Compare for equality.
012	GT0b		068	INT		
013	*LBLC		069	ST0D		
014	INT		070	RCLE		
015	9		071	1/X		
016	X ² Y		072	R4D		
017	X>Y?		073	SF1		
018	GT0b		074	GSB1		
019	RCLA		075	CLX		
020	÷		076	ST09		
021	RCLB	Number of guesses.	077	ST08		Check for digits out of position.
022	INT		078	P ² S		
023	+		079	RCLD		
024	GT0b		080	CF1		
025	*LBLD		081	GSB1		
026	RCLC		082	RCLB		
027	RTN		083	STOI		
028	*LBLA		084	*LBL3		
029	SPC		085	RCLI		
030	CF0		086	P ² S		
031	CLRG		087	RCLI		
032	X=0?	Input seed.	088	X ² Y?		
033	Pi		089	GT0b		
034	STOE		090	CHS		
035	1		091	X ² Y		
036	8		092	CHS		
037	ST0A		093	X ² Y		
038	4		094	RCLA		
039	.		095	ST+9		
040	5		096	R4		
041	*LBL0		097	*LBL0		
042	ST08	Input guess.	098	ST01		
043	FIX		099	X ² Y		
044	DSPI		100	P ² S		
045	RTN		101	ST01		
046	*LBL0		102	DSZ1		
047	CF2		103	GT03		
048	F0?		104	RCLB		
049	GT0a		105	ST08		
050	ENT†		106	*LBL9		
051	SF0		107	RCL0		
052	RCLE		108	ST01		
053	RCLB		109	RCLI		
054	X		110	P ² S		
055	X		111	X ² Y?		
056	X=0?		112	GT05		

REGISTERS

0	1 Used	2 Used	3 Used	4 Used	5 Used	6 Used	7 Used	8 Used	9
S0 Used	S1 Used	S2 Used	S3 Used	S4 Used	S5 Used	S6 Used	S7 Used	S8 Used	S9 Used
A Used	B Used	C Used	D Used	E Used	F Used	G Used	H Used	I Used	J Used

LABELS						FLAGS			SET STATUS		
A Start	B #digits	C Max digit	D #guesses	E Guess	F Used	0 Used	FLAGS	TRIG	DISP		
^a Used	b	c	d	e Used	1		0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>		
⁰ Used	1	² Used	³ Used	4	2		1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>		
⁵ Used	6 Used	⁷ Used	⁸ Used	⁹ Used	3		2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>		
							3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n		
113	SF2					169	RCLC				
114	RCLB					170	1				
115	STOI					171	+				
116	*LBL6					172	STOC				
117	CLX					173	DSPi				
118	RCLI					174	X ^Y				
119	X=Y?					175	PRTX				
122	GT08					176	F2?				
121	DSZI					177	RTN				
122	GT07					178	X ^Y		Win?		
123	GT05					179	DSP8				
124	*LBL7					180	PRTX				
125	CLX					181	RTN				
126	RCLI					182	*LBL1				
127	X=Y?					183	RCLB				
128	GT06					184	FRC				
129	DSZI					185	RCLA				
130	GT08					186	1/X				
131	GT05					187	+				
132	*LBL8					188	ST08				
133	CLX					189	CLX				
134	RCLI					190	RCLB				
135	X=Y?					191	STOI				
136	GT08					192	INT				
137	DSZI					193	10 ^X				
138	GT06					194	÷				
139	GT05					195	ABS				
140	*LBL8					196	ST09				
141	CHS					197	*LBL2				
142	STOI					198	RCLS				
143	RCLA					199	FRC				
144	ST+8					200	RCLA				
145	*LBL5					201	×				
146	P2S					202	ST09				
147	CLX					203	RCLB				
148	STOI					204	X ^Y				
149	DSZI					205	F1?				
150	GT09					206	×				
151	P2S					207	1				
152	RCLD					208	+				
153	RCLB					209	INT				
154	INT					210	ST01				
155	10 ^X					211	DSZI				
156	÷					212	GT02				
157	FRC					213	RTN				
158	RCL0					214	*LBL6				
159	RCLA					215	ST01				
160	÷					216	ST02				
161	+					217	ST03				
162	RCL9					218	ST04				
163	+					219	ST05				
164	RCLB					220	ST06				
165	STOI					221	ST07				
166	CLX					222	ST08				
167	CSBe					223	RTN				

Nim_k

001 *LBLA		L mode.	057 RCLB		
002 3			058 ST01		Set I to right-most pile.
003 2			059 *LBL8		
004 CHS			060 GSB2		
005 GT08			061 X>Y?		Test for binary unit in
006 *LBLD			062 ST+0		designated pile/column.
007 DSP1			063 SSZ1		Accumulate Σc_{ij} .
008 PRTX		Print pile.# taken.	064 GT08		Cycle till zero.
009 ST01			065 2		
010 INT			066 STx0		Double R0 for Σc_{ij} .
011 CHS			067 RCL8		
012 10 ^k			068 RCL6		
013 RCLI			069 RCL4		
014 RCLI			070 1		
015 FRC			071 +		
016 1			072 X>Y?		
017 0			073 GT08		
018 X			074 3		
019 INT			075 RCLC		$k < \Sigma c_{ij}$
020 X>Y?			076 ABS		
021 GT08		Error, taking more than in	077 X>Y?		
022 K=0?		pile.	078 SF0		Set F0 for Σc_{ij} mod
023 GT08		Error, taking zero delete #	079 +		$(k + 1) = 0$.
024 ST-i		from pile.	080 R↓		
025 R↑			081 *LBL8		
026 X		Shift by 10.	082 ENT1		
027 1			083 R↓		
028 +			084 ÷		
029 CHS			085 INT		
030 RCLA		Adjust A.	086 R↑		
031 +			087 X		Σc_{ij} mod $(k + 1)$.
032 ST0A			088 -		
033 RCLB			089 ST08		
034 ST01			090 RCLC		
035 DSP1		Readjust display.	091 X<0?		neg. = L mode
036 RCLA			092 F0?		
037 PRTX		Print new combination.	093 GT08		F0 not set.
038 RTN			094 3		
039 *LBLC			095 RCLC		
040 3			096 ABS		
041 2			097 X>Y?		
042 *LBL8			098 GT08		
043 DSP8			099 RCL8		
044 PRTX			100 1		
045 ST0C		Initialize C to -32, L mode	101 -		
046 CF0		32, W mode.	102 X<0?		Subtract 1 from Σc_{ij} .
047 CF1			103 RCL6		If neg, replace with k.
048 *LBL9			104 ST08		
049 RCLC			105 *LBL8		
050 2			106 RCL8		
051 +		Get 2 ⁱ	107 X>0?		If $\Sigma c_{ij} = 0$ go to next
052 ST0C			108 GT08		column.
053 ABS			109 1		
054 1			110 0		
055 X=Y?			111 ST0C		Initialize pointer to RSO.
056 GT01		Exit if C = 1.	112 *LBL7		
REGISTERS					
0 Σc_{ij}	1 p_1	2 p_2	3 p_3	4 p_4	5 p_5
S0 k_1	S1 k_2	S2 k_3	S3 k_4	S4 k_5	S5 k_6
S6 k_7	S7 k_8	S8 k_9	S9		
A $k, p_1 p_2 p_3 \dots$	B no. of piles	C 2 ⁱ	D 10, pointer	E k	I Used

