HEWLETT-PACKARD

## HP-41C

### USERS' LIBRARY SOLUTIONS Games

				-	
	-				
~	-111.				
			-atilites.		
	 ··· •• •• ••				

### NOTICE

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

#### INTRODUCTION

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

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

#### **KEYING A PROGRAM INTO THE HP-41C**

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

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

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

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

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

Keystrokes

**Printer Listing** 

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

Display

### TABLE OF CONTENTS

*l.	HUNT THE WUMPUS	•	ı	1
**2.	3-D TIC TAC TOE	٠	•	8
*3,	ROBOT TRAP	•	•	17
**4.	HEXAPAWN	•	a	24
*5.	SCATTER	1	•	33
6.	FLIP-FLOP	•		41
*7.	OR BITAL LANDER	•	·	46
8.	PLANET LANDER	•	•	53
<b>*</b> 9.	WARI	•	•	59
10.	SIMON If you can remember the sequence, you win.			66
*	Requires one memory module		<b>\$</b>	

\*\* Requires two memory modules

ŧ

### HUNT THE WUMPUS

#### (Requires 1 Memory Module)

There are 20 caves each connected to 3 others. There are 6 occupied caves: 2 with super bats, 2 with pits, 1 with a wumpus, and 1 with a hunter (you). The object is to move from cave to cave, watching the warnings to see what is nearby, find the wumpus and shoot it with an arrow. You may only move or shoot into an adjacent cave.

The warnings are as follows:

"SMELL WUMPUS" -- The wumpus is in an adjacent cave.

"FEEL A DRAFT" -- Pits are in adjacent cave(s).

"HEAR SQUEEKS" -- Super bats are in adjacent cave(s).

If you walk into the cave with the wumpus he will eat you. If you shoot an arrow and miss (by shooting into the wrong cave), you wake the wumpus up and he moves to one of his adjacent caves. If it's the cave you are in, he eats you. Since he has sucker feet he can walk into a cave with pits without falling. And, since he is too heavy for the bats, they cannot bother him. If you walk into a cave with pits, you fall and the game is ended. If you walk into a cave with super bats, they will carry you to some other cave randomly chosen. If the wumpus, pits, or more super bats are there, you will suffer their consequences. The bats then return to their original cave.

Each time you move you will first see the consequences (if any) of your move: "CHOMP" means you've been eaten by the wumpus, "YYIIIEEEE..." means you've fallen into a pit, and "SNATCH" followed by "MOVED TO ()" means the super bats have grabbed you and moved you. After the consequences you see any warnings that are appropriate. Last, you will see the cave you are in followed by your adjacent caves.

The caves are arranged as a dodechedron with each vertex being a cave and each edge a tunnel.



Example:

Keystrokes:	Display:
[XEQ] [ALPHA] SIZE [ALPHA] 012	
[XEQ] [ALPHA] WUMPUS [ALPHA]	SEED?
.1232123 [R/S]	HEAR SQUEAKS
[R/S]	6-1,7,15
1 [A]	SNATCH
[R/S]	MOVED TO 3
[R/S]	HEAR SQUEAKS
[R/S]	3-4,2,10
10 [A]	FEEL A DRAFT
[R/S]	10-3,11,9
11 [A]	SMELL WUMPUS
[R/S]	11-18,12,10
12 [B]	11-18,12,10
18 [A]	SMELL WUMPUS
[R/S]	18-11,19,17
19 [B]	18-11,19,17
17 [A]	SMELL WUMPUS
[R/S]	FEEL A DRAFT
[R/S]	17-9,18,16
9 [A]	YYIIIEEEE
(Note that you should have known pits were	
there from your pass through cave 10 and	

•

I

its warnings.)

,

## **User Instructions**

				SIZE: 012
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program.			
2	Initialize.		[XEQ] WUMPUS	SEED?
3	Key in number between 0 and 1.	seed	[R/S]	(warnings)
				(caves)
4	To move:	cave #	[A]	(consequences
				(warnings)
				(caves)
5	To shoot an arrow:	cave #	[в]	(consequences
				(warnings)
				(caves)
6	To see warnings and caves again:		[c]	(warnings)
				(caves)
7	For another game:		[E]	(warnings)
				(caves)
8	Go to step 4 or 5.			
			·····	······································
				<u>+.</u>

01+LBL "WUM		47 RCL 06	
PUS"	Initialize	48 XEQ 21	
02 0	Initialize	49+LBL 22	
03 "SEED?"		50 CLA	1
04 PROMPT		51 ARCL 01	Output current
05 STO 00		52 "H- "	position
06 SF 27			1
		53 ARCL 07	
· · · · · · · · · · · · · · · · · · ·		54 "F, "	
08 FIX 0		55 ARCL 08	
09 CF 29		56 "H, "	
10 1.006		57 ARCL 09	
11 STO 10		58 AVIEW	
12+LBL 13		59 RTN	
13 RCL 10		60+LBL 21	
14 INT		61 RCL 07	
15 1		62 X<>Y	Test surrounding
16 -			Ű
17 STO 11		63 X=Y?	caves
		64 AVIEW	
18 20		65 RCL 08	
19 XEQ 99	Pick a cave	66 X<>Y	
20 1	TICK a cave	67 X=Y?	
21 +		68 AVIEW	
22+LBL 12		69 RCL 09	
23 RCL IND		70 X=Y?	
11	Make sure it's	71 AVIEW	
24 X<>Y	not used	72 RTN	
25 X=Y?			
26 GTO 13		73+LBL A	
27 DSE 11		74 XEQ 14	Mana
		75 FS? 00	Move
28 GTO 12		76 GTO 22	
29 STO IND		77 STO 01	
10		78 GTO 09	
30 ISG 10		79+LBL B	
31 GTO 13		80 XEQ 14	Shoot
32+LBL C		81 FS? 00	311001
33+LBL 20		82 GTO 22	
34 RCL 01	Check	83 RCL 02	
35 XEQ 50	surroundings		
36 "SMELL W	Surroundings	84 X=Y?	Hit
UMPUS"		85 GTO 11	
		86 XEQ 50	
37 RCL 02		87 3	
38 XEQ 21		88 XEQ 99	
39 "FEEL A		89 7	
DRAFT"		90 +	
40 RCL 03		91 RCL IND	1
41 XEQ 21		x	
42 RCL 04			New Wumpus
43 XEQ 21	1	93 RCL 01	position
44 "HEAR SQ		94 XEQ 50	
UEEKS"			
		95+LBL 09	ļ
45 RCL 05		96 2.006	
46_XEQ_21	1[	<u>97 STO 10</u>	

98 RCL 01 145 RCL 09 99+LBL\_08 Check current 146 X=Y? 100 RCL IND 147 RTN position for 10 148 "ILLEGAL dangers 101 X<>Y CAVE" 102 X=Y? 149 AVIEW 103 GTO IND 150 SF 00 10 151 RTN 104 ISG 10 152+LBL 99 105 GTO 08 Random number 153 RCL 00 106 GTO 20 154 9821 generator 107+LBL 02 155 \*108 "CHOMP" .21137 156 Eaten by Wumpus 109 AVIEW 157 + 110 RTN FRC 158 111+LBL 03 159 STO 00 112+LBL 04 160 Fell into pit \* 113 "YYIIIEE 161 INT EE..." 162 RTN 114 AVIEW 163+LBL 50 115 RTN 164 CF 00 116+LBL 05 165 5 117+LBL 06 X < > Y166 Super bat move 118 "SNATCH" 167 STO 10 119 AVIEW 168 X<=Y? 120 20 169 GTO 10 121 XEQ 99 170 15 Determine which 122 1 171 X<>Y ring the cave is 123 + X < = Y?172 in 124 STO 01 173 GTO 11 125 "MOVED T 174 2 0 175 ske 126 ARCL 01 176 25 Find adjacent 127 AVIEW 177 caves for outside 128 PSE 178 STO 07 ring 129 GTO 09 179 21 130+LBL 11 180 RCL 10 131 "GOT HIM 181 1 Shoot Wumpus 182 + 132 BEEP 183 16 133 AVIEW 184 RDN 134 RTN 185 X = Y?135+LBL 14 186 R↑ 136 CF 00 187 STO 08 137 RCL 07 Illegal cave 188 15 138 X=Y? test 189 **RCL 10** 139 RTN 190 1 140 X<>Y 191 141 RCL 08 192 X = Y?142 X=Y? 193 20 143 RTN 194 X=0? 144 X<>Y 195 RDN

196 STO 09			248	R↑	
197 RTN			249	STO 09	
198+LBL 10			250	RTN	
199 1					
200 +	Find adjacent		251	.END.	
	caves for inside				
201 X>Y?	ring				7
202 1	8		<u> </u>	······	-
203 STO 07			<u> </u>		4
204 RCL 10					4
205 1			ļ		4
206 -		60			
207 X=0?			[		
208 5					]
209 STO 08					
					4
210 RCL 10					-
211 2					4
212 *			L		4
213 4					
214 +					
215 STO 09					1
216 RTN		70			1
217+LBL 11					1
218 2	,				-
219 /	Find adjacent				1
220 FRC	caves for middle				4
					-
221 X=0?	ring			· · · · · · · · · · · · · · · · · · ·	4
222 SF 00					-
223 25					
224 RCL 10					
225 FS? 00					
226 4		80			1
227 FS? 00				<u> </u>	4
228 CHS					4
229 CF 00					4
230 +					4
231 2					-
232 /					_
233 STO 07					]
234 16					1
235 RCL 10					1
236 1		90			-
237 +					-
238 X=Y?					-
239 6					-
240 STO 08					
241 5					
242 RCL 10					
242 RCL 10 243 1					1
					1
244 -				** • • • • • • • • • • • • • • • • • •	1
245 15					4
246 RDN					4
247 X=Y?		00	L		

\$

ř

### **REGISTERS, STATUS, FLAGS, ASSIGNMENTS**<sup>'</sup>

	DAT	A REGISTERS			\$	STATUS	i	
00	Seed Hunter Wumpus Pits	50	EN(	) í	.2. TOT. REG 	SCI	ON	
05	Pits S. bats S. bats	55	#	INIT S/C	SET INDIC	FLAGS ATES		
	Adj. cave Adj. cave Adj. cave		-00		Used		Used	
10	Used Used Used	60						
15		65						
20		70						
25		75						
30		80						
35		85						
35						IGNMEN		
40		90		FUNCT		:Y	FUNCTION	KEY
45		95						
		ll	I			<u> </u>		

### 3-D TIC TAC TOE

#### (Requires 2 Memory Modules)

This program pits the HP-41C against a human opponent in a game of 3-D Tic Tac Toe. The rules of this game are simple:

- 1) The board consists of 4 levels, each of which is 4 rows deep and 4 columns across, making a total of 64 squares on a 3 dimensional board.
- 2) Two players move alternately by placing a black or white marker on a square (or making an X or a 0 on a paper layout of the board). Once a move is made, the piece is never moved or removed. In this game, the human always goes first.
- 3) A player wins by placing four markers in a straight line. The line can lie in more than one level, and diagonals are perfectly legitimate wins.

In short, the game is played just like regular Tic Tac Toe, except that the board has one additional dimension, and is one square bigger in all dimensions. Unlike regular Tic Tac Toe, there is no known winning strategy for the 3-D version. It is a much more complex game which can require considerable skill in a player, allowing for very complicated strategies.

The 41C plays and remembers the game by dividing the board into its 16 component rows and storing an entire row in one register. The registers  $R_0$  through  $R_{15}$  are reserved for the game board.

Each square on the board can be characterized by its level=z, its row=y and its column=x. x,y, and z can have values from 1 through 4. When entering moves, make sure they are 3 digit numbers. All three digits must be between 1 and 4 inclusive. Entering a move outside this range may cause the program to make erroneous entries in the board.

The boards look like:





Example:

Keystrokes:	Display:
[XEQ] [ALPHA] SIZE [ALPHA] 026	
[XEQ] [ALPHA] 3DTTT [ALPHA]	READY
242 [R/S]	MY MOVE: 322
414 [R/S]	MY MOVE: 134
123 [R/S]	MY MOVE: 234
441 [R/S]	MY MOVE: 423
141 [R/S]	MY MOVE: 232
214 [R/S]	MY MOVE: 114
424 [R/S]	MY MOVE: 434
111 [R/S]	334, I WIN

The boards look like:



	0	
0		
X		

2

· · · · ·	<u> </u>	<b></b>	
X			0

3

0	X		X
			X
0	0	0	0

Z

4

## **User Instructions**

				SIZE:026
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program.			
2	Initialize.		[XEQ] 3DTTT	READY
3	Key in your move.	xyz	[R/S]	MY MOVE:
	Repeat 3 until you win or lose.			
		· · · · · · · · · · · · · · · · · · ·		

01+LBL "3DT		48 CF 03	4
TT"	Initialize	49 CF 00	1
02 FIX 0		50.06	
03 CLRG		51 RCL 18	1
04 CF 00		52 FRC	
	1	53 STO 18	
05 CF 01	1		
06 CF 02		54 X>Y?	
07 CF 03		55 GTO 02	
08 CF 29		56 X=Y?	
		57 GTO 03	
09 "READY"	1	58+LBL 01	
10 AVIEW			
11+LBL A		59 1 E-2	Thomas have a
12 STOP	1	60 ST+ 18	Increment round
13 1 E3	Input players	61 SF 02	count
14 /		62 GTO 03	
	move	63+LBL 02	
15 STO 19			
16 0		64 XEQ 10	The set is a state of
17 STO 16		65 XEQ 04	Test machine move
18 2		66 FS?C 02	
19 STO 17		67 GTO 03	
		68 RCL 19	
20 RDN		69 XEQ 10	
21 RDN			
22 XEQ 10		70+LBL 03	
23 STO 25		71 RCL 16	
24 RCL 20		72 INT	
		73 1	
25 RCL IND		74 -	
25		75 3	
26 *			
27 INT		76 /	
28 1 E2		77 21	
29 /		78 +	
		79 ENTER↑	
30 FRC		80 FRC	
31 "ILLEGAL			
MOVE"		81 X=0?	
32 X≠0?		82 CF 01	
33 AVIEW	Illegal move	83.5	
	1	84 X>Y?	Jump to proper
34 X≠0?		85 SF 00	test routine
35 GTO A		86 GTO IND	
36 5			
37 RCL 20	1	Z	
38 /		87+LBL 10	<b>-</b>
39 1		88 10	Parse move
		89 *	
40 +	Store move	90 INT	
41 ST+ IND		91 LASTX	
25	1		
42 RCL 18		92 FRC	
43 X=0?		93 10	
		94 *	
44 GTO 01	1	95 INT	7
45 SF 00	Test move	96 LASTX	
46 XEQ 04			
47 CF 02	ł	97 FRC	
		98.5	

