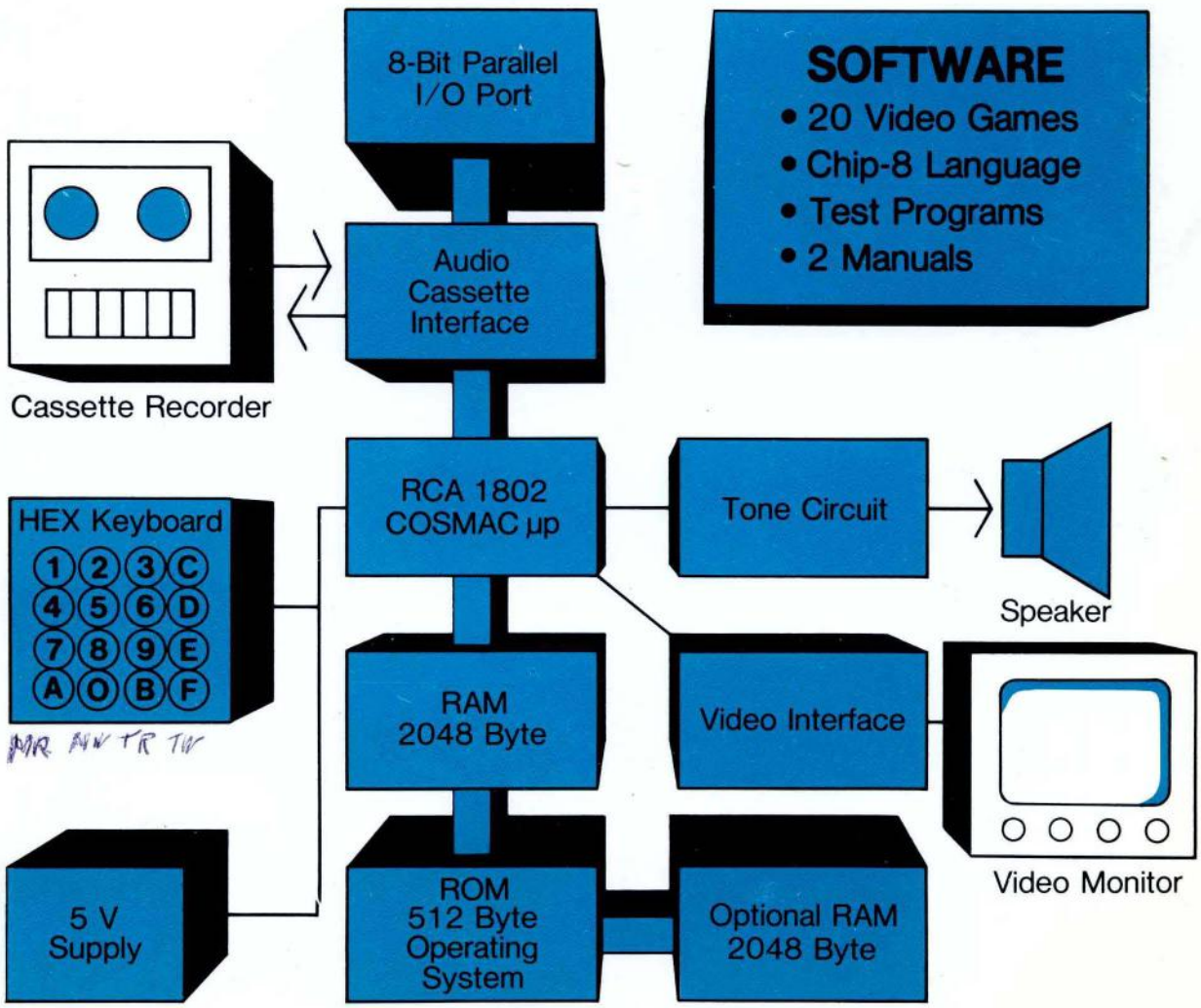
RCA Solid State

RCA COSMAC VIP CDP18S711 Instruction Manual



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RCA COSMAC VIP CDP18S711
Instruction Manual

RCA Solid State Division, Somerville, N. J. 08876

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VIP-311

ACKNOWLEDGMENT

COSMAC VIP has been created by Joe Weisbecker of the RCA Laboratories, Princeton, N.J. so that everyone can have fun and useful personal computer experiences. The elegant and simple hardware system design and the powerful video output together with the customized CHIP-8 language interpreter constitute a fresh and promising approach to personal computers.