113	STO1		169	RCLE	k				
114	RCLB		170	P2S	Clear pointer reg's.				
115	RCLI	If pointer empty, use right	171	CLRC					
116	X=0?	most pile no.	172	P2S					
117	X>Y		173	STOE	Restore E, C, A, B.				
118	STO1		174	R4					
119	#LBL6		175	STOC					
120	GSB2	Test for binary unit.	176	R4					
121	X>Y?		177	STOA					
122	GT06		178	R4					
123	SF1	Set F1, at least one pile	179	STOB					
124	SF2	decreased.	180	STCI					
125	DS2I	Set F2, this pile decreased.	181	DSP1	Adjust display.				
126	GT06	Step to next pile.	182	0					
127	#LBL8		183	XLBL4					
128	F2?		184	RCL7	Build display.				
129	GT06		185	+					
130	DS2I		186	1					
131	GT06		187	0					
132	#LBL8		188	÷	Shift by 10.				
133	RCLD	Recall D to I.	189	DS2I					
134	X2I		190	GT04	Recall k.				
135	STO1	Store pile # in pointer.	191	RCLE	Add to combination.				
136	IS2I	Increment I (D).	192	+					
137	CLX	0 to I.	193	STOA	Space and print display.				
138	X2I		194	SPC					
139	ST00	I to D.	195	PRTX					
140	DS2I	Decrement Σcol by 1.	196	RTN	Entry routine.				
141	GT07	Go to new pile or new	197	#LBL8	Clear all registers.				
142	GT09	column.	198	CLRG					
143	XLBL2	Subroutine.	199	P2S					
144	RCL1	Objects in pile.	200	CLRG					
145	RCLC		201	STOA					
146	ABS		202	ENT†	Store input in A.				
147	÷		203	INT					
148	FRC	Divided by 2 ¹² .	204	STOE					
149	.		205	-	Input fractional part.				
150	5	Compare fractional part	206	XLBL3					
151	RTN	to 0.5.	207	IS2I					
152	#LBL1		208	1					
153	F1?	Any pile decreased, exit	209	0	Shift by 10 to get				
154	GT08	with no change.	210	x	individual pile #s.				
155	RCLB		211	ENT†					
156	STO1		212	INT					
157	#LBL5		213	STO1					
158	RCL1		214	-	Continue till fractional				
159	DS2I		215	X#0?	part = 0.				
160	X#0?	Otherwise decrement right-	216	GT03					
161	GT08	most pile by 1.	217	RCLI	Set display.				
162	STO1		218	DSP1					
163	DS2I		219	STOB					
164	GT05		220	RCLA	Print input.				
165	#LBL8	Exit routine.	221	PRTX					
166	RCLB	Recall no. piles.	222	RTN					
167	RCL1	Display.							
168	RCLC								
		12							
LABELS									
FLAGS									
A	L mode	B	C W mode	D Delete	E Enter	0 L/W	FLAGS	SET	STATUS
a	b	c	d	e		1 > 1 pile	ON OFF	DEG	FIX
0 Used	1 Used	2 Used	3 Used	4 Used		2 this pile	1	GRAD	SCI
5 Used	6 Used	7 Used	8 Used	9 Used		3	2	RAD	ENG
							3	n	4

Queen Board

001	*LBLA	Current position. R ₁	057	1	127 = R ₂ ?
002	ST01		058	-	
003	GSBE		059	X=Y?	
004	1		060	GT09	
005	X=Y?		061	1	
006	GT02		062	-	
007	7		063	X=Y?	
008	ST01		064	GT09	
009	*LBL1		065	5	
010	RCLI		066	1	
011	RCLI	7 → R ₁	067	-	126 = R ₂ ?
012	EEX		068	X=Y?	
013	1		069	GT09	
014	x		070	2	
015	+		071	-	
016	ST02		072	X=Y?	
017	GSBE		073	GT09	
018	1		074	2	
019	X=Y?		075	9	
020	GT08		076	-	
021	RCLI	Yes, recall R ₂ .	077	X=Y?	75 = R ₂ ?
022	ST+2		078	GT09	
023	RCL2		079	3	
024	GSBE		080	-	
025	1		081	X=Y?	
026	X=Y?		082	GT09	
027	GT08		083	RTN	
028	RCLI		084	*LBL5	
029	EEX		085	1	
030	1		086	RTN	
031	x	10K + R ₁ → R ₂	087	-	41 = R ₂ ?
032	ST+2		088	-	
033	RCL2		089	-	
034	GSBE		090	-	
035	1		091	-	
036	X=Y?		092	-	
037	GT08		093	-	
038	DSZ1		094	-	
039	GT01		095	-	
040	RCLI		096	-	
041	*LBL2	Position good?	097	-	41 = R ₂ ?
042	EEX		098	-	
043	1		099	-	
044	ST+1		100	-	
045	RCLI		101	-	
046	RTN		102	-	
047	*LBL8		103	-	
048	RCL2		104	-	
049	RTN		105	-	
050	*LBL8		106	-	
051	1	Test for good position.	107	-	41 = R ₂ ?
052	5		108	-	
053	8		109	-	
054	X=Y?		110	-	
055	GT09		111	-	
056	3		112	-	

REGISTERS

0	1 Used	2 Used	3	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E				I	K

LABELS					FLAGS		SET STATUS			
A	Used	B	C	D	E	Used	0	FLAGS	TRIG	DISP
a		b	c	d	e		1	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0	Used	1	Used	2	Used	3	4	2	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5		6		7		8	9	Used	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
								3	<input type="checkbox"/> <input checked="" type="checkbox"/>	n 0

Hexapawn

001	*LBLC								
002	8	Machine first.			057	*LBL9			
003	3				058	Pi			
004	8				059	+			
005	8	Configurations for move 1.			060	ST06			
006	6				061	GT09			
007	6				062	*LBLA		Move	
008	7				063	ST08			
009	ST01				064	RCL4			
010	3				065	ST09			
011	1	Configurations for move 2.			066	RCL5			
012	3				067	ST07			
013	9				068	2			
014	5				069	RCL8			
015	8				070	Yx			
016	3				071	ST05			
017	ST02				072	3			
018	3				073	ST01			
019	4	Configurations for move 3.			074	RCL6			
020	3				075	Pi		Generate a random	
021	1				076	+		number between 1 and 3.	
022	4				077	X ²			
023	ST03				078	FRC			
024	GT08				079	ST06			
025	*LBL0	Player first.			080	3			
026	1				081	x			
027	6				082	1			
028	7	Configurations for move 1.			083	+			
029	7				084	INT			
030	7				085	ST04			
031	2				086	*LBL1		BEGIN loop 1	
032	1				087	3			
033	5				088	RCL4			
034	ST01				089	1		INCREMENT trial move	
035	1				090	+			
036	6	Configurations for move 2.			091	X?Y?			
037	7				092	1			
038	5				093	ST04			
039	6				094	X?i			
040	7				095	RCLi			
041	3				096	X?Y			
042	5				097	X?i			
043	ST02				098	R4			
044	5				099	RCL5			
045	2	Configurations for move 3.			100	÷			
046	4				101	FRC			
047	4				102	.			
048	1				103	5			
049	3				104	X?Y?		IF trial move OK	
050	ST03				105	GT04		THEN exit	
051	*LBL0				106	DS2I		IF less than 3 tries	
052	8				107	GT01		THEN REPEAT loop 1	
053	ST04				108	RCL7		ELSE no move possible.	
054	ST05				109	ST05			
055	ST06				110	ST04			
056	ST07				111	CLX			
					112	RTH			
REGISTERS									
0	1 Moves #1	2 Moves #2	3 Moves #3	4 Trial move	5 2†(Config)	6 Random	7 2†(Last conf)	8 This move	9 Last move
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D		E		I		

113	#LBL4							
114	RCL4							
115	RTN							
116	#LBL8							
117	RCL4							
118	X ² I							
119	RCLS							
120	2							
121	÷							
122	ST-I							
123	R4							
124	X ² I							
125	RTN							

LABELS					FLAGS	SET STATUS					
A	Move	B	Punish	C	Mach. 1 st	D	E	0	FLAGS	TRIG	DISP
a	b	c	Player 1 st	d	e	f	g	1	0 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> 1 <input type="checkbox"/> <input type="checkbox"/> 2 <input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/> <input type="checkbox"/> 5 <input type="checkbox"/> <input type="checkbox"/> 6 <input type="checkbox"/> <input type="checkbox"/> 7 <input type="checkbox"/> <input type="checkbox"/> 8 <input type="checkbox"/> <input type="checkbox"/> 9 <input type="checkbox"/> <input type="checkbox"/> 0 <input type="checkbox"/> <input type="checkbox"/> 1 <input type="checkbox"/> <input type="checkbox"/> 2 <input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/> <input type="checkbox"/> 5 <input type="checkbox"/> <input type="checkbox"/> 6 <input type="checkbox"/> <input type="checkbox"/> 7 <input type="checkbox"/> <input type="checkbox"/> 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Tic-Tac-Toe