99       -       151+LBL 02       Testing cycle         100       CHS       152 1       Testing cycle         101       20       152 1       Testing cycle         102       *       154 1 E2       Testing cycle         103       164X       155 ENTERt       Testing cycle         106       1       25       ENTERt       Testing cycle         106       1       25       RCL 24       Testing cycle         107       -       158 K<> 25       Testing cycle         108       STO 21       159 RCL 24       Testing cycle         109       X <y< td="">       160 +       Testing cycle         110       1       156 ENTERt       Testing cycle         111       -       158 RCL 24       Testing cycle         112       4       161 X&lt;&gt; 25       Testing cycle         115       166 K       161 X&lt;&gt; 25       Testing cycle         115       161 X&lt;&gt; 25       Testing cycle       Testing cycle         116       161 X&lt;&gt; 25       Testing cycle       Testing cycle         117       Testing cycle       Testing cycle       Testing cycle         118       Testing cycle       Testing cycle       Te</y<>				
100 CHS       152 1       Testing cycle         101 20       153 ST+18       154 1 E2         103 10fX       155 ENTER†       156 ENTER†         104 STO 20       157 RCL IND       157 RCL IND         106 1       25       158 X<> 25         108 STO 21       159 RCL 24       160 +         109 X<>Y       166 +       167 RCL 24         109 X<>Y       166 +       163 *         111 -       162 FS? 01       167 RCL 24         109 X<>Y       166 X       25         113 *       164 RCL IND       25         114 STO 22       155       165 +         115 *       166 X       25         117 RTH       166 X       25         121 XEG 01       Initialize test       169 X<> 25         122 A       173 +       172 RCL 1ND         123 XEQ 01       177 X       25         124 XEQ 01       177 X       25         125 P3       133 STO 24       183 GTO 01         136 ENTER†       179 %       183 GTO 01         137 *LBL 01       183 GTO 01       183 GTO 01         136 GTO 02       Set test points       187 /         137 STO 25       Set test points	99 -	·····	151+LBL 02	
101       20       153       ST+       16         102       167       155       ENTER+         104       STO       20       155       ENTER+         105       RDM       156       ENTER+       155       ENTER+         106       1       25       159       RCL       24         106       1       25       159       RCL       24         109       X<>Y       166       +       151       157       RCL       24         109       X<>Y       166       +       167       RCL       24         110       1       161       25       01       168       +         111       -       166       K       25       165       +         113       *       166       X<> 25       25       168       +         119       1       Initialize test       169       X<> 25       25       173       +         120       RCL       21       controls       176       F       27       01       174       X<>>25       175       RCL       24       175       RCL       24       176       177       X<>>25<	100 CHS			Testing cycle
102 *       154 1 E2         103 104X       155 ENTER+         104 STO 20       156 ENTER+         105 RDN       157 RCL IND         106 1       25         108 STO 21       159 RCL 24         109 X(SY)       160 +         111 -       161 X(S) 25         111 -       162 FS? 01         112 4       163 *         113 *       164 RCL IND         114 STO 22       25         115 +       165 +         116 STO 23       166 X(S) 25         117 RTN       167 RCL 24         120 RCL 22       controls         121 XEQ 01       171 *         122 XEQ 01       173 +         123 RCL 21       25         124 XEQ 01       173 +         125 STO 25       177 RT/S FS? 01         133 STO 24       183 +         134 RCL 23       182 FS? 01         135 STO 25       Set test points         136 GTO 02       184 Rt         137 STO 25       Set test points         138 CF 01       186 /         134 RCL 24       190 Rt         140 RDN       188 + LBL 01         14141 STO 24       189 FRC <tr< td=""><td>101 20</td><td></td><td></td><td></td></tr<>	101 20			
103       107X       155       ENTER†         104       STO 20       156       ENTER†         105       RDN       157       RCL IND         106       1       25       159       RCL 24         109       STO 21       159       RCL 24       160         109       X(>Y       166       +       161       X(> 25         110       1       161       X(> 25       01       157       RCL 1ND         111       -       162       FS?       01       167       RCL 24       168       -         113       *       164       RCL 1ND       167       RCL 24       168       -       168       -       167       RCL 24       171       *       168       -       167       RCL 24       171       *       167       RCL 24       171       *       172       RCL 24       173       +       172       RCL 24       173       +       173       *       175       RCL 24       175       RCL 24       175       RCL 24       177       *	102 *			
104 ST0 20       156 ENTER†         105 RDN       25         107 -       158 X<> 25         108 ST0 21       159 RCL 24         109 X<>Y       160 +         111 -       162 FS? 01         112 4       163 *         113 *       164 RCL IND         114 *       164 RCL IND         115 +       165 +         116 ST0 23       166 +         117 RTN       166 ×         120 RCL 22       controls         171 RTN       166 ×         121 XEQ 01       171 *         122 XEQ 01       177 *         123 RCL 21       25         124 XEQ 01       177 *         125 S       177 RTN         122 4       172 RCL IND         123 RCL 21       25         124 XEQ 01       173 +         125 S       174 X<> 25         126 ENTER†       175 RCL 24         127 Ø       178 FS? 01         133 STO 24       181 +         134 RCL 23       188 RCL 1ND         133 STO 24       188 FC         138 CF 01       188 FC         139 STO 25       Set test points         187 /       189 FC </td <td>103 10†X</td> <td></td> <td></td> <td></td>	103 10†X			
105 RDN       157 RCL IND         106 1       25         107 -       158 X<> 25         108 STO 21       159 RCL 24         109 X<>Y       160 +         111 -       161 X<> 25         111 -       162 FS? 01         112 4       163 *         113 *       164 RCL IND         114 STO 22       25         115 +       165 +         116 RTN N       167 RCL 24         118 * LBL 04       167 RCL 24         119 1       Initialize test         120 RCL 22       controls         177 f *       177 s? 01         122 4       172 RCL IND         123 RCL 21       25         124 XEQ 01       177 +         128 XEQ 01       177 x<> 25         130 ENTER†       179 *         133 STO 24       180 RCL IND         133 STO 25       181 +         134 RCL 23       181 +         135 RCL 24       182 FS? 01         136 GTO 02       184 R†         137 HBN       189 FRC         138 CF 01       186 /         134 RCL 24       189 FRC         140 RDN       188+LBL 01         141 SF 061<	104 STO 20			
106 1       25 $325$ $325$ 107 -       158 $358$ $352$ 108       STO 21       158 $358$ $352$ 109 $358$ $358$ $25$ 159         101       1       160       +       160       +         111       -       162 $557$ 01       161         113       *       164       RCL       IND       165       +         114       STO 23       165       +       166 $4525$ 165       +         118       HB4       Initialize test       1667       RCL 24       171       *       122       172       RCL 24       173       *       121       XEQ 01       173       *       122       7       *       123       174       X       25       174       X       25       174       X       25       175       RCL 24       176       R       180       RCL 1ND       181       *       183       STO 25       183       RCL 1ND				
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				
108       STO 21       159       RCL 24         109       X $\langle \rangle Y$ 160       +         110       1       160       +         111       -       162       FS? 01         1112       4       163       *         113       *       164       RCL 1ND         114       STO 22       165       +         115       +       165       +         116       STO 23       166       +         117       RTN        168       +         119       1       Initialize test       169       X<> 25         120       RCL 21       25       177       *         122       A       171       *       172         123       RCL 21       25       177       *         124       XEQ 01       177       *       25         126       ENTER†       179       *       174         129       3       177       *       25         133       STO 25       183       GTO 01       184         134       STO 25       188       188       *         140				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
110       1       161 $X \le 25$ 111       -       161 $X \le 25$ 113       *       163       *         113       *       164       RCL       IND         114       STO 22       25       165       +         115       -       167       RCL 24       168         117       RTH       -       167       RCL 24         118       Initialize test       167       FS?       01         120       RCL 22       controls       170       FS?       01         121       XEQ 01       173       +       172       RCL 1ND         122 4       171       *       174       X<<> 25       25         124       XEQ 01       175       +       177       *       178       FS?       01         132       RCL 23       177       *       180       RCL IND       25       181       +       182       182       FS?       01       133       STO 25       181       +       184       Rt       +       184       Rt       +       185       RCL 20       185       RCL 20       183       Analyze su				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
112 4       163 *         113 *       164 RCL IND         114 \$TO 22       25         115 +       166 $\times$ 115 +       166 $\times$ 116 \$TO 23       166 $\times$ 117 RTN          118 + L8L 04       168 +         119 1       Initialize test         120 RCL 22       controls         121 XEQ 01       171 $\times$ 122 4       172 RCL IND         123 RCL 21       25         126 ENTER†       177 $\times$ 127 0       175 RCL 24         128 XEQ 01       177 $\times$ 129 3       178 FS? 01         130 ENTER†       179 $\times$ 131 XEQ 01       25         133 STO 24       180 RCL IND         135 STO 25       183 GTO 01         138 CF 01       185 RCL 20         139 STO 25       Set test points         143 SF 01       190 R†         141 STO 24       190 R†         143 SF 01       192 INT         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       194 X< <y< td="">         147 XEQ 02       195 FS? 01         1</y<>				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
114       STO 22       25         115       +       165       +         116       STO 23       167       RCL 24         118       H       Initialize test       167       RCL 24         119       Initialize test       168       +       168         120       RCL 22       controls       170       FS? 01         121       XEQ 01       171       *       167         122       4       172       RCL 10       177         123       RCL 21       25       174       X         124       XEQ 01       177       7       +         125       5       176       +       +         126       ENTER†       177       X       25         126       ENTER†       177       Y       +         130       ENTER†       177       Y       180       RCL IND         132       0       25       181       +       182       FS? 01         135       STO 25       181       +       182       FS? 01       183       Hall       Analyze sum         140       RDN       189       FRC       189				
115 +       165 +         117 RTN          118+LBL 04       Initialize test       166 $X <> 25$ 120 RCL 22       controls       167 FS? 01         121 XEQ 01       171 *         122 4       172 RCL 1ND         123 RCL 21       173 +         124 XEQ 01       175 +         125 5       173 +         126 ENTER†       177 KCL 24         127 0       176 +         128 XEQ 01       176 FS? 01         130 ENTER†       177 KSS? 01         132 0       181 +         133 STO 24       183 GTO 01         134 RCL 23       184 R†         137 +LBL 01       188 RCL 20         138 CF 01       189 FRC         139 STO 25       Set test points         140 RDN       189 FRC         142 XEQ 02       190 R†         143 SF 01       199 A         144 RCL 24       193 4 $<>>Y         145 CHS       192 INT         145 CHS       193 4         146 STO 24       195 FS? 06         148 RCL 24       193 4         149 CHS       195 FS? 06         149 CHS       196 GTO 061         149 $				
116       STO       23         117       RTN          18*LBL       04         119       Initialize test       167         120       RCL       22         controls       170       FS?         121       XEQ       01         122       4       171         122       4       171         123       RCL       21         124       XEQ       01         124       XEQ       01         124       XEQ       01         125       174       X<> 25         126       ENTER†       177         129       3       177         130       ENTER†       179         131       XEQ       01         132       0       25         133       STO 25       183         134       Rt       182         137       F01       185         138       CF 01       185         137       Set test points       187         140       RDN       189         141       STO 24       190         143       SF 01				
117 RTN        167 RCL 24         118+LBL 04       Initialize test       168 +         119 1       Initialize test       168 +         120 RCL 22       controls       170 FS? 01         121 XEQ 01       171 *       123 RCL 21         123 RCL 21       25       173 +         124 XEQ 01       175 RCL 24       125         126 ENTER†       176 +       25         128 XEQ 01       176 +       25         129 3       176 +       25         130 ENTER†       179 *       180 RCL IND         132 0       25       183 GTO 01         132 0       188 FS? 01       186 /         135 STO 25       183 GTO 01       186 /         137 +LBL 01        184 Rt         138 CF 01       186 /       189 FRC         139 STO 25       Set test points       189 FRC         144 RDN       190 Rt       191 R         144 STO 24       192 INT       192 INT         143 SF 01       191 *       193 4         144 RCL 24       192 INT       193 4         144 RCL 24       195 FS? 00       191 4         144 RCL 24       195 FS? 00       1				
118+LBL 04       Initialize test       168 +         119 1       Initialize test       169 $X \le 25$ 120 RCL 22       controls       170 FS? 01         121 XEQ 01       177 FS? 01       171 *         122 4       172 RCL IND       25         126 ENTER1       177 X <> 25       176 FS? 01         124 XEQ 01       177 X <> 25       176 FS? 01         127 0       177 FCL 24       177 FCL 24         128 XEQ 01       177 FS? 01       177 FS? 01         130 ENTER1       179 *       178 FS? 01         132 0       180 RCL IND       25         133 STO 24       181 +       182 FS? 01         135 STO 25       183 GTO 01       183 GTO 01         136 GTO 02       184 Rt       185 RCL 20         138 CF 01       Set test points       186 /         140 RDN       Set test points       189 FRC         143 SF 01       191 *       193 4         144 RCL 24       192 INT       193 4         143 SF 01       193 4       194 X<>Y         144 RCL 24       195 FS? 00       194 X<>Y         147 XEQ 02       195 FS? 00       194 Y         149 CHS       196 GTO 01       196 GTO 01				
119 1 120 RCL 22 121 XEQ 01 121 XEQ 01 122 4 123 RCL 21 124 XEQ 01 125 5 126 ENTER1 127 0 138 XEQ 01 130 ENTER1 132 $0$ 139 STO 25 138 CF 01 138 CF 01 138 CF 01 137 +LBL 01 137 +LBL 01 138 CF 01 138 CF 01 138 SF 01 144 RCL 24 137 +LBL 01 138 SF 01 146 STO 24 143 SF 01 144 RCL 24 145 CHS 146 STO 24 146 STO 24 146 STO 24 147 XEQ 02 149 RCL 24 149 CHS 149 CHSInitialize test controls169 X<> 25 170 F 170 F 171 R 171 R 172 RCL IND 25 173 + 173 F 175 RCL 24 177 X<> 25 177 X<> 25 180 RCL IND 25 181 + 187 CHS 187 C 188 +LBL 01 187 C 188 +LBL 01 187 C 190 R 190 R 190 R 191 R 191 R 191 R 193 4 194 X<>Y 193 4 195 FS? 00 196 GTO 01 197 X>Y?Analyze sum				
120       RCL       22       controls       170       FS?       01         121       XEQ       01       171       *       172       RCL       117       *         123       RCL       21       173       *       174       RCL       180         124       XEQ       01       174 $X <> 25$ 25       176       +       177       *		Initialize test		
121       XEQ 01       171       *         122       4       172       RCL 1ND         123       RCL 21       25       173       +         125       5       174       X<> 25       25         126       ENTER†       175       RCL 24       176         127       0       177       X<> 25       25         126       ENTER†       177       X<> 25       25         129       3       178       FS? 01       179         130       ELQ 01       179       *       180       RCL IND         132       0       25       183       GTO 01       189       RCL IND         132       0       25       183       GTO 01       184       Rt         133       STO 25       184       Rt       185       RCL 20       186       187         139       STO 25       Set test points       187       188       LBL 01       189       RC       Analyze sum         141       STO 24       190       Rt       191       *       144       RCL 24       192       INT         144       STO 24       193       193 <t< td=""><td></td><td>· · · · · · · · · · · · · · · · · · ·</td><td></td><td></td></t<>		· · · · · · · · · · · · · · · · · · ·		
122 4 $172$ RCL IND $123$ RCL 21 $25$ $124$ XEQ 01 $173$ + $125$ 5 $174$ X<> 25 $126$ ENTER† $175$ RCL 24 $127$ 0 $177$ X<> 25 $128$ XEQ 01 $177$ X<> 25 $129$ 3 $177$ X<> 25 $120$ 8 $177$ X<> 25 $129$ 3 $177$ X<> 25 $129$ 3 $177$ X<> 25 $130$ ENTER† $179$ * $131$ XEQ 01 $177$ X<> 25 $132$ 0 $125$ $133$ STO 24 $181$ + $134$ RCL 23 $181$ + $135$ STO 25 $183$ GTO 01 $138$ CF 01 $184$ R↑ $137 + LBL$ 01 $186 /$ $138$ STO 25       Set test points $187 /$ $188 + LBL$ 01 $141$ STO 24 $190$ R↑ $142$ XEQ 02 $190$ R↑ $143$ SF 01 $191$ * $144$ RCL 24 $192$ INT $144$ STO 24 $193$ 4 $144$ SCHS $193$ 4 $146$ STO 24 $194$ X<>Y $147$ XEQ 02 <td< td=""><td></td><td>concrois</td><td></td><td></td></td<>		concrois		
123       RCL 21       25         124       XEQ 01       173 +         125       173 +       174 X<> 25         126       ENTER1       177 K<> 25         129       176 +       177 X<> 25         129       178 FS? 01       178 FS? 01         130       ENTER1       180 RCL IND         132       0       25         133       STO 24       180 RCL IND         134       RCL 23       182 FS? 01         135       STO 25       183 GTO 01         136       GTO 02       184 Rf         137*LBL 01        184 Rf         139       STO 25       Set test points         140       RDN       189 FRC         141       STO 24       190 Rf         142       XEQ 02       190 Rf         144       RCL 24       191 *         144       RCL 24       193 4         145       CHS       193 4         146       STO 24       194 X<>Y         143       SF 01       193 4         144       RCL 24       195 FS? 00         148       RCL 24       195 GTO 01         149				
$124 \ XEQ \ 01$ $173 \ +$ $125 \ 5$ $173 \ +$ $126 \ ENTER^{+}$ $177 \ RCL \ 24$ $127 \ 0$ $177 \ RCL \ 24$ $127 \ 0$ $177 \ RCL \ 24$ $129 \ 3$ $177 \ RCL \ 24$ $129 \ 3$ $177 \ RCL \ 24$ $130 \ ENTER^{+}$ $177 \ RCL \ 24$ $130 \ ENTER^{+}$ $177 \ RCL \ 25$ $130 \ ENTER^{+}$ $179 \ R$ $131 \ XEQ \ 01$ $180 \ RCL \ IND$ $132 \ 0$ $25$ $133 \ STO \ 24$ $181 \ +$ $136 \ GTO \ 02$ $188 \ RCL \ 20$ $138 \ CF \ 01$ $188 \ RCL \ 20$ $139 \ STO \ 25$ Set test points $187 \ /$ $189 \ RC$ $141 \ STO \ 24$ $199 \ R^{+}$ $142 \ XEQ \ 02$ $199 \ R^{+}$ $143 \ SF \ 01$ $191 \ R$ $144 \ RCL \ 24$ $192 \ INT$ $145 \ CHS$ $193 \ 4$ $146 \ STO \ 24$ $194 \ X < Y$ $147 \ XEQ \ 02$ $195 \ FS? \ 00$ $148 \ RCL \ 24$ $1996 \ GTO \ 01$ $149 \ CHS$ $197 \ X > Y?$ <td></td> <td></td> <td></td> <td></td>				
125       5         126       ENTER†         127       0         128       XEQ 01         129       3         130       ENTER†         131       XEQ 01         132       0         133       STO 24         134       RCL 23         135       STO 25         138       CF 01         139       STO 25         140       RDN         141       STO 24         143       SF 01         144       RCL 24         157       Set test points         180       RCL 20         181       +         142       XEQ 02         143       SF 01         144       RCL 24         190       R†         143       SF 01         144       RCL 24         190       R†         145       CHS         146       STO 24         191       *         142       XEQ 02         190       R†         144       RCL 24         191       *         144       RCL				
126       ENTER1       175       RCL 24         127       0       176       +         128       XEQ 01       177       X<> 25         129       3       177       X<> 25         130       ENTER1       179       *         131       XEQ 01       179       *         132       0       25       178       FS? 01         132       0       25       181       +         133       STO 24       181       +       182       FS? 01         135       STO 25       183       GTO 01       184       R1         136       GTO 02        184       R1          138       CF 01       185       RCL 20       186 /          138       CF 01       186 /       187 /          140       RDN       188       187 /          141       STO 25       Set test points       187 /          144       RCL 24       199       R1       4				
127 0       176 +         128 XEQ 01       176 +         129 3       178 FS? 01         130 ENTER†       179 *         131 XEQ 01       180 RCL IND         132 0       181 +         133 STO 24       181 +         134 RCL 23       182 FS? 01         135 STO 25       183 GTO 01         136 GTO 02       184 R†         137*LBL 01       186 /         138 CF 01       186 /         139 STO 25       Set test points         140 RDN       188+LBL 01         141 STO 24       189 FRC         143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       195 FS? 00         148 RCL 24       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
128       XEQ       01 $177$ X<> 25         129       3 $178$ FS?       01         130       ENTER↑ $179$ *         131       XEQ       01 $179$ *         132       0 $180$ RCL       IND         132       0 $180$ RCL       IND         133       STO 24 $181$ + $180$ RCL       IND         133       STO 25 $183$ GTO 01 $184$ R↑ $137^+$ LBL $186$ /         137       +LBL       01 $185$ RCL 20 $188$ $186^ 188^+$ LBL $190$ $186^+$ $190$ $189^+$ $190$ $110^+$ $1100^+$ $110^+$ $1100^+$ <td></td> <td></td> <td></td> <td></td>				
129 3       178 FS? 01         130 ENTER†       179 *         131 XEQ 01       179 *         132 0       180 RCL IND         132 0       25         133 STO 24       181 +         134 RCL 23       181 +         135 STO 25       183 GTO 01         136 GTO 02       184 R†         137 * LBL 01       185 RCL 20         138 CF 01       186 /         139 STO 25       Set test points         140 RDN       189 FRC         141 STO 24       190 R†         142 XEQ 02       190 R†         143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       195 FS? 00         148 RCL 24       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
130       ENTER†       179 *         131       XEQ 01       180       RCL IND         132       0       25         133       STO 24       181 +         135       STO 25       183       GTO 01         136       GTO 02       183       GTO 01         136       GTO 02       184       R↑         137*LBL 01       185       RCL 20       184         138       CF 01       186 /       187 /         139       STO 25       Set test points       187 /         140       RDN       188*LBL 01          141       STO 24       190       R↑         143       SF 01       199       R↑          143       SF 01       191 *       4         143       SF 01       191 *       192       Analyze sum         144       RCL 24       192       193 4       4         145       CHS       193 4       194       X<>Y         147       XEQ 02       195       FS? 00       194       195         148       RCL 24       196       GTO 01       197       X>Y?         149 </td <td></td> <td></td> <td></td> <td></td>				
131 XEQ 01       180 RCL IND         132 0       25         133 STO 24       181 +         134 RCL 23       181 +         135 STO 25       183 GTO 01         136 GTO 02       184 R <sup>↑</sup> 137*LBL 01       185 RCL 20         138 CF 01       186 /         139 STO 25       Set test points         140 RDN       188*LBL 01         141 STO 24       189 FRC         142 XEQ 02       190 R <sup>↑</sup> 143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       194 X<>Y         147 XEQ 02       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
132 0       25         133 STO 24       181 +         134 RCL 23       181 +         135 STO 25       183 GTO 01         136 GTO 02       184 R↑         137*LBL 01       185 RCL 20         138 CF 01       186 /         139 STO 25       Set test points         140 RDN       188*LBL 01         141 STO 24       189 FRC         142 XEQ 02       190 R↑         143 SF 01       191 *         144 RCL 24       191 *         145 CHS       193 4         146 STO 24       195 FS? 00         148 RCL 24       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
133       STO 24       181 +         134       RCL 23       182 FS? 01         135       STO 25       183 GTO 01         136       GTO 02       184 R†         137+LBL 01       185 RCL 20         138       CF 01       186 /         139       STO 25       Set test points       186 /         140       RDN       188+LBL 01       Analyze sum         144       SF 01       191 *       191 *         143       SF 01       191 *       193 4         144       RCL 24       193 4       193 4         145       CHS       193 4       194 X<>Y         147       XEQ 02       195 FS? 00       196 GTO 01         148       RCL 24       196 GTO 01       197 X>Y?				
134       RCL 23       182       FS? 01         135       STO 25       183       GTO 01         136       GTO 02       184       R↑         137+LBL 01       185       RCL 20       186 /         139       STO 25       Set test points       186 /         140       RDN       188+LBL 01       188+LBL 01         141       STO 24       189       FRC         142       XEQ 02       190       R↑         143       SF 01       191       *         144       RCL 24       192       INT         145       CHS       193       4         146       STO 24       195       FS? 00         148       RCL 24       196       GTO 01         149       CHS       197       XY?				
135       STO       25         136       GTO       02         137*LBL       01       183         137*LBL       01       184         137*LBL       01       185         138       CF       01         139       STO       25         140       RDN       186         141       STO       24         142       XEQ       02         143       SF       01         143       SF       01         144       RCL       24         143       SF       01         144       RCL       24         145       CHS       193         146       STO       24         147       XEQ       02         148       RCL       24         147       XEQ       02         148       RCL       24         149       CHS       196         149       CHS       197         149       CHS       197         149       CHS       197				
136 GTO 02        183 GTO 01         137*LBL 01        184 R†         138 CF 01       185 RCL 20         139 STO 25       Set test points       186 /         140 RDN       188*LBL 01         141 STO 24       189 FRC         142 XEQ 02       190 R†         143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
137*LBL 01       138 CF 01       185 RCL 20         138 CF 01       186 /         139 STO 25       Set test points       186 /         140 RDN       188*LBL 01         141 STO 24       189 FRC         142 XEQ 02       190 R↑         143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
138       CF 01       139       Set test points       186          140       RDN       187        188*LBL 01         141       STO 24       189       FRC       Analyze sum         142       XEQ 02       190       R↑       191         143       SF 01       191       *       192       INT         144       RCL 24       192       INT       193       4         145       CHS       193       4       194       X<>Y         147       XEQ 02       195       FS? 00       196       GTO 01         149       CHS       197       X>Y?       INT       INT				
139       Stet test points       187 /         140       RDN       188*LBL 01         141       STO 24       189         142       XEQ 02       190         143       SF 01       191         144       RCL 24       192         145       CHS       193         146       STO 24       193         148       RCL 24       195         148       RCL 24       196         149       CHS       197         149       CHS       197				
140 RDN       187         141 STO 24       188*LBL 01         141 STO 24       189 FRC         142 XEQ 02       190 R↑         143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?		Set test points		
141 STO 24       189 FRC       Analyze sum         142 XEQ 02       190 R↑       191 *         143 SF 01       191 *       191 *         144 RCL 24       192 INT       193 4         145 CHS       193 4       194 X<>Y         146 STO 24       195 FS? 00       195 FS? 00         148 RCL 24       196 GTO 01       197 X>Y?		-		
142       XEQ       02       190       R↑         143       SF       01       191       *         144       RCL       24       192       INT         145       CHS       193       4         146       STO       24       194       X<>Y         147       XEQ       02       195       FS?       00         148       RCL       24       196       GTO       01         149       CHS       197       X>Y?       X				
143 SF 01       191 *         144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       194 X<>Y         147 XEQ 02       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				Analyze sum
144 RCL 24       192 INT         145 CHS       193 4         146 STO 24       194 X<>Y         147 XEQ 02       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
145 CHS       193 4         146 STO 24       194 X<>Y         147 XEQ 02       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
146 STO 24       194 X<>Y         147 XEQ 02       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
147 XEQ 02       195 FS? 00         148 RCL 24       196 GTO 01         149 CHS       197 X>Y?				
148 RCL 24 149 CHS 197 X>Y?				
149 CHS 197 X>Y?				
100 010 24 <u></u> 198 RIN				
	100 010 24		198 KIN	