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III. CHIP-8 Language Programming

CHIP-8 is an easy-to-learn programming language that lets you write your own programs. To use the CHIP-8 language, you must first store the 512-byte CHIP-8 language program at memory locations 0000 to 01FF. The CHIP-8 language program is shown in Appendix C in hex form so you can enter it directly in memory using the hex keyboard. You can then record it on a memory cassette for future use. Each CHIP-8 instruction is a two-byte (4-hex-digit) code. There are 31, easy-to-use CHIP-8 instructions as shown in Table I.

When using CHIP-8 instructions your program must always begin at location 0200. There are 16 one-byte variables labeled 0-F. VX or VY refers to the value of one of these variables. A 63FF instruction sets variable 3 to the value FF (V3=FF). I is a memory pointer that can be used to specify any location in RAM. An A232 instruction would set I=0232. I would then address memory location 0232.

Branch Instructions

There are several types of jump or branch instructions in the CHIP-8 language. Instruction 1242 would cause an unconditional branch to the instruction at memory location 0242. Instruction BMMM lets you index the branch address by adding the value of variable 0 to it before branching. Eight conditional skip instructions let you test the values of the 16 one-byte variables or determine if a specific hex key is being pressed. This latter capability is useful in video game programs. (Only the least significant hex digit of VX is used to specify the key.)

A 2570 instruction would branch to a subroutine starting at location 0570. 00EE at the end of this subroutine will return program execution to the instruction following the 2570. The subroutine itself could use another 2MMM instruction to branch to (or call) another subroutine. This technique is known as subroutine nesting. Note that all subroutines called (or branched to) by 2MMM instructions must end with 00EE. **Ignoring this rule will cause hard-to-find program bugs.**

How to Change and Use the Variables

The CXKK instruction sets a random byte value into VX. This random byte would have any bits matching 0 bit positions in KK set to 0. For example, a C407 instruction would set V4 equal to a random byte value between 00 and 07.

A timer (or real-time clock) can be set to any value between 00 and FF by a FX15 instruction. This timer is automatically decremented by one, 60 times per second until it reaches 00. Setting it to FF would require about 4 seconds for it to reach 00. This timer can be examined with a FX07 instruction. A FX18 instruction causes a tone to be sounded for the time specified by the value of VX. A value of FF would result in a 4-second tone. The minimum time that the speaker will respond to is that corresponding to the variable value 02.

A FX33 instruction converts the value of VX to decimal form. Suppose I=0422 and V9=A7. A F933 instruction would cause the following bytes to be stored in memory:

```
0422  01
0423  06
0424  07
```