001	*LBL4		Start a new game.	057	STOB													
002	2			058	INT													
003	STOE			059	RTN													
004	1			060	*LBL6													
005	CHS			061	STOA			Store to R_A & R_I .										
006	STOB			062	STOI													
007	2			063	RTN													
008	GSBB			064	*LBL8													
009	GSBB			065	1			Increase move number.										
010	GSBD			066	ST+0													
011	GSBe			067	RCLI													
012	RCLI			068	RTN													
013	RCLE			069	*LBL4													
014	DSP9			070	RCLI													
015	R/S			071	CHS													
016	GSBB			072	10 ⁴													
017	GSBB			073	2													
018	GSBD			074	x													
019	RCLI			075	RCLE													
020	INT			076	+													
021	RCLI			077	STOE													
022	STOB			078	RCLI													
023	*LBL8			079	RTN													
024	+			080	*LBL6													
025	GSBB			081	EEX													
026	STOI			082	6													
027	GSBD			083	GSB9													
028	GSBe			084	EEX													
029	RCLI			085	3													
030	DSP9			086	GSB9													
031	RCLE			087	1													
032	+			088	GSB9													
033	R/S			089	SPC													
034	*LBL6			090	RTN													
035	GSBB			091	*LBL9													
036	GSBB			092	DSP3													
037	GSBD			093	RCLI													
038	RCLI			094	x													
039	GSBB			095	FRC													
040	X=Y?			096	RCLI													
041	GSBB			097	+													
042	STOI			098	PRTX													
043	GSBD			099	DSP8													
044	GSBe			100	RTN													
045	RCLI			101	*LBL6													
046	DSP5			102	RCLI													
047	RCLE			103	CHS													
048	+			104	10 ⁴													
049	R/S			105	RCLE													
050	CTOE			106	+													
051	*LBL8			107	STOE													
052	RCLB			108	RCLI													
053	FRC			109	RTN													
054	1			110	*LBL6													
055	0			111	x													
056	x			112	5													
REGISTERS																		
0	play no.	1	5873649	2	3	58891467	4	13598	5	.1374698	6	.31578	7	.13589	8	.3175964	9	.31587
S0		S1		S2		S3		S4		S5		S6		S7		S8		S9
A	Temp.	B	Last X of LBL B	C	D		E	Used	F						I	1, 2, ..., 9		

113	8		169	3		
114	7		170	1		
115	3		171	5		
116	6		172	8		
117	4		173	7		
118	5		174	ST05		
119	ST01		175	0		
120	.		176	PTN		
121	5					
122	8					
123	9					
124	1					
125	4					
126	6					
127	7					
128	ST03					
129						
130	1					
131	3					
132	5					
133	9					
134	8					
135	ST04					
136	.					
137	1					
138	3					
139	7					
140	4					
141	6					
142	^ 9					
143	8					
144	ST05					
145	.					
146	3					
147	1					
148	5					
149	7					
150	8					
151	ST06					
152	.					
153	1					
154	3					
155	5					
156	8					
157	9					
158	ST07					
159	.					
160	3					
161	1					
162	7					
163	5					
164	9					
165	6					
166	4					
167	ST08					
168	.					

LABELS

A	B	C	FLAGS			SET STATUS		
			D	E	F	FLAGS	TRIG	DISP
a	b	c	d	e	f	0 <input type="checkbox"/> <input checked="" type="checkbox"/> ON OFF	DEG <input checked="" type="checkbox"/> SCI <input type="checkbox"/>	FIX <input checked="" type="checkbox"/> RAD <input type="checkbox"/> ENG <input type="checkbox"/> n 0
0	1 st move	1	2	3	4	1 <input type="checkbox"/> <input checked="" type="checkbox"/> GRAD		
5	6	7	8	9	0	2 <input type="checkbox"/> <input checked="" type="checkbox"/> RAD		
						3 <input type="checkbox"/> <input checked="" type="checkbox"/> FIX		