100 CTO 00			
199 GTO 02		250 FS? 00	
200+LBL 01		251 X<>Y	
201 5	Analyze player	252 FS? 01	
202 /	sum	253 STO 20	
203 "YOU WIN	4	253 510 20 254 RCL 20	
	4		
204 X=Y?		255+LBL 05	
205 PROMPT	Player wins	256 XEQ 19	Find move
206 FRC	LIGYEL WINS	257 X<> 25	ring move
200 FRC 207 X≠0?		258 RCL 24	
207 A+07 208 RTN		259 +	
200 KIN 209 LASTX		260 X<> 25	
		261 1 E-2	
210+LBL 02	1_	262 FS? 00	
211 RCL 17	Test tactical	263 1/X	
212 X>Y?	status	264 RCL 20	
213 RTN		265 FS? 01	
214 X<>Y	4	266 *	
215 SF 02		267 GTO 05	
216 STO 17		267 GTU 03 268+LBL 20	
217 FC? 00			
218 SF 03	1	269 16	
219 RCL 18		270 STO 20	Strategic play
220 STO 16		271 4	
221 RTN		272 STO 25	
222+LBL 21		273 1	
		274 STO 24	
223 1 224 PCL 22		275 XEQ 07	
224 RCL 22		276 2	
225 GTO 01		277 XEQ 07	
226+LBL 22		278 3	
227 4		279 XEQ 07	
228 RCL 21		280 0	
229 GTO 01		281 XEQ 08	
230+LBL 23		281 AEG 08 282 RCL 22	
231 5			
232 ENTER↑			
233 0		284 STO 24	
234 GTO 01		285 *	
235+LBL 24		286 STO 23	
236 3		287 16	
238 3 237 ENTER↑		288 STO 20	
237 ENTERT		289 1	
238 GTU 01 239+LBL 25		290 XEQ 08	
		291 2	1
240 SF 01		292 XEQ 08	
241 0		293 3	
242 RCL 23	Tactical play	294 XEQ 08	
243+LBL 01	pray	295 0	
244 STO 25		296 XEQ 08	
245 RDN		297 RCL 22	
246 STO 24		297 RCL 22 298 RCL 23	
247 1 E2		298 RUL 23 299 +	
248 ENTER↑			
249 1 E8	L	300 STO 25	<u></u> _

301+LBL 09		· · · · · · · · · · · · · · · · · · ·	
	Find move	348 INT	
302 RCL IND		349 RCL 20	
25		350 X<=Y?	
303 RCL 24		351 RTN	
304 X<=Y?		352 RDN	
305 GTO 01		353 STO 20	
306 RCL 25		354 RDN	
307 2		355 STO 22	
308 /			
309 FRC		356 RTN	
310 X=0?		357+LBL 02	
311 GTO 02		358 1 E2	Find empty space
312 GTO 03		359 XEQ 19	a find compety optice
313+LBL 01		360 1 E4	
		361 XEQ 19	
314 RCL 25	Reset reg. #	362 1 E8	
315 +		363 XEQ 19	
316 16		364+LBL 03	
317 X>Y?		365 1 E6	
318 CLX	•	366 XEQ 19	
319 -			
320 STO 25		367 1 E4	
321 GTO 09		368 XEQ 19	
322+LBL 08		369 1 E2	
323 STO 25		370 XEQ 19	
324+LBL 07	Find total moves	371 1 E8	
		372+LBL 19	
325 RCL IND		373 STO 20	
25		374 RCL IND	
326 X<> 25		25	Check/store move
327 RCL 24		375 *	
328 +		376 INT	
329 X<> 25		377 1 E2	
330 RCL IND		378 /	
25			
331 +		379 FRC	
332 X<> 25		380 X≠0?	
333 RCL 24		381 RTN	
334 +		382 RCL 20	
335 X<> 25		383 1/X	
		384 ST+ IND	
336 RCL IND		25	
25		385 LOG	
337 +		386 2	
338 X<> 25		387 /	
339 RCL 24		388 5	
340 +		389 +	
341 X<> 25		390 RCL 25	
342 RCL IND			
25		391 4	
343 +		392 /	
344 X<> 25		393 INT	
344 AV 23 345 RCL 24		394 LASTX	
		395 FRC	
346 +		396 4	<b>1</b>
347 X<> 25			

14

397 *		51	
398 1			
399 ST+ IND			
25			
400 +			
401 X<>Y			
402 1			
403 +	Place in XYZ		-1
404 10			_
405 *	form		
406 +		60	
407 10			-
			-1
408 *		·	
409 +			
410 CLA			
			-1
411 ARCL X			-1
412 1 E3			4
413 /			]
414 FS?C 02			7
415 GTO 01			-1
		70	-1
416 STO 18		70	
417 RCL 17			
418 3			7
419 X>Y?			-1
			4
420 GTO 01			
421 FC? 03			
422 GTO 01			7
423 "F, I WI			-1
			-4
N"			
424 AVIEW	41C wins		
425 GTO A	_	80	
426+LBL 01			
427 ASTO X			
428 "MY MOVE			
: "			7
429 ARCL X			
430 AVIEW	1		
431 GTO A	Cot nort -lamor		
	Get next player		
432 .END.	move		7
	1		-
40	1		-4
	•	90	J
	Į		1
			7
	1		-
			_ I
	Į		]
			7
			4
			-l 1
			1
			7
50		00	
50			

### <sup>16</sup> REGISTERS, STATUS, FLAGS, ASSIGNMENTS

	DATA F	EGISTERS				STA	TUS		
00	Board	50	ENG		26 TOT. R 	SCI	I	ON	
05		55		INIT	SET IND		AGS		DICATES
			# 00	S/C	Used	CATE	<u> </u>	CLEAR IN	DICATES
			00		Used				
			02		Used				
10		60	03		Used				
15	V	65							
	Test #								
	Tactic status								
	mach. move							· · · · · · · · · · · · · · · · · · ·	
00	player move Used	70							
20	<u>Y-1</u>	70							
ļ	Z-1								
	Register #						<u> </u>		
	Position Inc.								
25	Used	75							
23								· · · · ·	
	»								
30		80							
35		85							
					A	SSIGN	IMENT	ſS	
				UNCT	ION	KEY	Fl	INCTION	KEY
40		90							
							<b> </b>		
ļ							ļ		
					<b> </b>		<b> </b>		
45	·····	95							
L								·····	
I							<b> </b>		
L	L				L		L		- L

### ROBOT TRAP

#### (Requires at least 1 Memory Module)

You move your android to any adjacent square on a 10 x 10 playing board studded with destructive force fields and up to 49 enemy robots in such a way as to lure the robots into their own electronic booby traps and save the android. The robots will always close on the android, moving to the square adjacent to their present position which is nearer to the row and column position of the android, and will team up to destroy him. The android, like the robots, is destroyed by moving into a force field, and the android is also destroyed by colliding with a robot. If robots collide all but one involved are destroyed. You choose the initial number of robots. The number of force fields is equal to the initial number of robots plus one. Even a few robots can be challenging and the more robots the more difficult. All initial positions are randomly generated.

If you move the android into a force field you will see "ZAP" then "TOO BAD". If you move the android into a robot you will see "STOMP" then "TOO BAD". If a robot stumbles into a force field you will see "STUMBLE". And, if robots hit, you will see "BUMP". Finally, if all robots are destroyed, you will see "YOU WIN".

The board is set up as below:

Y



Х

Board positions are denoted as x.y. The android shown is at 7,2. To move the android use the digits keys to specify directions as follows:

l - down and left	6 - right
2 - down	7 – up and left
3 - down and right	8 - up
4 - left	9 - up and right
5 - no movement	

Note: Do not move off the board. Execution ti program increase with the initial number	
Example: Try to destroy robots.	
Keystrokes:	Display:
[XEQ] [ALPHA] SIZE [ALPHA] 014	
[XEQ] [ALPHA] RT [ALPHA]	SEED?
.12569 [R/S]	NO. OF ROBOTS
3 [R/S]	F.F. AT 7,8
[R/S]	F.F. AT 7,1
[R/S]	F.F. AT 3,6
[R/S]	F.F. AT 3,3
[R/S]	ROBOT AT 6,8
[R/S]	ROBOT AT 0,6
[R/S]	ROBOT AT 7,9
[R/S]	ANDROID: 6,1
3 [R/S]	STUMBLE
	ROBOT AT 7,7
[R/S]	ROBOT AT 1,5
[R/S]	ANDROID: 7,0
4 [R/S]	ROBOT AT 6,6
[R/S]	ROBOT AT 2,4
[R/S]	ANDROID: 6,0
	•
•	•

## **User Instructions**

	·			SIZE: 6+
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program.			
2	Initialize.		[XEQ] RT	SEED?
3	Key in a seed between 1 and 0 for the			
	random number generator.	8	[R/S]	NO.OF ROBOTS
4	Key in the number of robots you wish.	n	[R/S]	SET SIZE (NN
5	Set size specified.		[XEQ] SIZE (NNN)	
	(If size was already set at or above		[R/S]	
	specified, the program will skip that			
	prompt.)			F.F. AT ()
6	Continue pressing [R/S] to see the rest of		[R/S]	•
	the force field and robot placements until		•	
	the android placement appears.		[R/S]	ANDROID: (
7	Move the android (only when "ANDROID: ( )"			
	is in display).	direction	[R/S]	ROBOT AT (
8	Go to 6 to see the rest of the robot			
	placements and new android placement.			
9	For a new game		[E]	NO. OF ROBO
10	Go to step 4.			
*	Force field placements are only output at			
	the beginning of the game.			