Wari

		REGISTERS								
0	1	2	3	4	5	6	7	8	9	
S0	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Bin 9	
Bin 10		S1	S2	S3	S4	S5	S6	S7	S8	S9
A	Score 1	B	Score 2	C	Current bin	D	# seeds	E	Random	I
001	XLELA	002	CWS	003	7	004	+	005	SF1	006
007	ST09	008	*LBL8	009	6	010	+	011	CF1	012
013	XLBL9	014	ST0C	015	I	016	X=0?	017	ST0D	018
019	8	020	ST04	021	0	022	ST01	023	X=Y?	024
025	DSZI	026	*LBL1	027	1	028	GT08	029	GT01	030
031	2	032	STCI	033	I	034	RCLI	035	STOD	036
037	RTN	038	ST+I	039	X>?	040	RCLD	041	X=Y?	042
043	RTN	044	1	045	GT05	046	RTN	047	GT01	048
049	*LBLC	050	ST05	051	GT01	052	*LBL8	053	GT05	054
055	GT06	056	GT06	057	GT06	058	GT00	059	GT01	060
061	SPC	062	ST01	063	*LBL3	064	RCLI	065	1	066
067	ROLI	068	ST01	069	CLX	070	+	071	ROLI	072
073	EEX	074	RTN	075	+	076	PRTX	077	RCLI	078
079	1	080	3	081	-	082	CHS	083	ST01	084
085	SPC	086	DSZI	087	GT03	088	RTN	089	RCLA	090
091	EEX	092	RTN	093	+	094	RTN	095	RCLB	096
097	RTN	098	*LBL5	099	RTN	100	RTN	101	RTN	102
103	RTN	104	RTN	105	RTN	106	RTN	107	RTN	108
109	RTN	110	RTN	111	RTN	112	RTN	113	RTN	114
115	RTN	116	RTN	117	RTN	118	RTN	119	RTN	120
121	RTN	122	RTN	123	RTN	124	RTN	125	RTN	126
127	RTN	128	RTN	129	RTN	130	RTN	131	RTN	132
133	RTN	134	RTN	135	RTN	136	RTN	137	RTN	138
139	RTN	140	RTN	141	RTN	142	RTN	143	RTN	144
145	RTN	146	RTN	147	RTN	148	RTN	149	RTN	150
151	RTN	152	RTN	153	RTN	154	RTN	155	RTN	156
157	RTN	158	RTN	159	RTN	160	RTN	161	RTN	162
163	RTN	164	RTN	165	RTN	166	RTN	167	RTN	168
169	RTN	170	RTN	171	RTN	172	RTN	173	RTN	174
175	RTN	176	RTN	177	RTN	178	RTN	179	RTN	180
181	RTN	182	RTN	183	RTN	184	RTN	185	RTN	186
187	RTN	188	RTN	189	RTN	190	RTN	191	RTN	192
193	RTN	194	RTN	195	RTN	196	RTN	197	RTN	198
199	RTN	200	RTN	201	RTN	202	RTN	203	RTN	204
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211	RTN	212	RTN	213	RTN	214	RTN	215	RTN	216
217	RTN	218	RTN	219	RTN	220	RTN	221	RTN	222
223	RTN	224	RTN	225	RTN	226	RTN	227	RTN	228
229	RTN	230	RTN	231	RTN	232	RTN	233	RTN	234
235	RTN	236	RTN	237	RTN	238	RTN	239	RTN	240
241	RTN	242	RTN	243	RTN	244	RTN	245	RTN	246
247	RTN	248	RTN	249	RTN	250	RTN	251	RTN	252
253	RTN	254	RTN	255	RTN	256	RTN	257	RTN	258
259	RTN	260	RTN	261	RTN	262	RTN	263	RTN	264
265	RTN	266	RTN	267	RTN	268	RTN	269	RTN	270
271	RTN	272	RTN	273	RTN	274	RTN	275	RTN	276
277	RTN	278	RTN	279	RTN	280	RTN	281	RTN	282
283	RTN	284	RTN	285	RTN	286	RTN	287	RTN	288
289	RTN	290	RTN	291	RTN	292	RTN	293	RTN	294
295	RTN	296	RTN	297	RTN	298	RTN	299	RTN	300
301	RTN	302	RTN	303	RTN	304	RTN	305	RTN	306
307	RTN	308	RTN	309	RTN	310	RTN	311	RTN	312
313	RTN	314	RTN	315	RTN	316	RTN	317	RTN	318
319	RTN	320	RTN	321	RTN	322	RTN	323	RTN	324
325	RTN	326	RTN	327	RTN	328	RTN	329	RTN	330
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355	RTN	356	RTN	357	RTN	358	RTN	359	RTN	360
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373	RTN	374	RTN	375	RTN	376	RTN	377	RTN	378
379	RTN	380	RTN	381	RTN	382	RTN	383	RTN	384
385	RTN	386	RTN	387	RTN	388	RTN	389	RTN	390
391	RTN	392	RTN	393	RTN	394	RTN	395	RTN	396
397	RTN	398	RTN	399	RTN	400	RTN	401	RTN	402
403	RTN	404	RTN	405	RTN	406	RTN	407	RTN	408
409	RTN	410	RTN	411	RTN	412	RTN	413	RTN	414
415	RTN	416	RTN	417	RTN	418	RTN	419	RTN	420
421	RTN	422	RTN	423	RTN	424	RTN	425	RTN	426
427	RTN	428	RTN	429	RTN	430	RTN	431	RTN	432
433	RTN	434	RTN	435	RTN	436	RTN	437	RTN	438
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457	RTN	458	RTN	459	RTN	460	RTN	461	RTN	462
463	RTN	464	RTN	465	RTN	466	RTN	467	RTN	468
469	RTN	470	RTN	471	RTN	472	RTN	473	RTN	474
475	RTN	476	RTN	477	RTN	478	RTN	479	RTN	480
481	RTN	482	RTN	483	RTN	484	RTN	485	RTN	486
487	RTN	488	RTN	489	RTN	490	RTN	491	RTN	492
493	RTN	494	RTN	495	RTN	496	RTN	497	RTN	498
499	RTN	500	RTN	501	RTN	502	RTN	503	RTN	504
505	RTN	506	RTN	507	RTN	508	RTN	509	RTN	510
511	RTN	512	RTN	513	RTN	514	RTN	515	RTN	516
517	RTN	518	RTN	519	RTN	520	RTN	521	RTN	522
523	RTN	524	RTN	525	RTN	526	RTN	527	RTN	528
529	RTN	530	RTN	531	RTN	532	RTN	533	RTN	534
535	RTN	536	RTN	537	RTN	538	RTN	539	RTN	540
541	RTN	542	RTN	543	RTN	544	RTN	545	RTN	546
547	RTN	548	RTN	549	RTN	550	RTN	551	RTN	552
553	RTN	554	RTN	555	RTN	556	RTN	557	RTN	558
559	RTN	560	RTN	561	RTN	562	RTN	563	RTN	564
565	RTN	566	RTN	567	RTN	568	RTN	569	RTN	570
571	RTN	572	RTN	573	RTN	574	RTN	575	RTN	576
577	RTN	578	RTN	579	RTN	580	RTN	581	RTN	582
583	RTN	584	RTN	585	RTN	586	RTN	587	RTN	588
589	RTN	590	RTN	591	RTN	592	RTN	593	RTN	594
595	RTN	596	RTN	597	RTN	598	RTN	599	RTN	600
601	RTN	602	RTN	603	RTN	604	RTN	605	RTN	606
607	RTN	608	RTN	609	RTN	610	RTN	611	RTN	612
613	RTN	614	RTN	615	RTN	616	RTN	617	RTN	618
619	RTN	620	RTN	621	RTN	622	RTN	623	RTN	624
625	RTN	626	RTN	627	RTN	628	RTN	629	RTN	630
631	RTN	632	RTN	633	RTN	634	RTN	635	RTN	636
637	RTN	638	RTN	639	RTN	640	RTN	641	RTN	642
643	RTN	644	RTN	645	RTN	646	RTN	647	RTN	648
649	RTN	650	RTN	651	RTN	652	RTN	653	RTN	654
655	RTN	656	RTN	657	RTN	658	RTN	659	RTN	660
661	RTN	662	RTN	663	RTN	664	RTN	665	RTN	666
667	RTN	668	RTN	669	RTN	670	RTN	671	RTN	672
673	RTN	674	RTN	675	RTN	676	RTN	677	RTN	678
679	RTN	680	RTN	681	RTN	682	RTN	683	RTN	684
685	RTN	686	RTN	687	RTN	688	RTN	689	RTN	690
691	RTN	692	RTN	693	RTN	694	RTN	695	RTN	696
697	RTN	698	RTN	699	RTN	700	RTN	701	RTN	702
703	RTN	704	RTN	705	RTN	706	RTN	707	RTN	708
709	RTN	710	RTN	711	RTN	712	RTN	713	RTN	714
715	RTN	716	RTN	717	RTN	718	RTN	719	RTN	720
721	RTN	722	RTN	723	RTN	724	RTN	725	RTN	726
727	RTN	728	RTN	729	RTN	730	RTN	731	RTN	732
733	RTN	734	RTN	735	RTN	736	RTN	737	RTN	738
739	RTN	740	RTN	741	RTN	742	RTN	743	RTN	744
745	RTN	746	RTN	747	RTN	748	RTN	749	RTN	750
751	RTN	752	RTN	753	RTN	754	RTN	755	RTN	756
757	RTN	758	RTN	759	RTN	760	RTN	761	RTN	762
763	RTN	764	RTN	765	RTN	766	RTN	767	RTN	768
769	RTN	770	RTN	771	RTN	772	RTN	773	RTN	774
775	RTN	776	RTN	777	RTN	778	RTN	779	RTN	780
781	RTN	782	RTN	783	RTN	784	RTN	785	RTN	786
787	RTN	788	RTN	789	RTN	790	RTN	791	RTN	792
793	RTN	794	RTN	795	RTN	796	RTN	797	RTN	798
799	RTN</td									

113	3	priate score,	169	INT	
114	X#Y?	Else no more capture,	170	STOB	
115	GT06	Begin loop 7	171	6	
116	*LBL7	If player 1	172	+	
117	F1?	Then go to 9	173	STOI	If bin is empty
118	GT99	Else	174	RCLI	Then try again
119	RCLB	increment score 2	175	X#0?	Else
120	+	-----	176	GT06	make move
121	STOB	Increment score 1	177	RCLB	-----
122	GT07	-----	178	PRTX	Search for attacking bin
123	*LBL9	-----	179	GSBE	
124	RCLA	-----	180	RTN	Save pointer from loop 2
125	+	-----	181	*LBL4	Initialize new pointer
126	ST0A	-----	182	RCLI	
127	*LBL?	Remove seeds from bin	183	STOB	
128	0	-----	184	1	
129	STOI	Step to next bin	185	2	
130	ISZI	If this is bin 7 or 13	186	STOI	
131	7	Then done	187	*LBLd	
132	FCLI	Else	188	RCLI	
133	X=Y?	Try to capture from this	189	X#0?	
134	GT06	bin	190	GT08	
135	1	-----	191	1	
136	3	-----	192	1	
137	X=Y?	-----	193	+	
138	GT06	-----	194	FRC	
139	GT07	-----	195	1	
140	*LBL4	Automatic player 2	196	1	
141	1	-----	197	X	
142	STOI	I←1	198	RCLI	
143	*LBL2	Begin loop 2	199	RCL0	
144	RCLI	-----	200	-	
145	X#0?	If C(I) = 0	201	X=Y?	If capture is possible
146	GT06	Then next I	202	GT09	Then go to 9
147	3	Else if C(I) = 1 or 2	203	*LBL8	
148	X#Y?	Then	204	DSZI	Decrement pointer
149	GT04	Search for attacking bin	205	RCLI	
150	*LBL6	Else next I	206	6	
151	ISZI	I←I + 1	207	X=Y?	If search is complete
152	RCLI	-----	208	GT08	Then go to 8
153	7	-----	209	GT04	
154	X#Y?	While I < 7	210	*LBL8	
155	GT02	Repeat loop 2	211	RCL0	Restore pointer for
156	*LBL6	-----	212	STOI	loop 2
157	RCLE	Move randomly	213	GT06	
158	P1	-----	214	*LBL9	Capture possible
159	+	-----	215	RCLI	
160	8	-----	216	6	
161	Y*	-----	217	-	
162	FRC	-----	218	PRTX	
163	ST0E	-----	219	GSBE	
164	6	-----	220	RTN	
165	x	-----			
166	1	-----			
167	+	-----			
168	+P	-----			

LABELS

LABELS					FLAGS		SET STATUS		
A	B	C	D	E	0	P1 vs. P2	FLAGS	TRIG	DISP
a	b Random move	c Random loop	d Loop	e Auto player 2	0	Player 1	ON OFF	DEG	FIX
0	Loop	1 Loop	2 Loop	3 Loop	1		1	GRAD	SCI
5	Used	6 Used	7 Used	8 Used	2	Used	2	RAD	ENG
					3	Used	3		n 2

Racetrack

081	#LBL6	START	057	ISZI		
082	CLRS		058	ISZ!		
083	PSE		059	RCLI		
084	CLRG		060	+		
085	:		061	STO!		
086	7		062	GSB2	Increment v _x	
087	STOI	Initialize loop 8	063	DSZI		
088	XLBL9		064	DSZI		
089	RCLI		065	RCLI		
090	1		066	+		
091	-		067	STO!	Increment x	
092	4	Compute starting position	068	X#Y		
093	÷		069	ISZI		
094	5		070	ISZI		
095	x		071	ISZI		
096	5		072	RCLI		
097	5		073	+	Increment v _y	
098	+		074	STO!		
099	STOI		075	GSB2		
080	RCLI	Decrement pointer	076	DSZI		
081	4		077	DSZI		
082	-		078	RCLI		
083	STOI		079	+		
084	X#Y?	While pointer is positive,	080	STOI	Increment y	
085	GT09	repeat loop 9	081	RCL0		
086	RTN		082	STOI		
087	#LBLA	Identify cars	083	RCLI	Initialize loop 8	
088	1		084	STOB		
089	GT08		085	ISZI		
090	#LBLB		086	RCLI		
091	2		087	STOC		
092	GT08		088	1		
093	#LBLC		089	7		
094	3		090	STOI		
095	GT08		091	#LBL8	Test for crash	
096	#LBLD		092	RCL6		
097	4		093	X#Y?	If same car	
098	GT08		094	GT08	Then skip test	
099	#LBLE		095	RCLI		
080	5		096	RCL8		
081	#LBLF		097	-		
082	PRTX	Print car ID	098	ISZI		
083	1	Compute a pointer	099	RCLI		
084	-		100	RCLC		
085	4		101	-		
086	x		102	+P		
087	1		103	2		
088	+		104	X#Y?		
089	STOB		105	DSZI		
090	STOI		106	X#Y?		
091	R1		107	GT08		
092	9		108	RCLI		
093	KEY?	If lv1 exceeds 9	109	2	If distance ≥ 2	
094	X#Y	Then use 9 instead	110	-	Then no crash	
095	R4		111	4		
096	+R		112	+		
REGISTERS						
0	Pointer	1	2	3	4	5
S0		S1	S2	S3	S4	S5
A	B	Used	C	Used	D	E
					I	Used

Teaser

601	#LBLC	Initialize	657	STX9					
602	1		658	GTOD					
603	ST05		659	#LBL7					
604	CHS		660	STX4					
605	STG1		661	STX5					
606	ST02		662	STX7					
607	ST03		663	STX8					
608	ST04		664	GTOD					
609	ST06		665	#LBL8					
610	ST07		666	STX7					
611	ST08		667	STX8					
612	ST09		668	STX9					
613	ST08		669	GTOD					
614	1		670	#LBL9					
615	0		671	STX5					
616	STOA		672	STX6					
617	GTOC		673	STX8					
618	#LBLA	Store move	674	STX9					
619	STOI		675	#LBLD					
620	RCLI	Generate a negative 1 or	676	F0?					
621	X0?	display "Error"	677	SPC					
622	GTOs		678	FIX					
623	CHS		679	DSP3					
624	GTOi		680	RCL9					
625	#LBL1	Go to appropriate routine	681	X0?					
626	STX1	to change board	682	0					
627	STX2		683	RCLA					
628	STX4		684	÷					
629	STX5		685	RCL8					
630	GTOD		686	X0?					
631	#LBL2		687	CLX					
632	STX1		688	+					
633	STX2		689	RCLA					
634	STX3		690	÷					
635	GTOD		691	RCL7					
636	#LBL3		692	X0?					
637	STX2		693	CLX					
638	STX3		694	+					
639	STX5		695	RCLA					
640	STX6		696	÷					
641	GTOD		697	F0?					
642	#LBL4		698	PRTX					
643	STX1		699	EEX					
644	STX4		700	0					
645	STX7		701	÷					
646	GTOD		702	ST08					
647	#LBL5		703	RCL6					
648	STX2		704	X0?					
649	STX5		705	0					
650	STX8		706	RCLA					
651	STX4		707	÷					
652	STX6		708	RCL5					
653	GTOD		709	X0?					
654	#LBL6		710	CLX					
655	STX3		711	+					
656	STX6		712	RCLA					
REGISTERS									
0	1 ±1	2 ±1	3 ±1	4 ±1	5 ±1	6 ±1	7 ±1	8 ±1	9 ±1
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A 10	B # of moves	C	D	E					

113	÷											
114	RCL4											
115	X<0?											
116	CLX											
117	+											
118	RCLA											
119	÷											
120	F0?											
121	PRTX											
122	EEX											
123	3											
124	÷											
125	ST+0											
126	RCL3											
127	X<0?											
128	0											
129	RCLA											
130	÷											
131	RCL2											
132	X<0?											
133	CLX											
134	+											
135	RCLA											
136	÷											
137	RCL1											
138	X<0?											
139	CLX											
140	+											
141	RCLA											
142	÷											
143	F0?											
144	PRTX											
145	RCL6											
146	+											
147	9											
148	÷											
149	RCLB											
150	1											
151	+											
152	ST08											
153	10 ^K											
154	X											
155	SCI											
156	DSP9											
157	RTN											
158	XLBL											
159	F0?											
160	GT0e											
161	SF0											
162	1											
163	RTN											
164	XLBL											
165	CF0											
166	0											
167	RTN											
LABELS												
FLAGS												
SET STATUS												
A	B	C	Start	D	Print	E	Print?	F	True/False	FLAGS	TRIG	DISP
a	b	c		d		e		f		ON OFF		
0 Used	1 Used	2 Used		3 Used		4 Used		2		0 <input checked="" type="checkbox"/> <input type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input type="checkbox"/>
5 Used	6 Used	7 Used		8 Used		9 Used		3		1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input checked="" type="checkbox"/>
										2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
										3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n 9