01+LBL "FT"       49+LBL 00       Get positions         02 SF 27       Initialize       50 RCL 04       Get positions         03 "SEED?"       64 FCR       51 100       Get positions         04 PROMPT       53 10       53 10       Get positions         05 STO 00       65 Sto 00       53 10       Get positions         06 PROMPT       57 X=Y?       Make sure no two         09 STO 03       57 X=Y?       Make sure no two         11 *       Calculate SIZE       60 DSE Y         13 +       Galculate SIZE       63 1         14 6       62 STO IND       See STO 03         15 +       63 1       63 1         16 "SET SIZ       63 1       Get positions         17 FIX 0       64 ST+ 04       Get positions         18 CF 29       67 FIX 1       Get positions         23 STO IND       See if reg.       71 ASTO 03         24 FC?C 25       73 KEQ 10       Output P.P's once         27 1 E3       76 "F.S."       Get positions         24 FC?C 25       73 KEQ 10       Output Robots         31 +       83 RCL 03       84 RN ROBOD "         32 STO 02       81 ARCL 05       90 WIPH Robots         33 RCL 03 <th></th> <th></th> <th></th> <th></th> <th></th>					
$02 + 3F + 27$ Initialize $33 + 100$ $04 + PROMPT$ $52 \times EQ + 99$ $53 + 100$ $04 + PROMPT$ $52 \times EQ + 99$ $53 + 100$ $06 + LBL = E$ $54 + 4$ $54 + 4$ $07 + NO. OF$ $55 + LBL + 11$ $56 + RCL + IND$ $09 + STO + 03$ $57 \times SP7$ $57 \times SP7$ $09 + STO + 03$ $58 + GTO + 00$ $are + be same$ $11 + 2$ $6a + STE + 04$ $61 + GTO + 11$ $12 + 1$ $6a + STE + 04$ $65 + SC + 03$ $13 + 16 + 512$ $63 + 1$ $63 + 78 + 04$ $16 + SET + SI2$ $64 + STE + 04$ $65 + SC + 03$ $11 + 20 + SF + 52$ $66 + CTO + 00$ $67 + F + 5 + 04$ $12 - 2 + 2 - 2$ $66 + CTO + 01$ $70 + F + F + 100$ $22 - 2 + 2 + 25 + 25 + 25 + 25 + 25 + 25$	01+LBL "RT"			Cet	
03 "SEED?"       Nutreative       51 1000         04 PROMPT       52 XEQ 99         05 STO 00       53 10         06-LBL E       53 10         07 "NO. OF       55 ELL 11         09 STO 03       56 RCL IND         09 STO 03       57 X=Y?         09 STO 03       57 X=Y?         11 *       Calculate SIZE         60 DSE Y       61 GTO 11         14 6       62 STO IND         15 +       63 1         16 "SET SIZ       63 1         17 FIX 0       66 GTO 00         18 CF 29       67 FIX 1         19 ARCL X       67 FIX 1         20 SF 25       68 CF 28         21 1       76 "F.F."         23 STO IND       See if reg.         24 FC?C 25       77 ASTO 03         27 ASTO 03       77 ASTO 03         28 /       72 KEQ 10         29 ST+ 03       77 ASTO 03         31 +       80 "ANDROID         32 STO 04       81 ARCL 05         34 +       82 AVIEW         33 RCL 03       77 "ANDROID         36 +       85 GTO 97         37 STO 01       85 GTO 97         38 FRC       86 FYEE	02 SF 27	Tritializa	50 RCL 04	Get positions	
04       PROMPT         05       STO 00         06+LBL E       53         07       "NO. OF         08       PROMPT         09       STO 00         10       2         11       *         12       1         13       +         14       6         15       *         16       2         11       *         12       1         14       6         15       *         16       *SET SIZ         63       11         16       *SET SIZ         63       1         64       ST 4         63       1         67       FIX         63       1         64       ST 4         65       ISG 03         66       GT 000         17       ARCL X         20       SF 25         21       63         22       -         23       STO 01ND         24       FC? 25         25       PROMPT         26       RCL 03			51 100		
05 STO 00       53 10         06 + LBL E       53 10         07 *NO. OF       55 + LBL 11         08 PROMPT       57 X=Y?         09 STO 03       57 X=Y?         10 2       57 X=Y?         11 *       60 DSE Y         13 +       61 GTO 11         14 6       62 STO IND         15 +       63 1         16 *SET SIZ       63 1         17 FIX 0       64 ST+ 04         18 CF 29       66 GTO 00         19 ARCL X       69 RCL 01         24 FC?C 25       73 + EL 98         21 I       76 * ROBOT "         26 STO 03       77 STO 03         27 I E3       76 * ROBOT "         28 /       77 ASTO 03         29 ST+ 03       78 CF 05         30 6.005       79 XEQ 10         31 +       81 ARCL 05         32 STO 02       81 ARCL 05         33 RCL 03       81 ARCL 05         34 +       83 SF 28         35 GT 097       85 GTO 97         36 HRC       89 TONE 9         37 STO 01       85 GTO 97         38 FRC       89 TONE 9         39 6       87 TONE 9         37 STO 04		1	52 XEQ 99		
06+LEL E       54 /         07 *NO. OF       55+LEL 11         08 PROMPT       56 RCL IND         09 STO 03       57 X=Y?         10 2       58 GTO 00         11 *       61 GTO 01         12 1       61 GTO 11         14 6       62 STO IND         15 +       63 1         16 *SET SIZ       63 1         17 FIX 0       65 ISC 03         18 CF 29       66 GTO 00         19 ARCL X       68 CF 28         21 1       69 RCL 01         20 SF 25       68 CF 28         21 1       70 *F. F. *         23 STO IND       See if reg.         24 FC?C 25       73 LBL 98         25 PROMPT       77 ASTO 03         26 CR CL 03       75 RCL 02         27 1 E3       76 *ROBOT *         28 /       77 ASTO 03         29 ST+ 03       78 CF 05         30 6 6.005       79 XEG 10         31 +       81 ARCL 05         32 STO 02       81 ARCL 05         33 RCL 03       81 ARCL 05         34 +       82 GY 097         35 F0 01       83 SF 28         36 +       87 * ANDROID         37 *		}	53 10		
07       ND. OF ROBOTS"       55*LBL 11         08       PROMPT       57       SE GTO 00         10       2       57       SE GTO 00         11       *       60 DSE Y         13       -       61 GTO 11         14       62 STO IND       63 1         15       *       63 1         16       *SET SIZ       63 1         16       *SET SIZ       63 1         17       FIX 0       66 GTO 00         18       Cf 29       66 GTO 00         19       ARCL X       68 CF 28         21       22       67 FIX 1         23       STO IND       See if reg.         24       FC?C 25       73*EBL 98         24       FC?C 25       74 CF 28         25       PROMPT       0utput F.F's         26       RCL 03       77 ASTO 03         27       1 E3       76 *ROBOT "         32       STO 02       77 ASTO 03         33       RCL 03       81 ARCL 05         34       80       AVIEW         35       801       83 SF 28         36       F28       67 ST         36 <td></td> <td></td> <td></td> <td></td> <td></td>					
R000TS**       56 RCL IND         08 PROMPT       9         09 STO 03       57 X=Y?         10 2       58 GTO 00         11 *       6         12 1       Calculate SIZE         60 DSE Y       66 GTO 01         13 +       63 1         15 +       63 1         16 GTO 11       62 STO IND         17 FIX 0       66 GTO 00         18 CF 29       66 GTO 00         19 ARCL X       67 FIX 1         20 SF 25       68 CF 28         21 1       70 "F.F."         22 -       73*LBL 98         23 STO IND       See if reg.         24 FC?C 25       73*LBL 98         25 PROMPT       74 CF 28         26 ACL 03       78 CF 05         30 6.005       79 XE0 10         31 +       80 "ANDROID         32 STO 02       81 ARCL 05         34 +       82 AVIEW         35 .001       83 SF 28         36 +       84 FS? 05         37 STD 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       90 TONE 9         41 STO 03       88 AVIEW <td></td> <td></td> <td></td> <td></td> <td></td>					
08       PROMPT       9       STO 03       63       57       X=Y?       Make sure no two are the same         11       *       58       GTO 00       are the same       are the same         11       *       61       GTO 11       are the same       are the same         12       1       61       GTO 11       62       STO 1ND       are the same         15       +       61       GTO 11       62       STO 1ND       are the same         16       *SET SIZ       63       1       62       STO 1ND       are the same         16       *SET SIZ       63       1       63       1       are the same         17       FIX 0       64       ST 00       3       are the same       are the same         18       CF 29       66       GT 000       3       are the same       are the same         21       1       20       SF 25       68       CF 28       output F.F's once         21       1       21       73       FC 22       STO 000       output F.F's once       output F.F's once         22       FC 27       25       74       CF 28       output F.F's once       once			1		
09       STO 03       57       X=Y?       Make sure no two are the same         10       2       59       RDN       are the same         12       1       60       DSE Y       are the same         12       1       60       DSE Y       are the same         12       1       61       GTO 11       are the same         14       6       SET SIZ       63       1         15       +       63       1       are the same         15       +       63       1       are the same         16       "SET SIZ       63       63       are the same         17       FIX 0       63       16       GE STO IND       are the same         19       ARCL X       66       GT0 00       are the same       are the same         20       SF 25       66       GT0 00       are the same       are the same         21       1       "GT FIX 1       66       GE GT0 00       are the same       are the same         21       1       "GT FIX 1       66       GE GT 00       are the same       are the same         22       To ST FCL 02       To ST 7       ST CL 02       are the same </td <td></td> <td></td> <td></td> <td></td> <td></td>					
10       2       58       GTO       00       are the same         11       *       Calculate SIZE       59       RDN       are the same         12       1       60       DSE Y       61       GTO       11         14       61       GTO       11       62       STO       IND         13       +       63       1       62       STO       IND         63       16       "SET SIZ"       63       1       64       ST + 04         15       +       63       16       GTO       00       66       GTO       00         19       ARCL X       66       GTO       03       66       GTO       03       01				Make gure no two	
11       *       Calculate SIZE       59 RDN         12       1       60 DSE Y       61 GTO 11         14       6       63 1       62 STO IND         15       +       63 1       63 1         16       "SET SIZ       63 1       63 1         17       FIX 0       64 ST+ 04       67 FIX 1         18       CF 29       66 GTO 00       67 FIX 1         20       SF 25       68 CF 28       67 FIX 1         21       1       70 "F. F. "       71 ASTO 03         22       -       72 XEQ 10       0utput F.F's once         23       STO IND       See if reg.       74 CF 28       0utput F.F's once         24       FC?C 25       72 KEQ 10       0utput Robots       0utput Robots         24       FC?C 25       77 ASTO 03       75 RCL 02       0utput Robots         27       1 E3       76 "ROBOT "       78 CF 05       0utput Robots         31       +       81 ARCL 05       83 SF 28       64       91 MINBROID         32       STO 01       85 GTO 97       86 PSE       86 PSE       87 "ANDROID         38       FRC       86 PSE       87 "ANDROID       84 Fume					
12       1       Calculate SIZE       60 DSE Y         13       +       61 GTO 11         14       6       62 STO IND         15       +       63         16       "SET SIZ       63         17       FIX 0       66 GTO 00         18       CF 29       66 GTO 00         19       ARCL X       67 FIX 1         20       SF 25       68 CF 28         21       1       69 RCL 01         22       -       70 "F. F. "         23       STO IND       See if reg.         exists       72 XEQ 10       Output F.F's once         24       FC?C 25       73+LBL 98       once         24       FC?C 25       73*LBL 98       once         25       PROMPT       74 CF 28       once         26       RCL 03       77 ASTO 03       once         31       -       -       77 ASTO 03       once         32       STO 02       -       -       -       0utput Robots         33       -       81 ARCL 05       85 GTO 97       85 GTO 97       85 GTO 97         38       FRC       86 PSE       87 ANDROID       Safe t				are the same	
12       1       61       GTO       11         14       62       STO       IND         15       +       63       1         16       "SET SIZ       63       1         17       FIX 0       64       ST+ 04         18       CF 29       64       ST+ 04         19       ARCL X       67       FIX 1         20       SF 25       68       CF 28         21       1       70       "F. F."         23       STO IND       See if reg.       71       ASTO 03         25       PROMPT       74       CF 28       once         26       RCL 03       75       RCL 02       once         27       1       E3       76<"ROBOT"		Calculate STZE			
14       6       2       STO IND       83         15       +       63       1       63       1         16       "SET SIZ       63       1       64       ST+04         17       FIX 0       66       GT 000       66       GT 000         19       ARCL X       67       FIX 1       69       RCL 01         20       SF 25       68       CF 28       69       RCL 01         21       1       20       SF 25       68       CF 28         24       FC?C 25       73       HEU 98       0utput F.F's once         25       PROMPT       74       CF 28       once         26       RCL 03       76       RB003       once         27       1       E3       76       R003       once         31       +       33       S0       96       0utput Robots         33       RCL 03       81       ARCL 05 </td <td></td> <td>Carculate Size</td> <td></td> <td></td> <td></td>		Carculate Size			
15       +       63         16       "SET SIZ       63         16       "SET SIZ       63         17       FIX 0       63         18       CF 29       66         19       ARCL X       67         20       SF 25       68       CF 28         21       1       69       RCL 01         22       -       69       RCL 01         23       STO IND       See if reg.       71       ASTO 03         25       PROMPT       74       CF 28       Output F.F's once         26       RCL 03       75       RCL 02       77         27       1 E3       76       "ROBOT"       Output F.F's once         30       6.005       79       XEQ 10       Output Robots         31       +       80       "ANDROID"       Output Robots         33       RCL 03       81       ARCL 05       84         34       +       82       AYIEW       83         35       001       85       GT 97       86         34       +       85       87<"ANDROID					
16       "SET SIZ       63 1         17       FIX 0       64 ST+ 04         18       CF 29       66 GTO 00         19       ARCL X       67 FIX 1         20       SF 25       69 RCL 01         21       1       69 RCL 01         22       -       69 RCL 01         23       STO IND       See if reg.         exists       72 XEQ 10         24       FC?C 25         PROMPT       74 CF 28         26       RCL 03         27       1 E3         28       77 ASTO 03         29       ST+ 03         30       6.005         31       -         32       STO 02         33       82         34       -         35       001         36       6         37       STO 01         38       SF 28         36       -         37       STO 01         38       SF 28         39       6         44       83 SF 28         39       6         40       -         42       S.004 <td>14 6</td> <td></td> <td></td> <td></td> <td></td>	14 6				
E       64 ST+ 04         17 FIX 0       66 GTO 00         18 CF 29       66 GTO 00         19 ARCL X       69 FL 01         20 SF 25       68 CF 28         21 1       69 RCL 01         22 -       71 ASTO 03         23 STO IND       see if reg.         exists       72 XEQ 10         X       72 XEQ 10         24 FC?C 25       73 +LBL 98         25 PROMPT       74 CF 28         26 RCL 03       77 ASTO 03         27 1 E3       76 "ROBOT "         28 /       77 ASTO 03         29 ST+ 03       78 CF 05         30 6.005       80 ADROID         31 +       80 ADROID         32 STO 02       "         33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 001       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         44 100       90 TONE 8         91 TONE 9       91 TONE 9         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       94 RTN         47 (       94	15 +	•			
E       "       64 ST+ 04         17 FIX 0       65 ISG 03         18 CF 29       66 GTO 00         19 ARCL X       67 FIX 1         20 SF 25       69 RCL 01         21 1       70 "F. F. "         23 STO IND       See if reg.         24 FC?C 25       73 LBL 98         25 PROMPT       74 CF 28         26 RCL 03       73 LBL 98         27 1 E3       76 "ROBOT "         28 /       78 CF 05         30 6.005       79 XEQ 10         31 +       80 "ANDROID         32 STO 02       "         33 RCL 03       81 ARCL 05         34 +       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       89 TONE 9         42 5.004       99 TONE 8         43 STO 04       90 TONE 8         45 XEQ 99       92 TONE 7         46 10       94 RTH	16 "SET SIZ	1			
17       FIX 0       65       ISG 03       66       GTO 00         19       ARCL X       67       FIX 1       68       CF 28       69       RCL 01       70       F.F. F.       71       ASTO 03       72       XEQ 10       0utput F.F's       0utput F.F's       0utput F.F's       0cc         24       FC?C 25       FROMPT       74       CF 28       0utput F.F's       0cc       0utput F.F's       0cc         24       FC?C 25       FROMPT       74       CF 28       0utput F.F's       0cc         25       PROMPT       74       CF 28       0utput F.F's       0cc         26       RCL 03       75       RCL 02       76       ROBOT       0utput Robots         29       ST+ 03       78       CF 05       79       XEQ 10       0utput Robots         31       +       80       "ANDROID       0utput Robots       0utput Robots         33       RCL 03       81       ARCL 05       82       94       SF 28       64         34       +       82       AVIEW       83       SF 28       64       95       64       94       64       94       94       94       84       94			1		
18 CF 29       66 GT0 00         19 ARCL X       66 GT0 00         20 SF 25       68 CF 28         21 1       69 RCL 01         22 -       70 "F. F. "         23 STO IND       See if reg.         24 FC?C 25       73 + LBL 98         25 PROMPT       74 CF 28         26 RCL 03       75 RCL 02         27 1 E3       76 "ROBOT "         28 /       77 ASTO 03         29 ST+ 03       78 CF 05         30 6.005       79 XEQ 10         31 +       80 "ANDROID"         32 STO 02       81 ARCL 05         33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 .001       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       88 AVIEW         42 5.004       90 TONE 8         43 STO 04       90 TONE 9         43 STO 04       91 TONE 9         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       94 RTH	17 FIX 0		65 ISG 03		
19       ARCL X       67       FIX 1         20       SF 25       68       CF 28         21       1       69       RCL 01         22       -       70       "F. F."         23       STO IND       See if reg.       71       ASTO 03         24       FC?C 25       FC. 02       73+LBL 98       Output F.F's once         25       PROMPT       74       CF 28       Output F.F's once         26       RCL 03       75       RCL 02       Output F.F's once         27       1       E3       76       "ROBOT"       Output F.F's once         28       /       77       ASTO 03       Output Robots       Output Robots         31       +       80       "ANDROID       Output Robots         33       RCL 03       81       ARCL 05       Output Robots         34       +       85       STO 97       85       GTO 97         35       .001       85       STO 97       86       PSE         39       6       87< "ANDROID			66 GTO 00		
20       SF 25       68       CF 28       69       RCL 01         21       1       70       "F. F. "       71       ASTO 03         23       STO IND       See if reg.       71       ASTO 03       0utput F.F's once         24       FC?C 25       FROMPT       74       CF 28       0utput F.F's once         26       RCL 03       75       RCL 02       76       "ROBOT "         27       1       E3       76       "ROBOT "       0utput F.F's once         28       7       ASTO 03       78       CF 05       00         29       ST+ 03       78       CF 05       0utput Robots         31       +       80       "ANDROID       0utput Robots         33       RCL 03       81       ARCL 05       0utput Robots         34       +       83       SF 28       84       ST 05         36       +       83       SF 28       84       SF 28         39       6       87<"ANDROID			67 FIX 1		
21 1       69 RCL 01         22 -       70 "F. F. "         23 STO IND       See if reg.         24 FC?C 25       73 LBL 98         25 PROMPT       74 CF 28         26 RCL 03       75 RCL 02         27 1 E3       76 "ROBOT "         28 /       78 CF 05         29 ST+ 03       78 CF 05         30 6.005       79 XEQ 10         31 +       80 "ANDROID         32 STO 02       "         33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 .001       85 GTO 97         36 +       86 PSE         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       90 TONE 8         41 STO 03       88 AVIEW         42 5.004       90 TONE 8         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       94 RTN					
22       -       70 "F.F."       -         23       STO IND       See if reg.       71 ASTO 03       -         24       FC?C 25       -       -       -       -         25       PROMPT       -       -       -       -       -         26       RCL 03       - <t< td=""><td></td><td></td><td></td><td></td><td></td></t<>					
23       STO IND       See if reg.       71 ASTO 03         24       FC?C 25       exists       72 XEQ 10         25       PROMPT       74 CF 28       once         26       RCL 03       75 RCL 02       once         27       1 E3       76 "ROBOT"       once         29       ST+ 03       78 CF 05       once         30       6.005       79 XEQ 10       Output Robots         31       +       80 "ANDROID       output Robots         33       RCL 03       81 ARCL 05       82 AVIEW         34       83 SF 28       84 FS? 05       0utput Robots         36       +       85 GTO 97       86 PSE         36       +       88 AVIEW       88 AVIEW         35       .001       88 AVIEW       89 TONE 9         38       FRC       89 TONE 9       90 TONE 8         39       6       91 TONE 9       92 TONE 7         41       100       91 TONE 9       92 TONE 7         45       XEQ 99       92 TONE 7       94 RTN         47       -       94 RTN       -					
X       exists       72 XEQ 10       Output F.F's once         24 FC?C 25       73+LBL 98       Output F.F's once         25 PROMPT       75 RCL 02       75 RCL 02         26 RCL 03       75 RCL 02       76 "ROBOT "         27 1 E3       76 "ROBOT "       77 ASTO 03         29 ST+ 03       79 XEQ 10       Output Robots         30 6.005       79 XEQ 10       Output Robots         31 +       80 "ANDROID       0utput Robots         32 STO 02       "       "         33 RCL 03       81 ARCL 05       82 AVIEW         35 .001       83 SF 28       84 FS? 05         36 +       86 PSE       87 "ANDROID         38 FRC       86 PSE       87 "ANDROID         39 6       87 "ANDROID       88 AVIEW         40 +       88 AVIEW       89 TONE 9         42 5.004       90 TONE 8       Safe tume         42 5.004       91 TONE 9       92 TONE 7         45 XEQ 99       92 TONE 7       94 RTN         47 /       94 RTN       10		Const Const			
24       FC?C 25       73+LBL 98       Output F.F.S         25       PROMPT       74 CF 28       once         26       RCL 03       75 RCL 02       once         27       1 E3       76 "ROBOT"       once         29       ST+ 03       78 CF 05       output Robots         30       6.005       79 XEQ 10       Output Robots         31 +       80 "ANDROID       2"       0utput Robots         32       STO 02       81 ARCL 05       0utput Robots         34 +       82 AVIEW       83 SF 28       0utput Robots         36 +       84 FS? 05       85 GTO 97       85 GTO 97         38       FRC       86 PSE       87 "ANDROID         39       6       87 "ANDROID       84 FS?         40 +       SAFE"       86 PSE       87 "ANDROID         40 +       SAFE"       88 AVIEW       84 FC         41 STO 03       89 TONE 9       90 TONE 8       94 Ftme         43 STO 04       90 TONE 8       91 TONE 9       94 Ftme         45 XEQ 99       92 TONE 7       94 RTN       94 RTN		-			uli i
25       PROMPT       74       CF       28       Once         26       RCL       03       75       RCL       02         27       1       E3       76       "ROBOT"       7         28       /       77       ASTO       03       7         29       ST+       03       78       CF       05         30       6.005       79       XEQ       10       Output Robots         31       +       80       "ANDROID       0       0         32       STO       02       31       ARCL       05         34       +       80       "ANDROID       0       0         35       .001       83       SF       28       8         36       +       85       GTO       97       8         37       STO       01       85       GTO       97         38       FRC       87<"ANDROID		exists		Output F.F's	<b>y</b>
26       RCL 03       75       RCL 02         27       1       E3       76       "ROBOT"         28       77       ASTO 03       78       CF 05         30       6.005       79       XEQ 10       Output Robots         31       80       "ANDROID       0utput Robots         32       STO 02       "       "         33       RCL 03       81       ARCL 05         34       *       82       AVIEW         35       .001       85       GTO 97         38       FRC       86       PSE         39       6       87<"ANDROID				once	
27       1       E3       76       "ROBOT"         28       77       ASTO 03       78       CF 05         30       6.005       79       XEQ 10       Output Robots         31       +       80       "ANDROID       Output Robots         31       +       80       "ANDROID       Output Robots         31       +       80       "ANDROID       Output Robots         32       STO 02       :       "       "         33       RCL 03       81       ARCL 05       #         34       +       82       AVIEW       #         35       .001       83       SF 28       #         36       +       82       GTO 97       #         38       FRC       86       PSE       #         39       6       87       "ANDROID       #         41       STO 03       #       #       #       #         42       5.004       90       TONE 9       #       #         43       STO 04       91       TONE 9       \$       \$         44       100       93       TONE 7       #       #			5		
28       77 ASTO 03         29 ST+ 03       78 CF 05         30 6.005       79 XEQ 10         31 +       80 "ANDROID         32 STO 02       :"         33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 .001       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       88 AVIEW         42 5.004       90 TONE 8         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       93 TONE 9         47 /       94 RTN					
29       ST+ 03       78       CF 05       Output Robots         30       6.005       79       XEQ 10       Output Robots         31       +       80< "ANDROID	27 1 E3				
30       6.005       79       XEQ       10       Output Robots         31       +       80< "ANDROID	28 /				
31 +       80 "ANDROID         32 STO 02       81 ARCL 05         33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 .001       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       88 AVIEW         42 5.004       90 TONE 8         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       94 RTN         47        94 RTN	29 ST+ 03				
31 +       80 "ANDROID         32 STO 02       81 ARCL 05         33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 .001       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       88 AVIEW         41 STO 03       88 AVIEW         42 5.004       90 TONE 8         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       93 TONE 9         47 /       94 RTN	30 6.005			Output Robots	
32       STO 02       81       ARCL 05         33       RCL 03       81       ARCL 05         34       82       AVIEW         35       .001       83       SF 28         36       84       FS? 05         37       STO 01       86       PSE         39       6       87< "ANDROID			80 "ANDROID		
33 RCL 03       81 ARCL 05         34 +       82 AVIEW         35 .001       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       88 AVIEW         42 5.004       90 TONE 8         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       94 RTN         47 /       94 RTN			: "		
34 +       82 AVIEW         35 .001       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       89 TONE 9         42 5.004       90 TONE 8         43 STO 04       91 TONE 9         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       93 TONE 9         47 /       94 RTN			81 ARCL 05		
35.001       83 SF 28         36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       88 AVIEW         42 5.004       90 TONE 9         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       94 RTN         47 /       94 RTN		g	82 AVIEW		
36 +       84 FS? 05         37 STO 01       85 GTO 97         38 FRC       86 PSE         39 6       87 "ANDROID         40 +       SAFE"         41 STO 03       88 AVIEW         42 5.004       99 TONE 9         43 STO 04       91 TONE 9         44 100       92 TONE 7         45 XEQ 99       92 TONE 9         46 10       93 TONE 9         47 /       94 RTN		9			
37       STO 01       85       GTO 97         38       FRC       86       PSE         39       87<"ANDROID					
38       FRC       86       PSE         39       6       87 "ANDROID         40       +       SAFE"         41       STO 03       88       AVIEW         42       5.004       89       TONE 9         43       STO 04       90       TONE 8         44       100       91       TONE 9         45       XEQ 99       92       TONE 7         46       10       93       TONE 9         47       94       RTN					
39       6       87 "ANDROID         40       +       SAFE"         41       STO 03       88 AVIEW         42       5.004       89 TONE 9         43       STO 04       90 TONE 8         44       100       91 TONE 9         45       XEQ 99       92 TONE 7         46       10       93 TONE 9         47       94 RTN       94 RTN					
40 +       SAFE"         41 STO 03       88 AVIEW         42 5.004       89 TONE 9         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       93 TONE 9         47 /       94 RTN					
41 STO 03       88 AVIEW         42 5.004       89 TONE 9         43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       93 TONE 9         47 /       94 RTN					
42       5.004       89 TONE 9         43       STO 04       90 TONE 8         44       100       91 TONE 9         45       XEQ 99       92 TONE 7         46       10       93 TONE 9         47       94 RTN       94 RTN	1				
43 STO 04       90 TONE 8         44 100       91 TONE 9         45 XEQ 99       92 TONE 7         46 10       93 TONE 9         47 /       94 RTN					
44     100     91     TONE     9       45     XEQ     99     92     TONE     7       46     10     93     TONE     9       47     94     RTN	42 5.004				
44 100     91 TONE 9       45 XEQ 99     92 TONE 7       46 10     93 TONE 9       47 /     94 RTN	43 STO 04			Safe tume	
45 XEQ 99 46 10 47 / 94 RTN					
46 10 47 / 94 RTN					
47 / 94 RTN		4			
		ł	94 RTN	k	
98 STURD 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	48 STO 05		95+LBL 10		
96 STO 04					illu)