Golf

001	*LBL6	Random #.	057	RCL6	Print.
002	RCLA	ui+1	058	RCLD	
003	9		059	R1	
004	9		060	RCLC	
005	7		061	PRST	
006	X		062	RTN	
007	FRC		063	*LBLD	Print h, Y _h , Par, W.
008	STOA	ui	064	1	Club distance.
009	.		065	9	Putter
010	5		066	-GTOC	
011	-	ui - .5	067	*LBL6	Wood
012	RTN		068	4	
013	*LBLA	Woods distance.	069	-	
014	GSB6		070	2	
015	1		071	X	Iron
016	+		072	*LBLC	
017	4		073	1	S' = total strokes.
018	8		074	ST+1	
019	X	W	075	R4	
020	STOC		076	2	
021	0	Clear registers.	077	0	
022	ST05		078	-	
023	ST03		079	1	
024	ST02		080	0	
025	P2S		081	X	
026	ST05		082	CHS	Mean distance m.
027	ST03		083	ST06	
028	ST02		084	0	Enter s.
029	P2S		085	R/S	s
030	GSB6	Hole yardage.	086	STOB	Calculate Y _c
031	9		087	2	
032	X		088	1/2	
033	7		089	GSB6	
034	+		090	-	
035	5		091	LSTX	.5
036	8		092	X2Y	
037	X	Y _h	093	RCL7	H
038	ST00		094	5	
039	ST-2		095	6	
040	P2S	Y ₀₁	096	÷	
041	ST-2		097	X	
042	P2S	Y ₀₂	098	-	
043	2	Par.	099	RCL8	m
044	1		100	5	
045	5		101	÷	
046	÷		102	X	
047	3		103	RCL8	m
048	+		104	RCLB	s
049	INT	Par.	105	X	
050	ST+9	Σ Par.	106	+	
051	P2S		107	ABS	Y _c
052	ST+9	Σ Par.	108	STOE	
053	1	Hole number.	109	GSB6	Calculate θ _c .
054	ST+8	h	110	3	
055	P2S	h	111	X	
056	ST+8	h	112	RCL7	H
REGISTERS					
0	h	1 S ₁ '	2 Y ₁	3 x ₁	4 D _{h1}
S0	h	S ₁ S ₂ '	S ₂ Y ₂	S ₃ x ₂	S ₄ D _{h1}
A	ui	B s, θ _c	C W	D Y _h	E Y _c
					''

A	HOLE	B	WOOD	C	IRON	D	PUTTER	E	0				
a		b	RAN, #	c		d		e	1				
0	1			2		3		4	No hole	2			
5	6	7	Prt D _h , φ _h	8	Wood disp.	9	In woods	3					
LABELS										FLAGS			
										SET STATUS			
										FLAGS	TRIG	DISP	
										ON	OFF		
										0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
										1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
										2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
										3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
										DEG	<input type="checkbox"/>	FIX	<input type="checkbox"/>
										GRAD	<input type="checkbox"/>	SCI	<input type="checkbox"/>
										RAD	<input type="checkbox"/>	ENG	<input type="checkbox"/>
										n	0		

The Dealer

001	*LBLC	Deal n cards.	057	2		
002	SPC		058	x		
003	*LBL6		059	INT		
004	ST04		060	RCLE		
005	GSBA		061	-		
006	PRTX		062	EEX		
007	RCLA		063	2	Place selected card at bottom of deck.	
008	1		064	÷		
009	-		065	x		
010	X*0?		066	ST-i		
011	GT06		067	R†		
012	RTN		068	ST01	Place card from bottom of deck in place of selected card.	
013	*LBLA	Generate pseudo-random number.	069	LSTX		
014	RCLB		070	RCLD		
015	9		071	÷		
016	9		072	ST+i		
017	7		073	RCLC		
018	x		074	1	Move bottom of deck up one card.	
019	FRC		075	-		
020	STOB		076	ST0C		
021	RCLC		077	X*0?		
022	x	Scale pseudo-random number according to number of cards.	078	GSE		
023	INT		079	RCLE		
024	5		080	*LBL5	If all cards have been dealt, shuffle.	
025	÷	Calculate register containing selected card.	081	F1?	If bingo flag is set, go to zero.	
026	ST01		082	GT08		
027	FRC	Compute multiplier necessary to move selected card up to decimal point.	083	1	Calculate suit.	
028	1		084	3		
029	0		085	÷		
030	x		086	1		
031	10*		087	+		
032	ST0D		088	INT		
033	RCLi	Remove digits to left of decimal.	089	LSTX		
034	x		090	FRC		
035	FRC		091	1	Calculate card.	
036	EEX	Select card and store card number in RE.	092	3		
037	2		093	x		
038	x		094	1		
039	INT		095	.		
040	STOE		096	5		
041	RCLI	Take card from bottom of deck.	097	+		
042	RCLC		098	INT		
043	5		099	10*		
044	÷		100	x	Combine for output.	
045	ST0I		101	SCI		
046	FRC		102	RTN		
047	1		103	*LBL0		
048	0		104	1		
049	x		105	+		
050	10*		106	FIX		
051	1/X		107	RTN		
052	LSTX		108	*LBLc		
053	RCLI		109	2		
054	x		110	3		
055	FRC		111	ENT†		
056	EEX		112	5		
Registers						
0	.000102...	1 .050607...	2 .101112...	3 .151617...	4 .202122...	
S0	.505152...	S1 .555657...	S2 .606162...	S3 .656667...	S4 .707172...	
A	#Cards	B Seed	C Deck Point	D Used	E Card	Hole
S5 .757677...	S6 .808182...	S7 .858687...	S8 .909192...	S9 .959697...		

113	1				169	6		
114	F1?				170	3		
115	+				171	STOB		
116	STOC				172	GS8c		
117	CLX				173	RTN		
118	RTN				174	STOB		
119	*LBL#e			Set bingo flag.	175	RTN		
120	GT08				176	*LBL#e		
121	GT#1				177	SPC		
122	*LBL#e			Clear bingo flag.	178	RCLC		
123	CF1				179	GS8c		
124	*LBL#e				180	R↓		
125	1			Load cards as two digit	181	RCLC		
126	8			numbers; five per register.	182	STOB		
127	ST01				183	X#Y		
128	.				184	STOC		
129	0				185	*LBL#4		
130	5				186	RCLD		
131	0				187	5		
132	5				188	+		
133	0				189	STOI		
134	5				190	FRC		
135	8				191	1		
136	5				192	0		
137	8				193	X		
138	5				194	18X		
139	CHS				195	RCL#		
140	ENT†				196	X		
141	ENT††				197	FRC		
142	ENT†				198	EEX		
143	.				199	2		
144	9				200	X		
145	5				201	INT		
146	9				202	GS85		
147	6				203	PRTX		
148	9				204	RCLC		
149	7				205	RCLD		
150	9				206	1		
151	8				207	-		
152	9				208	STOB		
153	9				209	X#Y?		
154	ST09				210	*T04		
155	P#S				211	R↓		
156	*LBL#7				212	R↓		
157	+				213	RTN		
158	ST01							
159	DSZ1							
160	GTC7							
161	+							
162	ST08							
163	.							
164	5			Store seed.				
165	2							
166	8							
167	4							
168	1							

LABELS

LABELS					FLAGS		SET STATUS		
A→Hit	B	C n→Deal	D	E Review	0	FLAGS	TRIG	DISP	
^a Cards; seed	b	c Shuffle	d	e Bingo; seed	1 Bingo	ON OFF	DEG	FIX	
0 Used	1	2	3	4 Review	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD	SCI	
^s Suit/Card	6 Deal	7 Start	8	9	3	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD	ENG	
						2 <input type="checkbox"/> <input checked="" type="checkbox"/>		n 0	
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>			

Bowling Scorekeeper

001	XLBLA	Start	057	XLBLB	Spare
002	CLRG	Clear primary registers.	058	#LBLC	Strike
003	P=S		059	INT	Remove extra digits.
004	9		060	;	
005	STOI		061	+	
006	EEX		062		
007	4		063	STOI	Store and decrement for
008	CHS		064	DSZI	indirect address.
009	XLBL9		065	CF0	NOP
010	STOI	Store .0001 in secondary	066	P=S	Recall secondary register.
011	DSZI	registers 0 to 9.	067	RCL I	
012	GTO9		068	P=S	
013	STOI		069	ENT1	
014	CLX		070	INT	
015	RTN		071	1	
016	XLBLA	Entry for other than spare	072	0	10 pins
017	INT	or strike.	073	ENT1	
018	LSTX		074	XLBL0	
019	FRC		075	R↓	Pins down
020	ENT1		076	STOA	New CS to A
021	ENT1		077	R↓	
022	1		078	GSB1	Shift, get S1
023	0		079	STOB	S1 to B
024	X		080	GSB1	Shift, get S2
025	FRC		081	STOC	S2 to C
026	X#?	Error if extra digits in entry	082	GSB1	Shift, get PS
027	GTO8	e.g. 1.08.	083	STOD	PS to D
028	R↓		084	RCL I	Recall primary register.
029	1		085	CF1	Clear 2 nd ball flag.
030	0		086	X#?	If reg. neg.
031	±		087	SF1	set 2 nd ball flag.
032	+	Original entry	088	ABS	Remove sign.
033	STOI	Store and decrement for	089	EEX	
034	DSZI	indirect address.	090	2	
035	CF0	NOP	091	x	
036	FRC		092	INT	
037	EEX		093	EEX	
038	2		094	2	
039	X	Pin count	095	÷	
040	P=S		096	STOE	SSS.FS to E
041	RCL I	Recall secondary register	097	RCLC	
042	P=S	(CS,S1S2 PS).	098	X#?	If strike 2 balls back
043	ENT1		099	GSB2	GSB2.
044	INT		100	RCLB	Strike 1 ball back
045	ENT1	CS = current sum	101	STOC	now 2 balls back.
046	R↓		102	0	No strike 1 ball back.
047	+	New CS	103	STOB	
048	1		104	F1?	If 2 nd ball
049	1		105	GTO3	GTO 3
050	X>Y?	Less than 11?	106	RCLD	Add count
051	GTO8	Continue	107	X#?	
052	#LBLB	else error	108	GSB2	
053	ISZI		109	0	
054	RCL I		110	STOD	0 to PS
055	GSBD		111	RCLA	
056	GTO6		112	1	

REGISTERS

0 Used	1 Used	2 Used	3 Used	4 Used	5 Used	6 Used	7 Used	8 Used	9 Used
S0 Used	S1 Used	S2 Used	S3 Used	S4 Used	S5 Used	S6 Used	S7 Used	S8 Used	S9 Used
A CS	B S1	C S2	D PS	E SSS.FS	F	ID.P			

LABELS					FLAGS	SET STATUS		
A ID,P entry	B Spare	C Strike	D Recall score	E	0	FLAGS	TRIG	DISP
^a Start	^b Error	^c	^d	^e	1 2 nd ball	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
^c Used	¹ Shift sub.	² Score sub.	³ Spare	⁴ 2 nd	²	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
^d Add frame	⁶ Display	⁷ Add count	⁸ Error	⁹ Initialize	³	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>4</u>
113	0				169 2			
114	X#Y?				170 x			
115	GT04	Strike?			171 INT			
116	ST08	No strike			172 RCLI			NF.
117	GT05	Store strike			173 FRC			
118	XLBL4	-----			174 +			Last ball
119	SF1	2 nd ball			175 EEX			NF.LB
120	GT06	-----			176 4			
121	XLBL3	Spare?			177 ÷			.00NFLB
122	CF1				178 RCLE			
123	RCLA				179 +			SSS.FSNFLB
124	1				180 F1?			If flag set.
125	0				181 CHS			Make negative.
126	X#Y?	CS ≠ 10?			182 ST01			Update print register.
127	GT07				183 PRTX			Print display.
128	ST00				184 RTN			
129	GT05				185 XLBL1			
130	XLBL7	Add count			186 -			
131	GSB2				187 EEX			
132	XLBL5				188 2			
133	0				189 x			
134	ST0A	0 to CS			190 ENT↑			
135	RCLI	Increment frame count.			191 INT			
136	ABS				192 RTN			
137	EEX				193 XLBL2			
138	4				194 RCLB			
139	CHS				195 RCLC			
140	+				196 +			
141	ST01				197 RCLD			
142	XLBL6	Ready score and frame			198 +			
143	RCLD	display, PS.			199 RCLA			
144	EEX				200 +			
145	2				201 RCLE			
146	÷				202 ABS			
147	RCLC	S2			203 +			
148	+				204 EEX			
149	EEX				205 2			
150	2				206 CHS			
151	÷				207 +			
152	RCLB	S1			208 ST0E			.01
153	+				209 FRC			Increment FS
154	EEX				210 .			Update E
155	2				211 1			Compare FS to .1
156	÷				212 X#Y?			
157	RCLA	CS			213 RTN			If less than .1
158	+	CS.S1S2PS			214 RCLE			Continue
159	PSS				215 ABS			Otherwise
160	ST01	Update sec. reg.			216 ST01			
161	PSS				217 PRTX			Update print register.
162	RCL↑				218 R/S			Print and stop.
163	ABS				219 #LBLD			
164	EEX	Remove sign.			220 1			
165	2				221 -			
166	x				222 ST01			
167	FRC	.NF			223 RCLI			
168	EEX				224 RTN			

Biorhythms

001	*LBL2	Increment pointer by 3.	057	1	
002	ISZ1		058	-	
003	ISZ1	Store Birthdate	059	3	
004	ISZ1		060	1	
005	RTN	FUNCTION OF DATE	061	X	
006	*LBL4		062	+	
007	STOA	N (M, D, Y)	063	RCL6	
008	RTN		064	4	
009	*LBL6		065	=	
010	ENT1		066	INT	
011	INT		067	X \approx Y	
012	ST03		068	+	
013	-		069	RTN	
014	EEX		070	*LBL6	
015	2		071	RCLC	
016	X		072	ST09	
017	ENT1		073	*LBL7	
018	INT		074	1	
019	ST05		075	ST+9	
020	-		076	GSB6	
021	EEX		077	GT07	
022	4		078	*LBL8	
023	X		079	ST08	
024	ST06		080	RCL8	
025	3		081	GSB6	
026	6		082	ST02	
027	5		083	LSTX	
028	ST04		084	ST08	
029	X		085	RCLB	
030	2		086	GSB6	
031	RCL3		087	LSTX	
032	X \approx Y?		088	ST-8	
033	GT08		089	CLX	
034	X		090	RCL2	
035	CLX		091	-	
036	RCL6		092	RCL4	
037	1		093	2	
038	-		094	=	
039	ST06		095	ST=8	
040	GT01		096	X \approx Y	
041	*LBL8		097	ST0C	
042	-		098	ST09	
043	4		099	2	
044	X		100	3	
045	-		101	ST03	
046	3		102	2	
047	+		103	6	
048	+		104	ST02	
049	INT		105	3	
050	-		106	3	
051	RCL6		107	ST01	
052	*LBL1		108	*LBL6	
053	CLX		109	3	
054	RCL5		110	ST01	
055	+		111	DSP2	
056	RCL3		112	*LBL6	

REGISTERS

0 1 or 2	1 33	2 28	3 23	4 Days	5 Days	6 Days	7 Used	8	9 Δ days
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A Birth date	B Bio date	C Δ days	D	E		I			

113	RCL9		169	XLBLB	DAYS UNTIL NEXT MIN
114	RCL8		170	4	
115	÷		171	ENT†	
116	FRC		172	3	
117	F1?		173	÷	
118	ST08		174	ST07	
119	2		175	1	
120	x		176	RCLC	
121	PI		177	GT08	
122	×		178	XLBL8	DAYS UNTIL NEXT CRITICAL
123	SIN		179	2	
124	RND		180	ST07	
125	GT01		181	RCLC	
126	XLBL8		182	XLBL8	
127	RCL1		183	ST09	
128	x		184	X#Y	
129	GSB2		185	ST06	
130	ST01		186	SF1	
131	X#I		187	GSB6	
132	3		188	CF1	
133	-		189	3	
134	X#I		190	ST01	
135	DS21		191	XLBL3	
136	GT06		192	GSB2	
137	RTN		193	RCL1	
138	XLBL1		194	X#I	
139	GSB9		195	3	
140	XLBL8		196	-	
141	DS21		197	X#I	
142	GT06		198	RCL1	
143	SPC		199	RCL7	
144	RTN		200	÷	
145	XLBL9	----- PRINT/PAUSE	201	-	
146	F09		202	CHS	
147	PRTX		203	X#P?	
148	F09		204	GT03	
149	RTN		205	XLBL4	
150	R/S		206	PRTX	
151	RTN		207	XLBL3	
152	XLBL6	----- PRINT TOGLE	208	RCL1	
153	DSP0		209	RCL6	
154	F09		210	÷	
155	GT08		211	+	
156	1		212	RCL1	
157	SF8		213	X#Y	
158	RTN		214	X>Y?	
159	XLBL8		215	GT05	
160	6		216	GT04	
161	CF6		217	XLBL5	
162	RTN		218	SPC	
163	#LBL1	----- DAYS UNTIL NEXT MAX	219	DS21	
164	4		220	GT03	
165	ST07		221	RTN	
166	1				
167	RCLC				
168	GT08				
LABELS					
FLAGS					
SET STATUS					
A Birth date		B Bio date	C +1	D MIN	E Critical
a		b Print cycle	c N(M, D, Y)	d MAX	e Print?
0 Used	1 Used	2	3	4	5
5	6	7	8	9 Print/Pause	3
FLAGS			TRIG		
ON OFF			DEG		
0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	3	<input type="checkbox"/>	<input checked="" type="checkbox"/>
GRAD			RAD		
RAD			SCI		
SCI			ENG		
ENG			n 2		