97+LBL 16	····		
98 RCL IND	Output loop	147 XEQ 96	
04		148 FS? 05	Android blunder
99 X<0?		149 GTO 95	Android Diunder
		150 RCL 02	
100 GTO 10		151 STO 03	
101 SF 05		152+LBL 14	
102 CLA		153 RCL 05	Move robots
103 ARCL 03		154 INT	
104 "HAT "		155 RCL IND	Recall robot
105 ARCL X		03	neculi robot
106 AVIEW		156 X<0?	
107 STOP		157 GTO 10	
108+LBL 10		158 INT	
109 ISG 04		159 -	
110 GTO 16		160 X≠0?	
111 RTN		161 SIGN	
112+LBL 97		162 RCL 05	
113 CF 22		163 FRC	
114 STOP	Input	164 RCL IND	
115 FC? 22	Imput	03	
116 GTO 98		165 FRC	
117 GTO IND	►	166 -	
×		167 X≠0?	
118+LBL 01		168 SIGN	
119 -1.1	Change digit	169 10	
120 GTO 10	into ∆XY	170 /	
121+LBL 02			
1221		171 +	Hadata I.
123 GTO 10		172 ST+ IND	Update robot
124+LBL 03		03	
125.9		173+LBL 10	
		174 ISG 03	
126 GTO 10		175 GTO 14	
127+LBL 04		176 RCL 02	
128 -1		177 STO 03	
129 GTO 10		178+LBL 15	
130+LBL 05		179 -1	
131 0		180 X<> IND	
132 GTO 10		03	
133+LBL 06		181 X<0?	
134 1		182 GTO 10	
135 GTO 10		183 XEQ 96	
136+LBL 07		184 FC? 05	
1379		185 GTO 10	
138 GTO 10		186 -1	
139+LBL 08		187 "BUMP"	
140.1		188 FS? 06	Robot blunder
141 GTO 10		189 "STUMBLE	
142 <b>+</b> LBL 09			
143 1.1		190 AVIEW	
144+LBL 10	Update android	191 TONE 9	
145 ST+ 05	position	192 CLD	1 1
146 RCL 05		193+LBL 10	
	- · · · · · · · · · · · · · · · · · · ·	U	

194 STO IND 03 195 ISG 03 196 GTO 15 197 RCL 05 198 XEQ 96 199 FC? 05 200 GTO 98	Robot get android?	24 24	2 * 3 INT 4 RTN 5 .END.	
201+LBL 95 202 "STOMP" 203 FS? 06 204 "ZAP" 205 AVIEW 206 TONE 0 207 "TOO BAD " 208 AVIEW 208 AVIEW	Android loses	60		
209 RTN 210+LBL 96 211 SF 05 212 SF 06 213 RCL 01 214 X<>Y 215+LBL 12 216 RCL IND Y	Android or robot blunder routine	70		
217 X=Y? 218 RTN 219 RDN 220 ISG Y 221 GTO 12 222 CF 06 223 RCL 02 224 X<>Y 225+LBL 13 226 RCL IND		80		
Y 227 X=Y? 228 RTN 229 RDN 230 ISG Y 231 GTO 13 232 CF 05 233 RTN		90		
234+LBL 99 235 RCL 00 236 9821 237 * 238 .211327 239 + 240 FRC 241 STO 00	Randon number generator	00		. II

### **REGISTERS, STATUS, FLAGS, ASSIGNMENTS**<sup>23</sup>

DATA REGISTERS				STATUS					
00	Seed	50		6+	TOT. REG.	76+			
	Used				– FIX				
	Used				_ RAD G		_ UN		
	Used								
	Used			•		100			
05	Used	55		NIT		LAGS			
	Android		# 9	S/C	SET INDICAT	ES	CLEAR IN	DICATES	
	Robot <sub>1</sub>		05		Used				
	• -		06		Robot		F.F.		
					·				
10	Robot <sub>n</sub>	60							
	FF								
							·		
	•			-+			· · · · · ·		
	FFn+1					[			
15		65							
	·		····						
20		70							
				<u> </u>					
25		75							
20		/3							
			<b> </b>						
							<u> </u>		
			<u>}</u> <u>}</u> -						
30		80	<del></del>						
				- +-			· · · · · · · · · · · · · · · · · · ·	·······	
		·····	<u>}</u>	-+					
35		85			· · · · · · · · · · · · · · · · · · ·				
	<u> </u>		łł-						
					ASSIG	NMEN	TS		
			FU	NCTIC	N KEY	F	UNCTION	KEY	
40		90				I		1	
						1			
						1		1	
	·····					1	· ·	1	
			<b>I</b>			1		1	
45		95						1	
								1	
							· · · · · · · · · · · · · · · · · · ·	1	
. T						1		T	

#### HEXAPAWN

#### (Requires 2 Memory Modules)

Hexapawn is a game which is programmed to learn from its mistakes. The game is played with chess pawns on a 3x3 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.

Note the resemblance between the 41C digit keys and the board numbering. The three allowed opening moves for the first player (in this example, white) are 1 to 4 (keyed as 1.4), 2 to 5 (2.5), and 3 to 6 (3.6).



1 to 4

Figure 2. Opening moves

Black's three possible responses to white's 1.4 move are 8 to 4, 8 to 5, and 9 to 6.

o

3 to 6



2 to 5

Figure 3. Black's responses to white's 1.4 move

Black can move diagonally and capture white (8 to 4), or he can move either pawns 8 or 9 straight ahead one square. The black pawn at 7 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 the board position of the pawn to be moved, a decimal point, then the board position the pawn is to be moved to. The 41C does not

check for illegal moves; therefore, you are on your honor not to cheat. The 41C selects its move at random, but if it is then punished, it remembers not to make that move in that situation. Thus, if the machine makes a poor move and is punished, it will not repeat the mistake.\* Also, if the mirror image game is played, it will not make the mirror image of the poor move. If a point is reached in a game where all possible moves for a certain board configuration have received previous punishment, "NO MOVE" and "YOU WIN" is displayed, just as if there really were no move. If you cannot move, you can if you wish be a good sport and tell the 41C by keying 0 for your move. It will respond with "I WIN". If chess pawns are not available for visualization, different colored coins work well.

\*Similarly, you can punish good moves to make it play a losing game.

Example 1: Let the 41C go first.

Keystrokes:	Display:
[XEQ] [ALPHA] SIZE [ALPHA] 014	
[XEQ] [ALPHA] MACHINE [ALPHA]	SEED?
.1111111111 [R/S]	8 to 5
1.5 [R/S]	7 to 4
(A bad move; therefore, punish)	
[E]	AAAIIII
5.8 [R/S]	YOU WIN

Example 2: Start a new game with the 41C remembering its punishment.

Keystrokes:	Display:
[A]	8 to 5
1.5 [R/S]	7 to 5
3.5 [R/S]	9 to 5
0 [R/S]	I WIN

### **User Instructions**

				SIZE: 014
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Key in program.			
2	Initialize type of game: human first,		[XEQ] HUMAN	SEED?
	machine first.		[XEQ] MACHINE	SEED?
3	Key in a seed for the random number			
	generator between 0 and 1. (Just hit [R/S]			
	if a seed has been previously entered.)	S	[R/S]	READY (or)
				( ) to ( )
4	Key in your move FROM.TO	F.T	[R/S]	() to ()
	Repeat step 4 until game is over			
5	OPTIONAL: After the 41C displays its			
	move, punish it.	<u>.</u>	[E]	AAAIIII
6	To signify that you can't move	0	[R/S]	I WIN
7	To start a new game with the same player			
	first and punishments remembered.		[A]	READY (or)
				() to ()
	Go to step 4			
8	To start a new game with a different player			
	first and/or forgetting punishments go to			
	step 2.			
-				

01+LBL "MAC		50 3.6	
HINE"		51 FS? 05	
02 XEQ 01	Machine first	52 CHS	
03 8388607		53 X=Y?	
04 STO 01		54 SF 07	
05 3139583		55 RDN	
06 STO 02		56 1.4	
07 34314		57 FC? 05	
08 STO 03		58 CHS	
09 SF 05		59 X=Y?	
10 GTO A		60 SF 07	
11+LBL "HUM		61 RDN	
AN "	Human first	62 1.5	
12 XEQ 01		63 X=Y?	
13 16777215		64 SF 07	
14 STO 01		65 RIN	i I
15 16756735		66+LBL 00	
16 STO 02		67 CF 09	1
17 524413	!	68 STO 13	
18 STO 03		69 FRC	
19 CF 05		70.7	
20+LBL A	4	71 X<=Y?	
21 SF 09		72 GTO 26	
22 SF 08	Start game	73 RCL 13	
23 9503		74 XEQ 50	
24 STO 10		75 INT	
25 .8596	i	76 STO 11	From
26 STO 06		77 LASTX	
27 1	i	78 FRC	
28 FS? 05		79 10	
		80 *	
29 GTO 20			То
30 "READY"		81 STO 12	10
31 AVIEW		82 CF 06	
32 GTO 30		83 XEQ 21	
33+LBL 01		84.9	
34 SF 27	Initialize	85 STO 13	
35 CF 07		86 FS? 05	
36 CLRG		87 GTO 22	
37 "SEED?"		88 3185.848	
38 RCL 00		596	ļ
39 PROMPT		89 XEQ 23	Human move first
40 STO 00		90 7397.747	boards and
40 STO 00 41 RTN		5	
		91 XEQ 23	responses
42+LBL 30			
43 STOP	Get a human	92 1316.417	
44 "I WIN"	move	596	(Watch for extra
45 X=0?		93 XEQ 23	digits on a
46 PROMPT		94 1142.845	second line)
47 FC?C 08		396	
48 GTO 00		95 XEQ 23	
49 CF 07		96 2531.759	
		596	

L)<sub>IIII</sub>

97 XEQ 23	140 7341.748
98 1023.848	586
586	141 XEQ 23
99 XEQ 23	142 7449.747
100 6758.515	5
286	143 XEQ 23
101 XEQ 23	144 3237.848
102 7163.958	562
6	145 XEQ 23
103 XEQ 23	145 AEG 23
104 2720.414	
2	
105 XEQ 23	147 XEQ 23
105 720 25	148 8849.959
5	6
	149 SF 09
107 XEQ 23	150 XEQ 23
108 818.9596	151 CF 09
109 XEQ 23	152 6.9
110 6650.959	153 STO 13
6	154 8849.747
111 XEQ 23	5
112 992.96	155 XEQ 23
113 XEQ 23	156 6687.747
114 677.4152	5
115 XEQ 23	157 XEQ 23
116 369.75	158 855.7475
117 XEQ 23	159 XEQ 23
118 600.4186	160 1194.845
119 XEQ 23	253
120 384.8463	161 XEQ 23
121 XEQ 23	162 2583.756
122 693.4152	263
123 XEQ 23	163 XEQ 23
124 461.5263	164 6702.63
125 XEQ 23	165 XEQ 23
126 569.4195	
96	
127 XEQ 23	167 XEQ 23
128 411.8452	168 1368.754
129 XEQ 23	
130 195.5286	169 XEQ 23
	170 6887.959
131 XEQ 23	6
132 585.4175	171 XEQ 23
133 XEQ 23	172 2783.414
134 137.9563	295
135 XEQ 23	173 XEQ 23
136 GTO 25	174 6995.515
137+LBL 22	2
138 9503.859 Machine mov	<sub>7e</sub> 175 XEQ 23
6 first board	ls 176 1179.525
139 XEQ 23 and response	