Timer

001	XLBLA	INITIALIZATION	057	XLBLa	CALIBRATE 5
002	CLRG		058	R↓	SECOND TIMER
003	P±S		059	GSB4	
004	CLRG		060	R↑	
005	5	C _b (MINIMUM	061	HMS+	
006	1	INTERVAL	062	X±Y	
007	3	CALIBRATION	063	HMS+	
008	4	CONSTANT)	064	-	
009	1/X		065	LSTX	
010	ST0E		066	RCLC	K _a
011	5		067	x	
012	.	C _a (5 SECOND	068	÷	
013	7	PRIMARY)	069	RCLB	C _a
014	8		070	+	
015	3		071	PRTX	
016	0		072	RTN	
017	ST0B		073	XLBLC	COUNT-UP TIMER
018	.	K _a (5 SECOND	074	GSBA	
019	1	SECONDARY)	075	R/S	
020	6		076	XLBL7	FAST LOOP
021	7		077	DSZI	
022	5		078	GT07	CONVERT TO TIME
023	ST0C		079	XLBLc	
024	6	C _c (COUNT-UP)	080	RCLI	SPLITS
025	8		081	RCLD	
026	6		082	x	
027	0		083	→HMS	
028	1/X		084	RTN	
029	ST0D		085	P±S	
030	6	C _d (COUNT-DOWN)	086	RCL1	
031	7		087	ST0I	
032	9		088	RCL2	
033	8		089	ST01	
034	1/X		090	RCL3	
035	ST05		091	ST02	
036	0		092	RCL4	
037	RTN		093	ST03	
038	XLBL5	5 SECOND TIMER	094	RCL5	
039	PSE	LOOP	095	ST04	
040	HMS+		096	RCL6	
041	7		097	ST05	
042	2		098	RCL7	
043	0		099	ST06	
044	1/X	0:00:05 HRS	100	RCL8	
045	+		101	ST07	
046	ST0A	TIME	102	RCL9	
047	RCLB	C _a	103	ST08	
048	RCLI		104	RCL8	
049	+		105	ST09	
050	ST0I		106	P±S	
051	XLBL1	FAST LOOP	107	RCL1	
052	DSZI		108	P±S	
053	GT01		109	ST08	
054	RCLA	TIME	110	P±S	
055	→HMS		111	RCL2	
056	GT05		112	ST01	
REGISTERS					
⁰ SPLIT	¹ SPLIT	² SPLIT	³ SPLIT	⁴ C _a , SPLIT	⁵ C _d , SPLIT
S0 SPLIT	S1 SPLIT	S2 SPLIT	S3 SPLIT	S4 SPLIT	S5 SPLIT
A	B	C	D	E	F

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
^A 5 SEC	^B MIN INT	^C COUNT-UP	^D COUNT-DN	^E SPLITS	0	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input type="checkbox"/>
^A 5 SEC CAL	^B MIN CAL	^C CU to TIME	^D CAL C-U	^E CAL C-D	1	1	GRAD <input checked="" type="checkbox"/>	SCI <input type="checkbox"/>
0	¹ 5 SEC LP	² CAL SUB	³ C-U LOOP	⁴ T _c	2	2	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
5 SEC LP	MIN LOOP	C-U LOOP			3	3		n. 4
113	RCL3				169 *LBL6	FAST LOOP		
114	ST02				170 PSE			
115	RCL4				171 RCL6			
116	ST03				172 HWS+			
117	RCL5				173 GT06			
118	ST04				174 *LBL6			
119	RCL6				175 R4			
120	ST05				176 GSB4			
121	GT06				177 X2Y			
122	*LBL6				178 R4			
123	RCL5				179 RCL6			
124	ST06				180 GT02			
125	RCL4				181 PRTX			
126	ST05				182 RTN			
127	RCL3				183 *LBL2			
128	ST04				184 X2Y			
129	RCL2				185 HWS+			
130	ST03				186 X			
131	RCL1				187 X2Y			
132	ST02				188 HWS+			
133	PSS				189 =			
134	RCL0				190 1/X			
135	PSS				191 PRTX			
136	ST01				192 RTN			
137	PSS				193 *LBLd			
138	RCL9				194 GSB4			
139	ST08				195 GSBc			
140	RCL8				196 R/S			
141	ST09				197 X2Y			
142	RCL7				198 RCLD			
143	ST08				199 GT02			
144	RCL6				200 *LBLd			
145	ST07				201 GSBa			
146	RCL5				202 R/S			
147	ST06				203 ST04			
148	RCL4				204 HWS+			
149	ST05				205 RCL5			
150	RCL3				206 =			
151	ST04				207 ST01			
152	RCL2				208 RCL4			
153	ST03				209 R/S			
154	RCL1				210 *LBL3			
155	ST02				211 DSZI			
156	RCL1				212 GT03			
157	ST01				213 0			
158	4				214 RTN			
159	4				215 *LBL6			
160	2				216 GSB4			
161	+				217 RCL4			
162					218 X2Y			
163	ST01				219 RCL5			
164	PSS				220 GT02			
165	GT07				221 *LBL4			
166	*LBL6				222 CHS			
167	GSB4				223 HWS+			
168	R/S				224 RTN			
MINIMUM INTERVAL VISIBLE TIMER						CALCULATE SWEEP SECOND HAND TIME INTERVAL T _c		

Appendix A

MAGNETIC CARD

SYMBOLS AND CONVENTIONS

MAGNETIC CARD

SYMBOLS AND CONVENTIONS

SYMBOL OR CONVENTION	INDICATED MEANING
White mnemonic: x A	White mnemonics are associated with the user definable key they are above when the card is inserted in the calculator's window slot. In this case the value of x could be input by keying it in and pressing A.
Gold mnemonic: y x f E x \uparrow y A x A (x) A → x A → x, y, z A → x; y; z A → "x," y A ↔ x A	Gold mnemonics are similar to white mnemonics except that the gold f key must be pressed before the user definable key. In this case y could be input by pressing f E. ↑ is the symbol for ENTER↑. In this case ENTER↑ is used to separate the input variables x and y. To input both x and y you would key in x, press ENTER↑, key in y and press A. The box around the variable x indicates input by pressing STO A. Parentheses indicate an option. In this case, x is not a required input but could be input in special cases. → is the symbol for calculate. This indicates that you may calculate x by pressing key A. This indicates that x, y, and z are calculated by pressing A once. The values would be printed in x, y, z order. The semi-colons indicate that after x has been calculated using A, y and z may be calculated by pressing R/S. The quote marks indicate that the x value will be "paused" or held in the display for one second. The pause will be followed by the display of y. The two-way arrow ↔ indicates that x may be either output or input when the associated user definable key is pressed. If numeric keys have been pressed between user-definable keys, x is stored. If numeric keys have not been pressed, the program will calculate x.

SYMBOLS AND CONVENTIONS (Continued)

SYMBOL OR CONVENTION	INDICATED MEANING
P? A	The question mark indicates that this is a mode setting, while the mnemonic indicates the type of mode being set. In this case a print mode is controlled. Mode settings typically have a 1.00 or 0.00 indicator displayed after they are executed. If 1.00 is displayed, the mode is on. If 0.00 is displayed, it is off.
START A	The word START is an example of a command. The start function should be performed to begin or start a program. It is included when initialization is necessary.
DEL A	This special command indicates that the last value or set of values input may be deleted by pressing A.



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● B C D E

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