K

177 XEQ 23       226 RCL 04       Move loop         178 2286.747       227 1       228 +         179 XEQ 23       229 X>Y?       230 1         180 2270.959       230 1       231 STO 04         181 XEQ 23       232 X<> 13       13         182 2594.96       233 RCL IND       13         183 XEQ 23       13       235 X<> 13         184 621.4163       237 RCL 05       238 /         185 XEQ 23       239 FRC       239 FRC         188 GTO 25       239 FRC       240 .5         190 ISG 13       Check to see if       240 .5         191 INT       Check to see if       240 .5         192 RCL 10       correct board       242 GTO 04         193 X≠Y?       243 DSE 13       244 GTO 02         195 LASTX       245 RCL 07       245 RCL 07	
$178$ 2286.747 $227$ 1Move loop5 $228$ + $229$ X>Y? $180$ 2270.959 $230$ 16 $231$ STO 04181 XEQ 23 $232$ X<> 13 $182$ 2594.96 $233$ RCL IND $183$ XEQ 23 $13$ $184$ 621.4163 $234$ X<>Y $185$ XEQ 23 $235$ X<> 13 $186$ 432.52 $236$ RDN $187$ XEQ 23 $237$ RCL 05 $188$ GTO 25 $239$ FRC $189 \bullet LBL$ 23 $239$ FRC $190$ ISG 13Check to see if $191$ INTCheck to see if $192$ RCL 10correct board $193$ X≠Y? $243$ DSE 13 $194$ RTN $244$ GTO 02	
5228 +179 XEQ 23229 X>Y?180 2270.959230 16231 STO 04181 XEQ 23232 X<> 13182 2594.96233 RCL IND183 XEQ 2313184 621.4163234 X<>Y185 XEQ 23235 X<> 13186 432.52236 RDN187 XEQ 23237 RCL 05188 GTO 25238 $\checkmark$ 189+LBL 23239 FRC190 ISG 13Check to see if191 INTCheck to see if192 RCL 10correct board193 X≠Y?243 DSE 13194 RTN244 GTO 02	
$179 \times EQ 23$ $229 \times Y?$ $180 2270.959$ $230 1$ $6$ $231 \text{ STO } 04$ $181 \times EQ 23$ $232 \times Y$ $182 2594.96$ $233 \text{ RCL IND}$ $183 \times EQ 23$ $13$ $184 621.4163$ $234 \times Y$ $185 \times EQ 23$ $235 \times Y$ $185 \times EQ 23$ $236 \text{ RDN}$ $187 \times EQ 23$ $237 \text{ RCL } 05$ $188 \text{ GTO } 25$ $238 \times$ $189 \bullet LBL 23$ $239 \text{ FRC}$ $190 \text{ ISG } 13$ Check to see if $191 \text{ INT}$ Check to see if $192 \text{ RCL } 10$ $242 \text{ GTO } 04$ $193 \times \pm Y$ ? $243 \text{ DSE } 13$ $194 \text{ RTN}$ $244 \text{ GTO } 02$	
180 2270.959       230 1         6       231 STO 04         181 XEQ 23       232 X<> 13         182 2594.96       233 RCL IND         183 XEQ 23       13         184 621.4163       234 X<>Y         185 XEQ 23       235 X<> 13         186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       Check to see if         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
6       231 STO 04         181 XEQ 23       232 X<> 13         182 2594.96       233 RCL IND         183 XEQ 23       13         184 621.4163       234 X<>Y         185 XEQ 23       235 X<> 13         186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189◆LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
6       231 STO 04         181 XEQ 23       232 X<> 13         182 2594.96       233 RCL IND         183 XEQ 23       13         184 621.4163       234 X<>Y         185 XEQ 23       235 X<> 13         186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189◆LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
181 XEQ 23 $232 X <> 13$ 182 2594.96 $233 RCL IND$ 183 XEQ 23 $13$ 184 621.4163 $234 X <> Y$ 185 XEQ 23 $235 X <> 13$ 186 432.52 $236 RDN$ 187 XEQ 23 $237 RCL 05$ 188 GTO 25 $238 << 239 FRC$ 190 ISG 13Check to see if191 INTCheck to see if192 RCL 10correct board194 RTN244 GTO 02	
182       2594.96       233       RCL IND         183       XEQ       23       13         184       621.4163       234       X<>Y         185       XEQ       23       235       X<> 13         186       432.52       236       RDN         187       XEQ       23       237       RCL       05         188       GTO       25       238       239       FRC         189       LBL       23       239       FRC       239       FRC         190       ISG       13       Check to see if       240       5       240       5         191       INT       Check to see if       240       5       240       5         192       RCL       10       correct board       242       GTO       04         193       X≠Y?       243       DSE       13       13         194       RTN       244       GTO       02       244       GTO       02	
183 XEQ 23       13         184 621.4163       234 X<>Y         185 XEQ 23       235 X<> 13         186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189◆LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
183 XEQ 2313184 621.4163234 X $\langle \rangle$ Y185 XEQ 23235 X $\langle \rangle$ 13186 432.52236 RDN187 XEQ 23237 RCL 05188 GTO 25238 /189 LBL 23239 FRC190 ISG 13Check to see if191 INTCheck to see if192 RCL 10correct board193 X $\neq$ Y?243 DSE 13194 RTN244 GTO 02	
184 621.4163       234 X<>Y         185 XEQ 23       235 X<> 13         186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189◆LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
185 XEQ 23       235 X<> 13         186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189◆LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
186 432.52       236 RDN         187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189+LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189+LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
187 XEQ 23       237 RCL 05         188 GTO 25       238 /         189+LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
188 GTO 25        238 /         189◆LBL 23       239 FRC         190 ISG 13       Check to see if         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
189+LBL 23       239 FRC         190 ISG 13       240.5         191 INT       Check to see if         192 RCL 10       correct board         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
190 ISG 13       Check to see if       240.5         191 INT       Check to see if       241 X<=Y?	
191 INT     Check to see if     241 X<=Y?       192 RCL 10     correct board     242 GTO 04       193 X≠Y?     243 DSE 13       194 RTN     244 GTO 02	
191 INT     Conteck to see if correct board     241 X<=Y?	
192 RCL 10       correct board       242 GTO 04         193 X≠Y?       243 DSE 13         194 RTN       244 GTO 02	
193 X≠Y?     243 DSE 13       194 RTN     244 GTO 02	
194 RTN 244 GTO 02	
197 STO 06 247 STO 04	
198 RCL 13 248 FS? 08	
199 INT 249 CF 09	:
200+LBL 20 Move 250 FS? 09	
201 STO 08 251 RTN	
202 RCL 04 252+LBL 25	
	41.1 -
	ibie
204 RCL 05 "	i i
205 STO 07 254 AVIEW	
206 2 255 PSE	1
207 RCL 08 256+LBL 26	
	I
209 STO 05 "	I
210 3 258 AVIEW	
211 STO 13 259 STOP	
212 RCL 00 260+LBL 04	
213 9821 261 RCL 04	
214 * 262 1 Convert mach	ines
215 .211327 Random number 263 X≠Y? move to boar	a l
216 + Random number 264 CE 68	-
217 FRC 265 -	
218 STO 00 266 2	
219 * 267 *	
220 1 268 10 <sup>+</sup> X	J
	1
221 + 269 RCL 06	
222 INT 270 *	
223 STO 04 271 FRC	
224+LBL 02 272 10	
225 3 273 *	

274 INT		324 -	
275 STO 11		325 RTN	
276 LASTX		326+LBL 05	
277 FRC		327 5	
278 10		328 RTN	
279 *		329+LBL 06	
280 INT		330 10.4	
281 STO 12		331 RTN	
282 SF 06		332+LBL 07	
283 XEQ 21		333 17	
284 3		334 RTN	
285 RCL 12		335+LBL 21	
286 X>Y?		336 RCL 10	
287 GTO 00	41C win	337 3	Update board
288 AVIEW		338 ENTER↑	
289 BEEP		339 10	
290+LBL 00		340 ENTER↑	
291 RCL 11		341 RCL 12	
292 RCL 12	41C move display	342 -	
	and board update		
293 10		343 Y1X	
294 /	-	344 /	
295 +	i i	345 FRC	
296 XEQ 50		346 3	
297 FIX 0		347 *	
298 CF 29	I.	348 INT	
299 CLA		349 CHS	
300 INT		350 1	
301 ARCL X		351 FS? 06	
302 "⊢ TO "		352 ST+ X	
303 LASTX		353 +	
304 FRC		354 3	
305 10		355 ENTER↑	
306 *	1	356 9	
307 ARCL X		357 ENTER†	
308 AVIEW	l	358 RCL 12	
309 GTO 30		359 -	1
			1
310+LBL 50		360 Y1X	4
311 FC? 07	Get mirror image	361 *	
312 RTN		362 3	
313 STO 06	move	363 ENTER↑	
314 INT		364 9	
315 1		365 RCL 11	
	}		
316 -		366 -	
317 3		367 Y†X	
318 /		368 1	
319 INT	1	369 FS? 06	
320 5		370 ST+ X	
321 +		371 *	
322 XEQ IND		372 -	
X		373 ST+ 10	
323 RCL 06	1	374 RTN	1
L	l	l	

375+LBL E		- 51		
376 RCL 04	Punish			1
377 X<> 13	1 uitt Sii			-
378 RCL 05				4
379 2				
380 /				
				1
381 ST- IND				
13				4
382 RDN	,			4
383 X<> 13				4 1
384 "AAAIIII		60		
				]
385 AVIEW				]
386 GTO 30			· · · · · · · · · · · · · · · · · · ·	4
387 .END.		<b> </b>		4
	1	<b> </b>		4
	4	<b> </b>		4 1
	4			j l
	4			] [
	]			1
20	]	70		1
	4			4
	1			
	4			
	]			1
		<b>├</b> ──┤		
30		80		
			······	
		<u>├</u>		
		<b>├</b> ──── <b>┤</b>		
		<u>├</u>		
		· · · ·		
40		90		
		<u>├</u>		
		┝━∔		
		┝───┼		
		┝───╁		
		└─── <b>↓</b>		
				1
50		00		1

### <sup>32</sup>REGISTERS, STATUS, FLAGS, ASSIGNMENTS

	DATA R	EGISTERS					STA	TUS			
00	seed Possible moves Possible moves Possible moves	50			í	<u>4</u> TOT. FIX RAD	sci		_ ON		
05	Trial move Used	55		#	INIT S/C	SET I		AGS	CLEAR		ATES
	Used	++	- <u></u> .					-			AILO
	Used	+ +		05		41C fin 41C's r	<u>st</u>		<u>Human fi</u> human's		
	Current move	+		07	-	mirror			normal g		
10	Last move	60		07		first r			not firs		
-10-	Board			08		Used			Used		/
	From	╂──╂────		- 09	+	USeu			USEU	······	
	То	+ +			1						
	counter	<u> </u>		-							
15		65		+	+						
	······		· · · · · · · · · · · · · · · · · · ·	1							
		+		-							
-+	· · · · · · · · · · · · · · · · · · ·	+			1						
					1	1			· · · ·		-
20		70			+						
		+ <u>·</u>									
	· =	+ +			1						
	······································	+									
				-							
25		75			1						
		+ * +			1						
†						1					
	<u> </u>			-							_
				1	+-						
30		80		1	-	1					
				-		1					
		1 1									
		4		-	-						
				-	1	1					
35		85		-							
			· · · · · · · · · · · · · · · · · · ·	-	1	1				-	
	· · · · · · · · · · · · · · · · · · ·			-			ASSIG	MEN	ITS	-	
		+		+	FUNC	TION	KEY		FUNCTION		KEY
10	<u> </u>	90		+	FUNC			T		<u> </u>	1 V Bar 1
40						·····		+			
	<u> </u>			+							
				+						+	
		-						<u> </u>			
45		95						<u> </u>			
40		90		+		······································		<u> </u>			
		- <del>    </del>						+		-+	
		<u> </u>				=					
		-}}					ł	+			
		<u> </u>		_ <b>_</b>		·····	L	1		<u>i</u>	

U)
#### SCATTER

#### (Requires 1 Memory Module)

N atoms are randomly placed in a black box with dimensions 10x10. No atom can be on the edge of the box. By firing particles into the box from the edges, and noting their exit locations, you attempt to find the atom positions. For a single atom, the scatters and reflections are as shown in Figure 1. Multiple atom scatters are simple extensions of this diagram: See, for examples, Figures 2 and 3. Note in particular, the back reflections of Figure 3 which arise from two combined scatters. More complex scattering and reflection are shown in Figure 4 where atom 4 causes scatter A, atom 2 causes B, 1 causes C, 4 (again) causes D, 3 causes E, and atom 1 reflects the particle back along the convoluted path. The numbering of the box grid is given in Figure 5. The 5th position on the base has coordinates 5.0, the 7th on the right is 9.7, and so on.

You select the value of N, and the machine places the N atoms randomly. You then fire particles from the edge: The machine tracks them and displays the output edge locations. At any time you can get the machine to confirm or reject any suspected atom location. If the guess is wrong, you are "penalized" by having the number of used particles increased by 5. The object of the game is not only to find the atoms, but to do so with the minimum number of probes.

NOTE: Although 9 atoms may be placed, a "good" game is 4 or 5.

Diagrams



1. - SINGLE ATOM





3. TWO ATOMS (2)



4. COMPLEX REFLECTION

Ì



5. BOX NUMBERING AND AXES

34

1.11

1

1

Set up and find 4 atoms.

Example:

Keystrokes: Display: [XEQ] [ALPHA] SIZE [ALPHA] 022 [XEQ] [ALPHA] SCATTER [ALPHA] SEED? .191062 [R/S] NO. OF ATOMS? 4 [R/S] READY 2.0 [R/S] 0,2 4.0 [R/S] 9,2 3.3 [A] YES 2 PROBES 6.9 [R/S] 6,9 6.8 [A] NO 8 PROBES 0.8 [R/S] 9,8 • :

### **User Instructions**

				SIZE:022
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program.			
2	Initialize.		[XEQ] SCATTER	SEED?
3	Key in a seed for the random number			
	generator.	s	[R/S]	NO. OF ATOMS?
4	Key in number of atoms to be placed.	N	[R/S]	READY
5	Key in an entrance point.	x.y	[R/S]	(x).(y)
6	To guess a position key one in.	x.y	[A]	YES (or) NO
				() PROBES
	Continue with steps 5 and 6 as desired.			
7	To start a new game go to step 4.		[E]	NO. OF ATOMS?
8	If at any time you give up you can find			
	all positions.		[c]	(x).(y)
				(x).(y)
		1		<u></u>

l

01+LBL "SCA		48 .211327	•
TTER"	Initialize	49 +	1
1	Inferatioe	50 FRC	
02 SF 27			
03 CF 29	1	51 STO 00	
04 SF 28		52 8	
05 FIX 0		53 *	
f			
06 "SEED?"		54 1	
07 PROMPT		55 +	
08 STO 00		56 INT	
09+LBL E	<b>-</b>	57 RTN	
			<b>├</b>
100	Get number of	58+LBL 20	
11 STO 11	atoms	59 STOP	Get an entry
12 "NO. OF		60 INT	point
ATOMS?"			F
13 PROMPT		62 STO 15	
14 STO 10		63 CF 00	1
15 1 E3		64 X=0?	
16 /		65 SF 00	
17 1		66 9	
18 +		67 X=Y?	
19 STO 12		68 SF 00	
20+LBL 00		69 CF 01	
21 XEQ 10	Place atoms	70 X=Y?	
22 XEQ 10		71 SF 01	Select which
23 10		72 LASTX	side
24 /		73 FRC	1
25 +		74 10	
26 RCL 12		75 *	
27 INT		76 STO 13	
28 X<>Y	4	77 STO 14	
29 STO 09		78 X=Y?	
30+LBL 01		79 SF 01	
31 RCL IND	Test to see if	80 1	
	already filled		
Y	alleady lifted	81 ST+ 11	
32 X=Y?		82+LBL 02	
33 GTO 00		83 RCL 10	
34 RDN	1	84 STO 21	
35+LBL 09		85 10	
36 DSE Y		86 STO 17	
37 GTO 01	1	87+LBL 05	1
38 STO IND	1	88 RCL IND	Get an atom
	1		
12	1	21	
39 ISG 12		89 INT	
40 GTO 00		90 LASTX	ł
41 "READY"		91 FRC	
	ļ		Decompose fata
42 AVIEW		92 10	Decompose into
43 GTO 20	1	93 *	X and Y
44+LBL 10		94 RCL 13	· ·
45 RCL 00		95 -	Cot X V distances
	Get a coordinate		Get X,Y distances
46 9821		96 X<>Y	of probe position
47 *	1	97 RCL 12	from atom
	<u>ار من </u>		

				Ding (
98 -		149 "+,"		
99 FS? 00		150 ARCL 14		
100 X<>Y		151 AVIEW		
101 STO 20	1	152 GTO 20		
102 ABS		153+LBL 09	Perturbation	
103 1		154 FS?C 03		
104 -	Test X distance			
105 X>0?		155 GTO 03		
		156 RCL 12	Deflection	
	No effect on	157 RCL 13		
	probe	158 FS? 00		
108 STO 16		159 X<>Y		
109 FS? 01	Test Y distance	160 RCL 19		
110 CHS		161 1		
111 X<0?		162 FS? 01		
112 GTO 09	No effect	163 CHS		
113 RCL 17		164 -	1	l
114 X<>Y	Atom hidden	165 +		
115 X>Y?	behind another?	166 FS? 00		
116 GTO 09	benind another.	167 X<>Y		
117 SF 03		168 STO 13		
118 X≠Y?		169 RDN		
119 CF 03		170 STO 12		
120 STO 17	Flag 3 on for	171 FS? 00		
121 RCL 20	reflection	172 SF 02		
122 STO 18		173 SF 00		
123 RCL 16		174 FS?C 02		
124 STO 19		175 CF 00		
125 SF 02				
126+LBL 09		176 CF 01		
127 DSE 21	All atoms	177 RCL 18		
128 GTO 05	scanned?	178 X=0?		
128 G70 05 129 FS?C 02		179 GTO 03		
· _	Perturbation?	180 X>0?	, ,	
130 GTO 09		181 SF 01		
131 0		182 GTO 02		_
132 ENTERT		183+LBL A		
133 9		184 RCL 10	Verify guess	
134 FS? 01		185 X<>Y		
135 X<>Y		186+LBL 04		
136 RCL 12	Get exit	187 RCL IND		
137 RCL 13	coordinates	Y		
138 FS? 00	coordinates	188 "YES"		
139 X<>Y		189 X=Y?		
140 RDN		190 GTO 09		
141 FS? 00		191 RDN		
142 X<>Y		192 DSE Y		
143 STO 15		193 GTO 04		
144 RDN		194 5		
145 STO 14		195 ST+ 11		
146+LBL 03	Display	196 "NO"		
147 CLA	coordinates	197+LBL 09		
148 ARCL 15		198 AVIEW		
	L			. <b>(</b> )

199 PSE 51 200 CLA 201 ARCL 11 202 "⊢ PROBE S " 203 AVIEW 204 GTO 20 205+LBL C 206 RCL 10 Find and display 207 FIX 1 all positions 60 208 CF 28 209+LBL 06 210 CLA 211 ARCL IND Х 212 AVIEW 213 PSE 214 DSE X 215 GTO 06 216 SF 28 70 217 FIX 0 218 GTO 20 219 .END. 30 80 40 90 50 00

1

### **\* REGISTERS, STATUS, FLAGS, ASSIGNMENTS**

	DATA REGISTERS			STATUS				
00	Seed Atom locations	50		i	2 TOT. REG7 FIX SC RAD GI	ə	ON OFF	
05		55		INIT S/C	FL SET INDICATE	AGS		TES
			00		top or botto	-	ft or right	
			01		top or right	ho	<u>ttom or lef</u>	Et
10	↓¥		02		used		ed	
10	n	60	.03	<u> </u>	used	us	ed	
	probe count particle x							
	particle y							
	y				<b>†</b>			
15	x	65						
	Used							···
	Used							
	Used							
	Used							
20	Used	70						
	Used							
	· · · · · · · · · · · · · · · · · · ·							
25		75			l			
			·					
30		80						
05		85						
35		60						
	· · · · · · · · · · · · · · · · · · ·							
					ASSIG	NMENTS		
				UNC	TION KEY	FUNC	TION	<b>KEY</b>
40		90					<u> </u>	
				<u></u>				
						<b>_</b>		
45		95						
ļ					ł			
						+		
<u> </u>	· · · · · · · · · · · · · · · · · · ·					+		
<u> </u>	L				<u> l</u>		<b></b>	

### FLIP-FLOP

Flip-Flop challenges you to change a string of 8 zeroes and 1 one (.000010000) to 1 zero and 8 ones (,111101111). Only positions containing ones can be specified for flipping. Flipping a one to a zero will automatically flip adjacent zeroes to ones and ones to zeroes. Flipping a one in either end position will flip the opposite end as well as the adjacent position.

Positions are: previous move, 123456789. Note that the position to the left of the comma always shows the last move unless the last move tried to flip a zero, at which time it will show zero.

Example:

 Keystrokes:
 Display:

 [XEQ] [ALPHA] SIZE [ALPHA] 013
 0,000010000

 [XEQ] [ALPHA] FLIP [ALPHA]
 0,000010000

 5
 5,000101000

 6
 6,000110100

 5
 5,000001100

 6
 5,000001100

 5
 5,000001100

 5
 5,000001100

41

### **User Instructions**

				SIZE:013	
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY	<b>MD</b>
1	Load program.				
2	Initialize.		[XEQ] FLIP	0,000010000	]
3	Key in position to flip.	x	· · · · · · · · · · · · · · · · · · ·	(x), ( )	
					] ]
	Repeat step 3 until successful.				
	· · · · · · · · · · · · · · · · · · ·				
					1
		·····			
					1
					<b>-</b>
					1
					1
_					-
					1
			-		
					'
					-
			1		

		_	
01+LBL "FLI		47 CHS	
P"	Initialize	48 STO IND	]
02 CF 28	Initialize	12	
03 FIX 9			
04 CLRG		50 DSE 12	
05 9		51 DSE 12	
06 STO 12		52 RCL IND	
07+LBL 00		12	
08 10		53 CHS	
		54 STO IND	
10 CHS		12	
11 Y†X		55 ST- 00	
12 STO IND		56 GTO 01	
12		57+LBL 09	
13 DSE 12			
		58 RCL 01	Right end
14 GTO 00		59 CHS	Bure end
15 RCL 05		60 STO 01	
16 STO 00		61 ST- 00	
17 CHS		62 RCL 08	
18 STO 05		63 CHS	
19+LBL 01		64 STO 08	
20 RCL 00		65 ST- 00	
21 .1111011		66 GTO 01	
11		67+LBL 04	
22 X<>Y		68 RCL 02	Left end
23 X=Y?		69 CHS	Lett end
24 GTO 02		70 STO 02	
25 RCL 10		71 ST- 00	
26 +		72 RCL 09	
27 XEQ 05		73 CHS	
28+LBL 03		74 STO 09	
30 STO 10		76 GTO 01	
31 XEQ 07		77+LBL 05	
32 ISG 11		78 CF 22	1
33+LBL 10		79 VIEW X	
34 CHS		80+LBL 06	F
35 STO IND	Update		Transa Transa
	<b>▲</b>	81 PSE	Input loop
12		82 FS?C 22	
36 ST- 00		83 RTN	
37 9		84 GTO 06	
38 RCL 12		85+LBL 07	┝-------
39 X=Y?		86 RCL IND	W-1442
40 GTO 09			Valid?
		12	] ]
41 1		87 X<0?	1
42 X=Y?		88 RTN	
43 GTO 04		89 RCL 00	1
44 ISG 12		90 VIEW X	
45+LBL 10		91 XEQ 06	1
46 RCL IND		92 GTO 03	⊦−−−−−−
12		93+LBL 02	

ŧ

¥

94 RCL 10		51		
95 +	0			4
96 VIEW X	Game over			4
97. PSE				-
98 CLA				
99 FIX Ø			·	
100 CF 29				
101 SF 28				4
102 ARCL 11				4
103 "H FLIPS				4
••		60		4
104 AVIEW		ļ		
105 .END.				
			l	1
		•		1
		<u> </u>		
				ļ
				Į
20		70		
30		80		1
40		90		
	ĺ			
50	ł	00	· · · · · · · · · · · · · · · · · · ·	
	·	00	1	

### **REGISTERS, STATUS, FLAGS, ASSIGNMENTS 45**

	DATA REGISTERS			STATUS							
00	Current display Used Used Used	50			à ƙ	I		sc	I	_ USER MC ON (	
05	Used Used	55	······································		INIT				AGS		
	Used Used Used			#	S/C		SET IND		5		
10	Used Used # of flips	60						·			
	Counter									······	
15		65	· · · · · · · · · · · · · · · · · · ·								
				_							
20		70									
25		75	······································								
30		80									
35	·····	85									
					FUNCT						KEY
40		90									
										· · · · · · · · · · · · · · · · · · ·	
45		95		-							
					· · ·						

#### ORBITAL LANDER

#### (Requires One Memory Module)

This program simulates a Lunar Excursion Module in orbit 100 km above the surface of the moon. The object is to execute a soft landing (velocity less than 5m/sec, at an angle not more than 5° from vertical) given a limited supply of fuel. On each move, you have the option of either freefalling for a specified period of time, or applying a specified thrust during a specified time period. Thrust is calculated and applied from your input of change in velocity over a given amount of time in a given direction from  $0^{\circ}$  to +180°. Your velocity will not actually change by this amount, of course, since gravity is also acting. You are not allowed to apply a thrust of greater than 7 Gees (69m/sec/sec of time period). If you run out of fuel, your thrust will be reduced to the fuel supply on hand. Thereafter, any thrust value you provide will be automatically changed to zero. When you pass zero altitude (i.e., land or crash), the program will calculate and display your velocity at impact. (Note to skilled pilots: try also to land at 0° longitude.)

Because the orbital equations are time-independent, the program has to convert the desired "delta-t" into a variable the equations can work with. This conversion process is not completely accurate, but the only error it introduces is that the actual duration of the jump may be slightly different from the one you specify. No positional error is introduced--you will still be on exactly the correct orbit--but you will find yourself at a slightly different point along that orbit. For example, a 2000 second jump along the initial orbit will take you almost a third of the way around the moon, but the conversion approximation will be about 10 percent shorter than an actual 2000 second jump.



Variable Conventions

Important: The altitude (A) is from the surface of the moon, not the center. The angle of velocity (VA) is given from horizontal, with 0° being forward and 90° straight up. Thrust angles also follow VA conventions. 180° is a retrofire.

### Example:

1

5

M

(11

Keystrokes:	Display:	
[XEQ] [ALPHA] SIZE [ALPHA] 015		
[XEQ] [ALPHA] ORBIT [ALPHA]	A=100000.00 M	(altitude)
[R/S]	<b>∡</b> =0.00	(longitude)
[R/S]	V=1631.77 M/S	(velocity)
[R/S]	V <b>A=</b> 0.00	(angle from horizontal)
[R/S]	F=2,000.00	(fuel)
1000 [A]	A=99,957.06 M	
[R/S]	<b>∡</b> =55.65	
[R/S]	V=1,631.80 M/S	
[R/S]	₩ =0.00	
[R/S]	F=2,000.00	
For 10 seconds apply 7 gravities as retrofire		
69 [ENTER†] 10 [X]		
180 [ENTER <sup>†</sup> ]		
10 [B]	A=99,908.77 M	
[R/S]	<b>▲</b> =55.95	
[R/S]	V=941.88 M/S	
[R/S]	V <b>&amp;</b> =-0.59	
[R/S]	F=1,310.00	
200 [A]	A=78,392.28 M	
[R/S]	<b>∡=</b> 61.89	
[R/S]	V=974.77 M/S	
[R/S]	V <b>∡=</b> -12.14	
[R/S]	F=1,310.00	
	•	
•	•	

### **User Instructions**

				SIZE:015
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program.			
2	Initialize.		[XEQ] ORBIT	
3	*Mission status: altitude			A=
	longitude		[R/S]	٤=
	velocity		[R/S]	V=
	angle of flight		[R/S]	V <b>A</b> =
	fuel remaining		[R/S]	F=
4	To free fall: key in number of seconds.	n	[A]	
	Go to step 3 for outputs.			
5	To fire rockets: key in total change in V	dV (m/s)	[ENTER†]	
	key in angle of thrust	θ (deg)	[ENTER <sup>†</sup> ]	
	key in number of seconds			
	for total burn	n (sec)	[B]	
	Go to step 3 for outputs.	· · · · · · · · · · · · · · · · · · ·		
	When A=0.00, you are down.			
*	Continuing [R/S]will repeat status.			
			·	
			<u>,,,,,</u> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
				1

1

States and

01+LBL "ORB		49 -	
IT"	Initialize	50 STO 06	
02 SF 27		51 RCL 01	-
03 CLRG		52 RCL 05	
04 CF 05		53 *	
05 2000		54 STO 07	
06 STO 00		55 X12	
07 1839000		56 RCL 03	
08 STO 01		57 /	
09 4.89663		58 STO 08	
E12		59 *	
10 STO 03			
11 1631.765		60 2	
625		62 RCL 03	
12 STO 05		63 /	
13 1739000		64 1	
14 STO 11		65 +	
15 0		66 SQRT	
16 GTO 01		67 STO 09	
17+LBL B		68 RCL 08	
18 STO 12	<b>m</b> 1	69 RCL 01	
19 69	Thrust	70 /	
20 *		71 1	1
21 R↑		72 -	
22 RCL 00		73 RCL 09	
23 X<=Y?		74 /	
24 X<>Y	No greater than	75 FIX 7	
25 RDN	7 gees	76 RND	
26 X<=Y?		77 ACOS	
27 X<>Y		78 RCL 04	
28 RDN		79 RCL 05	
29 ST- 00		80 *	
30 P-R		81 X>0?	
31 ST+ 05		82 SF 05	
32 RCL 05		83 RDN	
33 9		84 FS?C 05	
34 X>Y?		85 CHS	
35 GTO 21		86 RCL 02	
36 R1		87 +	
37 ST+ 04		88 360	
38◆LBL 01		89 MOD	
39 RCL 04	<b>a</b> .	90 STO 10	
40 X12	Compute new		
40 ATZ 41 RCL 05	orbit		
41 RCL 05 42 X12		92+LBL A	Free fall
42 872		93 STO 12	TTCC TOTT
43 + 44 2		94 Ø	
		95 ENTERA	
45 / 47 DCL 97		96 ENTER↑	
46 RCL 03		97 RCL 05	
47 RCL 01		98 9	
48 🔨		99 X>Y?	
			· · · · · · · · · · · · · · · · · · ·

100 GTO 21		151 RCL 02	
101 RDN		152 RCL 10	
102 RCL 12		153 -	
103 *		154 SIN	
104 RCL 03		155 *	
105 RCL 01		156 X<0?	
106 X†2		157 SF 05	
107 /	g	158 RDN	
108 RCL 12		159 FS?C 05	
109 *		160 CHS	
110 2		161+LBL 20	
111 /		162 STO 14	
112 RCL 04		163 RCL 13	
113 X<>Y		164 P-R	
114 -		165 STO 05	
115 RCL 12		166 RDN	
116 *		167 STO 04	
117 RCL 01		168 RCL 01	
118 +		169 RCL 11	
119 R-P		170 -	
120 RDN		171 X<0?	
121 ST+ 02		172 GTO 22	
122 RCL 08		173+LBL 10	
123 RCL 09		174 FIX 2	
124 RCL 02		175 ADV	Output
125 RCL 10		176 "A="	
126 -		177 RCL 01	
127 COS		178 RCL 11	
128 *		179 -	
129 1		180 X<0?	
130 +		181 CLX	
131 /		182 ARCL X	
132 STO 01		183 "⊢ M"	
133 RCL 03		184 AVIEW	Altitude
134 X<>Y		185 STOP	
135 /		186 "∡="	
136 RCL 06		187 RCL 02	
137 +		188 1	
138 2		189 P-R	
139 *		190 R-P	
140 SQRT		191 ARCL Y	Longitude
141 STO 13		192 AVIEW	hongitude
142 RCL 01		193 STOP	
143 *		194 "V="	
144 RCL 07		195 ARCL 13	
145 X<>Y		196 "⊢ M∕S"	Velocity
146 /		197 AVIEW	
147 FIX 7		198 STOP	
148 RND		199 "V∡="	
149 ACOS		200 ARCL 14	Angle from
150 RCL 07	Ì	201 AVIEW	horizon

202 STOP		253 +	
203 "F="		254 ABS	
204 ARCL 00		255 SQRT	
205 AVIEW	Fuel	256 CHS	
205 HVIEW 206 STOP		257 STO 04	
	4	258 GTO 00	
207 GTO 10			
208+LBL 21		259 .END.	
209 RDN			
210 RDN	Vector sums		
211 2		60	
212 /			
213 CHS			
214 RCL 05			
215 +			
216 RCL 12			
217 *			
218 X<>Y			
219 RCL 03			
220 RCL 01			
220 KCC 01 221 X12			
222 /		70	
222 / 223 RCL 12			
224 * 225 -			
223 - 226 ST+ 04			
227 2			
228 /	1		
229 CHS			
230 RCL 04			
231 +		80	
232 RCL 12			
233 *			
234 RCL 01			
235 +			
236 R-P			
237 STO 01			
238 X<>Y			
239 ST+ 02			
240+LBL 00			
241 RCL 04			
242 RCL 05		90	
243 R-P			
244 STO 13			1
245 X<>Y			İ
246 GTO 20			
247+LBL 22	_		
248 ST- 01	Impact		:
249 3			
250 *			
251 RCL 04			
252 X↑2		00	

### **\*REGISTERS, STATUS, FLAGS, ASSIGNMENTS**

	DAT	A REGISTERS				STATU	S	
00	Fuel Ri	50	SIZE	015	TOT. RI	EG. <u>66</u>	USER	MODE
	<del>0</del> i Gm			i	RAD	GRAD	ON	OFF
05	Vr Ve	55		INIT S/C		FLAGS		
	<u>Е</u> 1			S/C	SET IND			NDICATES
	Ko		05		Used		Used	
				┝──┼			+	
10	e 0'	60		┢───┟-				
	surface						+	
	t						+	
	V			tt-			1	
	$\theta_{\mathbf{v}}$						<u>+</u>	·····
15	•	65			· · · · · · · · · · · · · · · · · · ·		1	
20		70						
25		76			······································			
25		75			· · · · · · · · · · · · · · · · · · ·			
{								-
			··					
$\rightarrow$								
30	······································	80		——— <del> </del> —			+	
+								
	PAN							
T								
35		85						·······
					AS	SIGNME	NTS	
			F	UNCTIO	N K	ΈY	FUNCTION	KEY
40		90	<u>+</u>			<u></u>		
				- / <u>-</u> _				
						·····	,,,	
45		95						
$ \rightarrow $								

### PLANET LANDER

The object here is to perform a vertical descent ending in soft landing on the planet of your choosing. You select the planet before you begin by specifying the acceleration of gravity in feet per second per second. Some values are given below:

Body	$g(f/s^2)$
Earth	32.2
Moon	5.32
Mars	12.3
Ganymede	5.25
Pluto	7.25
Icarus (asteroid)	.394

For interest, zero and negative values of g are allowed. The fuel allocated, as calculated from g, is more than adequate for a minimum use landing. At least twice as much fuel as needed is given. Although it takes longer to calculate, 3 seconds is the time your burn is stretched over. You can only key a burn in during the zero of each three second count down.

Note that if zero or negative g is selected and you run out of fuel, you may not impact. In this case you will see "DEEP SPACE..." instead of the normal "VF=" for final velocity.

Example:

Try a landing on the moon  $(g = 5.32 \text{ f/s}^2)$ .

Keystrokes:

Display:

[XEQ] [ALPHA] SIZE [ALPHA] 007

5.32 [XEQ] [ALPHA] GRAVITY [ALPHA] G=5.32 FUEL=54

FUEL=5456 V=-500 F/S A=5000 V THREE... TWO... ONE... ZERO...

(to free fall, just do nothing)

FUEL=5456

Keystrokes:

20

Display: V=-516 F/S A=3476 F THREE... TWO... ONE... FUEL=5436 V=-512 F/S A=1934 F THREE... TWO... ONE...

;

1

)

54

## **User Instructions**

				SIZE:007
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load program.			
2	Key in gravity.	$g(f/s^2)$	[XEQ] GRAVITY	G=
3			, 10 <u></u>	FUEL= (ente
			• <u>, , , , , , , , , , , , , , , , , , ,</u>	*V=
			P	A=
				THREE
				TWO
			·····	ONE
			*	ZERO
4	You have one second during the "ZERO"			
	prompt to key in a fuel burn.	burn		
5	Go to 3 for next status.			
6	For a new game with the same g		[A]	G=
	go to step 3.			
7	For a new game with a different g go to			
	step 2.			
*	When you see "VF= ", this is your			
	landing or crash velocity.			
			·	

01+LBL "GRA		51 "THREE	
VITY"	T. 1		Countdown
02 SF 27	Initialize	52 AVIEW	Countdown
03 STO 01		53 PSE	
04 ABS		54 "TWO"	
05 800		55 AVIEW	
06 *		56 PSE	
07 1200		57 "ONE"	
08 +		58 AVIEW	
09 STO 05		59 PSE	
10+LBL A		60 CLX	•
11 5000		61 "ZERO	
	Set up initial	01 2EKU	
12 STO 06	conditions		
13 -500	condicions	62 AVIEW	
14 STO 02		63 PSE	
15 RCL 05		64 CLD	
16 STO 03		65 STO 00	Calculate
17 "G="		66 ABS	acceleration
18 FIX 2		67 RCL 03	acceleration
19 CF 29		68 X>Y?	
20 ARCL 01			
		69 RDN	
21 AVIEW		70 ST- 03	
22 PSE		71 RCL 00	
23 FIX 0		72 SIGN	
24+LBL 09		73 *	
25 "FUEL="		74 3	
26 ARCL 03	Display status	75 /	
27 AVIEW		76 RCL 01	
28 PSE			
		• •	
29 RCL 02		78 STO 04	<u> </u>
30 RND		79 RCL 06	
31 RCL 06		80 *	Calculate time
32.5		81 2	to impact
33 "V"		82 *	
34 X>Y?		83 RCL 02	·
35 "FF"		84 X12	
36 "+="		85 X<>Y	
37 ARCL Z		86 -	
38 "H F/S"			1
		87 SF 00	1
39 AVIEW	1	88 X<0?	
40 PSE		89 GTO 01	
41 X>Y?		90 SQRT	1
42 RTN		91 RCL 02	
43 "A="		92 +	
44 ARCL 06		93 CHS	
45 "H F"	.	94 RCL 04	
46 AVIEW			
		95 X=0?	
47 PSE		96 GTO 01	
48 RCL 03		97 CF 00	If greater than
49 X=0?		98 /	3 seconds use 3
50 GTO 02		99 3	

100 X<>Y 101 X>Y? 102 RDN 103+LBL 01 104 FS?C 00 105 3 106 STO 00 107 RCL 04 108 * 109 RCL 02 110 + 111 X<> 02	$\Delta \mathbf{V}$	150 / 151 X<0? 152 PROMPT 153 RCL 01 154 * 155 ST- 02 156 0 157 STO 06 158 GTO 09 159 .END.	t ΔV
112 RCL 00 113 X†2 114 RCL 04 115 * 116 2 117 / 118 X<>Y 119 RCL 00 120 * 121 +	∆Altitude	70	
122 ST+ 06 123 GTO 09 124+LBL 02 125 "DEEP SP ACE" 126 RCL 01 127 X≠0? 128 GTO 03 129 0 130 STO 06	Find velocity calculation g=0	80	
131 RCL 02 132 X<0? 133 GTO 09 134 PROMPT 135◆LBL 03 136 RCL 01 137 RCL 06 138 * 139 2 140 *	g≠0	90	
140 * 141 RCL 02 142 X†2 143 + 144 X<0? 145 PROMPT 146 SQRT 146 SQRT 147 RCL 02 148 + 149 RCL 01		00	

### **\*REGISTERS, STATUS, FLAGS, ASSIGNMENTS**

	DATA	REGISTERS				STATUS	· · · · · · · · · · · · · · · · · · ·	
00	used g Vel. Fuel	50	ENG	ì		SCI		
05	Used Initial fuel Alt	55	#	INIT S/C	SET INDIC	FLAGS ATES	CLEAR IN	DICATES
10		60				·····	· · · · · · · · · · · · · · · · · · ·	
15		65						
20		70						
25		75						
30		80						
35		85						
						IGNMEN		
40	······································	90		FUNCTIO			FUNCTION	KEY
45		95						

### WARI

#### (This program requires one Memory Module)

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 shown here is set up to begin a 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.

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 [B] (for player A or B). The machine then moves the counters from the specified bin according to the rules. To play against the calculator, signal to the calculator to move by pressing [C]. The calculator will then move player B's counters.

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

When one of the sides of the board is displayed, as designated by leading A or B, it is as if you moved around to that side of the board. In other words, bin 1 for either players side is always to the left and counterclockwise always to the right. If you are looking at side A, [R/S] will get you side B. If you are looking at side B, [R/S] will get you the score. If you are looking at the score, [R/S] will get you side A.

#### Example:

Start a game and have the calculator make the first move.

Keystrokes:

Display:

[XEQ] [ALPHA] SIZE [ALPHA] O	018
[XEQ] [ALPHA] WARI [ALPHA]	SEED?
.9977663333 [R/S]	A 4,4,4,4,4,4
[R/S]	B 4,4,4,4,4,4
[R/S]	A=0, B=0
[C]	A 5,5,4,4,4,4
[R/S]	B 4,4,4,0,5,5
6 [A]	A 5,5,4,4,4,0
[R/S]	B 5,5,5,1,5,5
[C]	A 6,6,4,4,4,0
[R/S]	B 5,5,0,2,6,6
2 [A]	A 6,0,5,5,5,1
[R/S]	B 6,6,0,2,6,6,
[C]	A 7,1,6,6,6,0
[R/S]	B 6,6,0,2,6,0
[R/S]	A=0, B=2
:	:

### **User Instructions**

				SIZE: 018
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Load the program.			
2	Initialize.		[XEQ] WARI	SEED?
3	Key in a seed between 0 and 1 for the			
	random number generator.	seed	[R/S]	A 4,4,4,4,4,4
4	To see the other side of the board and/or			
	the score, press [R/S]. This can be done			
	as often as desired.		[R/S]	A (board)
				(or) B (board)
				(or) A= B=
5	Players A, B or the 41C moving B's counters			
	can move in any order with anyone starting	<u> </u>		
	the game.			
	Player A	_bin#	[A]	A (board)
	Player B	bin#	[B]	A (board)
	41C (moving for B)		[C]	A (board)
6	Go to step 4 or 5 as desired.			
7	To start a new game press [E] and go to	-		
	step 4 or 5 as desired.		[E]	A 4,4,4,4,4,4

Stradenting,

01+LBL "WAR		49 GTO 00	
I "	Initialize	50 X<>Y	
02 SF 27		51 R↑	
03 CF 29		52 CHS	
04 FIX 0		53 RCL IND	Player counters
05 "SEED?"		Y Y	
06 PROMPT		54 X<=Y?	
			1
07 STO 00		55 GTO 00	1
08+LBL E		56 X<>Y	
09 1.012		57 3	
10 CLRG		58 +	
11 4		59 X<=Y?	
12+LBL 06		60 GTO 00	
13 STO IND		61 SF 07	
Y Y		62 RCL Z	
14 ISG Y			
		63 RCL 17	
15 GTO 06		64 X>Y?	
16 GTO 50		65 GTO 00	
17+LBL C		66 X≠Y?	
18 CF 05	41C move	67 GTO 01	
190		68 FS? 06	
20 STO 17		69 GTO 00	
21 STO 15		70+LBL 01	
22 2		71 RDN	
23 XEQ 51		72 STO 17	
24 CF 06		73 RCL 16	
25 X=0?		74 STO 15	
26 SF 06		75+LBL 00	
27 CF 07		76 ISG 16	
28 7.012		77 GTO 05	
29 STO 16		78 FC?C 07	
30+LBL 05	Offense	79 GTO 00	
31 RCL 16	orrende	80 RCL 15	Found an
32 INT	410 -it #	81 INT	offensive move
33 RCL IND	41C pit #		
	41C counters	82 GTO A	
16		83+LBL 00	
34 X=0?		84 6	
35 GTO 00		85 STO 16	
36 RCL X		86 0	
37 12		87 STO 15	
38 /		88+LBL 04	Defense
39 INT		89 RCL 16	Defense
40 STO T		90 RCL IND	Player's pit #
41 +		16	Player's
42 +	1		counters
	1	91 X=0?	
43 12		92 GTO 00	
44 MOD		93 RCL X	
45 X=0?	Player pit #	94 12	
46 X<> L	I Tayer PIC #	95 /	
47 7	ł	96 INT	
48 X<=Y?	ł	97 X>0?	
		· · · · · · · · · · · · · · · · · · ·	

	98 GTO 00		147 RCL 16	
	99 RDN		148 X=Y?	
	100 +		149 GTO 01	
	101 12		150 RDN	
	102 MOD		151 STO 15	
	103 X=0?		152 GTO 03	
	104 LASTX	41C pit #	153+LBL 01	
	105 7		154 SF 05	
	106 X>Y?		155 "NO MOVE	
	107 GTO 00			
	108 RCL IND		156 AVIEW	
	Y Y	41C counters	157 STOP	
ŀ	109 X=0?		158 GTO 50	
	110 GTO 00		159+LBL 00	
	111 3		160 RCL 15	
	112 X<=Y?		161+LBL B	
1	113 GTO 00		162 6	Player B
	114 SF 07		163 +	
	115 R↑		164 CF 05	
	116 RCL 15		165+LBL A	
	117 X<=Y?		166 STO 15	Player A
	118 X<>Y		167 STO 17	-
	119 STO 15		168 RCL IND	
	120+LBL 00		15	
	121 DSE 16		169 X=0?	
	122 GTO 04		170 GTO 50	
	123 FC?C 07		171 STO 16	
	124 GTO 00		172 ST- IND	
	125 RCL 15	Defensive move	15	
	126 GTO A	found	173+LBL 08	Distribute
	127+LBL 00		174 RCL 17	counters
	128 6		175 1	
	129 XEQ 51		176 +	
	130 1		177 12	
	131 +		178 MOD	4
	131 + 132 STO 15		178 HOD 179 X=0?	
	132 STO 15 133 STO 16		180 LASTX	
	133 510 16 134+LBL 03	Random move	180 CHSTA 181 STO 17	
	135 6 136 +		182 RCL 15	
			183 X=Y?	
	137 RCL IND		184 GTO 08	
	X		185 1	1
	138 X≠0?		186 ST+ IND	
	139 GTO 00		17	
	140 RCL 15		187 DSE 16	1
	141 1		188 GTO 08	
	142 -		189+LBL 07	1
	143 6		190 RCL 17	
	144 MOD		191 7	
	145 X=0?		192 FS? 05	
(	146 LASTX		193 GTO 01	
		_ <b>I</b>	I	<u>ا</u> ـــــا

194 X<=Y?	1	242+LBL 00
195 GTO 50		243 ARCL IND
196 GTO 00		X
197+LBL 01		244 ISG X
198 X>Y?	İ	245 GTO 09
199 GTO 50	0	246 RTN
200+LBL 00	Capture pits	247+LBL 51
201 RCL IND		248 RCL 00 Random number
17		249 9821 generator
202 2		250 *
203 X>Y?		
		251 .211327
204 GTO 50	1	252 +
205 RDN		253 FRC
206 4		254 STO 00
207 X<=Y?		255 *
208 GTO 50		256 INT
209 RDN		257 RTN
210 FS? 05		258 .END.
		230 .END.
212 FC? 05		70
213 ST+ 14		70
214 ST- IND		
17		
215 RCL 17		
216 1		
217 -		
218 12		
219 MOD		
220 X=0?		
1		
221 LASTX		
222 STO 17		80
223 GTO 07		
224+LBL 50		
225 SF 05	Output	
226 "A "	oucpuc	
227 1.006		
228 XEQ 00		
229 PROMPT	A board	
230 "B "	bould	
231 7.012		
232 XEQ 00	B board	90
233 PROMPT		
234 "A="		
235 ARCL 13		
236 "⊢, B=		
••		
237 ARCL 14		
238 PROMPT	Score	
239 GTO 50		
240+LBL 09		
241 "⊢,"		00

### **REGISTERS, STATUS, FLAGS, ASSIGNMENTS**<sup>™</sup>

5	DATA REGISTERS			STATUS					
00	Seed Bin Al A2 A3	50	ENG	i		SCI	USER MO ON C 		
05	A4 A5 A6	55	#	INIT S/C		FLAG ATES	S CLEAR IND	CATES	
	Bin Bl B2		05 06		A's move Used		B's move		
10	B3 . B4	60	07		Found one		ack		
	B5 B6							<u> </u>	
	Score A Score B								
15	Used Used Used	65							
20		70			·····			<u></u>	
25		75							
								·····	
30		80							
	· · · · · · · · · · · · · · · · · · ·								
35		85					· · · · · · · · · · · · · · · · · · ·		
					ASS	GNM	ENTS		
40		90		FUNC		EY	FUNCTION	KEY	
45	err. 10.	95							

### SIMON

This game exercises your memory by presenting longer and longer sequences of random numbers. You try to remember and key in each sequence. Flag settings may be varied to change the difficulty.

Example: Use a seed of  $\pi$  for the random number generation to duplicate this game.

Keystrokes:	Display:	
[XEQ] [ALPHA] SIZE [ALPHA] 004		
[///] [π] [STO] 00		
[XEQ] [ALPHA] SIMON [ALPHA]	HOW MANY?	
3 [R/S]	1	(sequence)
	NUMBERS ?	• • • • • • • • • • • • • • • • • • • •
1 [R/S]	YES: 1	
	9	(sequence)
	2	
	NUMBERS?	
9 [R/S]	NO: 92, NOT 9	
	3	
	4	(sequence)
	6	
	NUMBERS?	
346 [R/S]	YES: 346	
	YOU MISSED 1	

## **User Instructions**

				SIZE:004
STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	Key in program and store seed (O≤s<1)	S	[STO] 00	
2	Begin a new game.		[XEQ] SIMON	HOW MANY?
3	Key in the longest sequence you desire	n* (≦10)	[R/S]	(SEQUENCE) NUM
4	Repeat the sequence you just saw	sequence	[R/S]	YES (or) NO
5	Step 4 is repeated until you win or lose			YOU WIN
				YOU MISSED (
	Note 1: You can set flag O (SFOO) to use			
	longer and longer pieces of the			
	same sequence. this version of			
	the game is easier for young			
	children.			
	Note 2: You can clear flag 26 (CF26) to			
	suppress the tone and make the			
	sequences pass more quickly.			
	Some people find them easier to			
-	memorize this way.			
	*You can start with a sequence longer than			
	l digit by keying in a number of the form			
	100 a+b where a is one less than the			
	length of the first sequence you want and			
	b is the maximum length. For example,			
	2006 would yield sequences of lengths			
	3, 4, 5 and 6.			

01+LBL "R"		49 BEEP	
02 FS? 00	Dondon1	50 "YOU WIN	Win message
03 RTN	Random number	JO TUU WIN	
04 RCL 00	generator		
05 9821		51 AVIEW	
-		52 RTN	
06 *		53+LBL "TON	F
07 .211327		ES"	
08 +	1	54 RCL 01	
09 FRC		55 INT	
10 1.1111			Set up tone
11 *			counter
12 FRC	[	57 RCL 00	
13 STO 00		58 FRC	
		59+LBL 03	Begin tone loop
14 RTN		60 10	
15+LBL "SIM		61 *	
ON"	Set display	62 INT	
16 FIX 0	format	63 VIEW X	
17 CF 29	LOLMAL		
18 CF 06		64 TONE IND	
19 FS?C 00	Clear error	X	1
20 SF 07	flag	65 LASTX	Decrement tone
		66 FRC	
21 XEQ "R"	Save status of	67 DSE 03	count
22 FS?C 07	FOO	68 GTO 03	Repeat tone
23 SF 00		69 RTN	loop
24 "HOW MAN		70+LBL "NO"	
Y?"		71 SF 06	
25 PROMPT			Ι
26 1 E3	Ask for maximum	72 TONE 2	"Un-oh" sound
27 /	length	73 TONE 0	
	_	74 "NO: "	
	]	75 ARCL X	
29 +		76 "⊢, NOT	
30 STO 01	Set up counters	••	
31 CLX	-	77 ARCL Y	_
32 STO 02		78 AVIEW	Increment error
33+LBL 10	<b>┝ ─ ─ ─ ─ ─ ─ </b> -  -  -  -  -	79 PSE	count
34 RCL 01	Cot o		Thomas
35 INT	Get a sequence	80 1	Increment
36 XEQ "R"		81 ST+ 02	counter
	Display the	82 ISG 01	Repeat loop
37 XEQ "TON	sequence	83 GTO 10	
ES"	-	84+LBL 01	
38 XEQ "?"	Ask player what	85 "YOU MIS	
39 FS? 05	he saw	SED "	Error message
40 GTO "NO"	Tf mans	86 ARCL 02	
41 "YES: "	If wrong,	87 CF 06	
42 ARCL X	branch to "NO"		
43 AVIEW	Increment	88 AVIEW	
44 ISG 01		89 RTN	
	counter	90+LBL "?"	
45 GTO 10	Repeat loop	91 "NUMBERS	Ask player to
46 FS?C 06	Tebear 100b	<u></u>	input numbers
47 GTO 01	If any errors,	92 PROMPT	seen
48 BEEP	skip win message		

94 RCL 00		51		
95 RCL 01			· · · · · · · · · · · · · · · · · · ·	
96 INT		[		
97 10†X				
98 *				
99 INT	If correct,			
100 X=Y?				
101 RTN	then done			
102 SF 05	Othersday ant	<u> </u>		
103 RTN	Otherwise, set		· · · · · · · · · · · · · · · · · · ·	
104 .END.	error flag	60		
104 . 2010.				
	1			
			· · · · · · · · · · · · · · · · · · ·	
	ĺ			
	1	<u> </u>	· · · · · · · · · · · · · · · · · · ·	
	4	L		
	1			
	4	J		
	1	L		
		1		
20	1	70		
	1			
		L		
	1			
	•			
30		80		
			· · · · · · · · · · · · · · · · · · ·	
	1			
	4	ļ		
	]			
	t	<b></b>	·	
	4	ļ		
	1			
40	1	90	· · · · · · · · · · · · · · · · · · ·	1
<u> </u>		<u>⊢</u> ⊸	· · · · · · · · · · · · · · · · · · ·	•
	4	L		
		<u> </u>	· · · · · · · · · · · · · · · · · · ·	1
h	4	}	······································	ł
	1	L		
	1			
	1	<u> </u>		
	4			
	J			
		1		
50	t	00	· · · · · · · · · · · · · · · · · · ·	1
	1	,		

### <sup>70</sup> REGISTERS, STATUS, FLAGS, ASSIGNMENTS

DATA REGISTERS				STATUS					
00	Random sequence length counter error counter tones counter	50	SIZE	=0(	04_ TOT FIX RAD	<sup>7.</sup> REG SC GF	40 I	_ USER ON	MODE OFF
05		55		FLAGS INIT # S/C SET INDICATES CLEA				NDICATES	
			00	T T		sequence		· · · ·	t sequence
			06		error 1	nas occu	urred	no error	yet
			07	L				s flag O	
10		60	26	ļ	tones			no tones	
		<b></b>		<b> </b>					
┝──┤		<b></b>		┣───	<b>_</b>				
				ļ	<b>.</b>			ļ	
15		65							· · · · ·
				<u> </u>	<b> </b>			<b> </b>	
┝──┤				<b> </b>	ļ			<b>.</b>	
					<u> </u>				<u></u>
				<b></b>	ļ				
20		70			<u> </u>				
		<b>.</b>		ļ	<b> </b>			4	
	<u>-</u>			I		•			
				ļ				ļ	
		<u>↓ _ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓</u>				1			
25		75			ļ				
									<u> </u>
		<b></b>		<b> </b>	ļ		-	l	
					ļ				
				<u> </u>				<b>.</b>	
30		80			· · · ·			<b> </b>	
		· · · · · · · · · · · · · · · · · · ·							
	· · · ·	<u> </u>			<u> </u>		-	<u> </u>	
					<u> </u>				
		85		<u> </u>	<u> </u>			<u> </u>	
35				<u> </u>				ł	
┣		ł — · ł - · · · · · · · · · · · · · · · · ·		L	I	<u> </u>		<b>I</b>	·····
├		<u> </u>				ASSIGI	NMEN	NTS	
				FUNC		KEY		FUNCTION	KEY
40		90					T		
		<u>  ~~  </u>				<u> </u>	<u> </u>		
┝╼╼╾┥		<u> </u>		ü			<u> </u>		
┣──┤	· · · ·	<b>++</b>					<b>†</b>		
┝+		<u> </u>				1	<u> </u>	<u></u>	
45		95				<u> </u>	1		
┝┷┤		<u>+ ~~ +</u>							
├──┤	· · · ·	<u>}    </u> }				†	1		
		<u>†                                    </u>				1	1		
}		<u>+</u>				1	<u>†</u>		
		<u> </u>				<u></u>	4	· · · · · · · · · · · · · · · · · · ·	

#### Hewlett-Packard Software

In terms of power and flexibility, the problem-solving potential of the HP-41C programmable calculator is nearly limitless. And in order to see the practical side of this potential, HP has different types of software to help save you time and programming effort. Every one of our software solutions has been carefully selected to effectively increase your problem-solving potential. Chances are, we already have the solutions you're looking for.

#### **Application Pacs**

To increase the versatility of your HP-41C, HP has an extensive library of "Application Pacs". These programs transform your HP-41C into a specialized calculator in seconds. Included in these pacs are detailed manuals with examples, minature plug-in Application Modules, and keyboard overlays. Every Application Pac has been designed to extend the capabilities of the HP-41C.

You can choose from:

Aviation Clinical Lab Circuit Analysis Financial Decisions Mathematics Structural Analysis Surveying Securities Statistics Stress Analysis Games Home Management Machine Design Navigation Real Estate Thermal and Transport Science

#### **Users'** Library

The Users' Library provides the best programs from contributors and makes them available to you. By subscribing to the HP-41C Users' Library you'll have at your fingertips literally hundreds of different programs from many different application areas.

#### \* Users' Library Solutions Books

Hewlett-Packard offers a wide selection of Solutions Books complete with user instructions, examples, and listings. These solution books will complement our other software offerings and provide you with a valuable tool for program solutions.

You can choose from:

Business Stat/Marketing/Sales Home Construction Estimating Lending, Saving and Leasing Real Estate Small Business Geometry High-Level Math Test Statistics Antennas Chemical Engineering Control Systems Electrical Engineering Fluid Dynamics and Hydraulics Civil Engineering Heating, Ventilating & Air Conditioning Mechanical Engineering Solar Engineering Calendars Cardiac/Pulmonary Chemistry Games Optometry I (General) Optometry II (Contact Lens) Physics Surveying

\* Some books require additional memory modules to accomodate all programs.

#### GAMES

HUNT THE WUMPUS 3-D TIC TAC TOE ROBOT TRAP HEXAPAWN SCATTER FLIP-FLOP ORBITAL LANDER PLANET LANDER WARI SIMON



00041-90099 Rev. D 4/81 Printed in U.S.A