Since A7 in hex equals 167 in decimal, we see that the

Table I – CHIP-8 Instructions

Instruction	Operation
1MMM	Go to 0MMM
BMMM	Go to 0MMM + VO
2MMM	Do subroutine at 0MMM (must end with 00EE)
00EE	Return from subroutine
3XKK	Skip next instruction if VX = KK
4XKK	Skip next instruction if VX ≠ KK
5XY0	Skip next instruction if VX = VY
9XY0	Skip next instruction if VX ≠ VY
EX9E	Skip next instruction if VX = Hex key (LSD)
EXA1	Skip next instruction if VX ≠ Hex key (LSD)
6XKK	Let VX = KK
CXKK	Let VX = Random Byte (KK = Mask)
7XKK	Let VX = VX + KK
8XY0	Let VX = VY
8XY1	Let VX = VX/VY (VF changed)
8XY2	Let VX = VX & VY (VF changed)
8XY4	Let VX = VX + VY (VF = 00 if VX + VY ≤ FF, VF = 01 if VX + VY > FF)
8XY5	Let VX = VX – VY (VF = 00 if VX < VY, VF = 01 if VX ≥ VY)
FX07	Let VX = current timer value
FX0A	Let VX = hex key digit (waits for any key pressed)
FX15	Set timer = VX (01 = 1/60 second)
FX18	Set tone duration = VX (01 = 1/60 second)
AMMM	Let I = 0MMM
FX1E	Let I = I + VX
FX29	Let I = 5-byte display pattern for LSD of VX
FX33	Let MI = 3-decimal digit equivalent of VX (I unchanged)
FX55	Let MI = VO : VX (I = I + X + 1)
FX65	Let VO : VX = MI (I = I + X + 1)
00E0	Erase display (all 0's)
DXYN	Show n-byte MI pattern at VX-VY coordinates. I unchanged. MI pattern is combined with existing display via EXCLUSIVE-OR function. VF = 01 if a 1 in MI pattern matches 1 in existing display.
0MMM	Do machine language subroutine at 0MMM (subroutine must end with D4 byte)

three RAM bytes addressed by I contain the decimal equivalent of the value of V9.

If I=0327, a F355 instruction will cause the values of V0, V1, V2, and V3 to be stored at memory locations 0327, 0328, 0329, and 032A. If I=0410, a F265 instruction would set V0, V1, and V2 to the values of the bytes stored at RAM locations 0410, 0411, and 0412. FX55 and FX65 let you store the values of variables in RAM and set the values of variables to RAM bytes. A sequence of variables (V0 to VX) is always transferred to or from RAM. If X=0, only V0 is transferred.

The 8XY1, 8XY2, and 8XY4, and 8XY5 instructions perform logic and binary arithmetic operations on two 1-byte variables. VF is used for overflow in the arithmetic operations.

Using the Display Instructions

An 00E0 instruction erases the screen to all 0's. When the CHIP-8 language is used, 256 bytes of RAM are displayed on the screen as an array of spots 64 wide by 32 high. A white spot represents a 1 bit in RAM, while a dark (or off) spot represents a 0 bit in RAM. Each spot position on the screen can be located by a pair of coordinates as shown in Fig. 1.

The VX byte value specifies the number of horizontal spot positions from the upper left corner of the display. The VY byte value specifies the number of vertical spot positions from the upper left corner of the display.

The DXYN instruction is used to show a pattern of spots on the screen. Suppose we wanted to form the

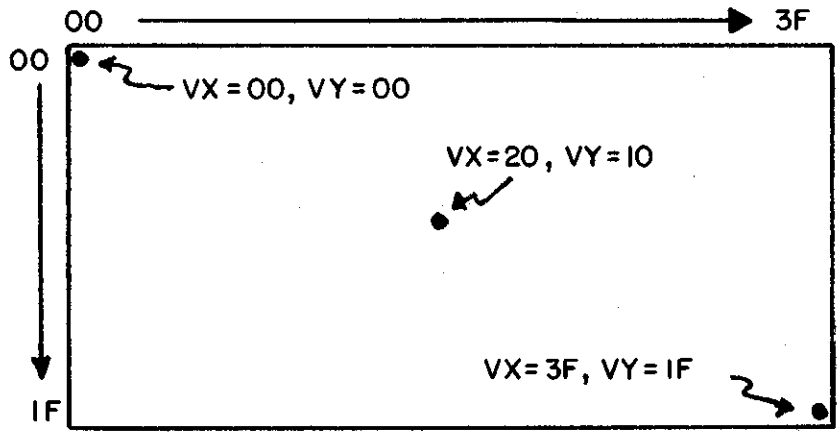


Fig. 1 — Display screen coordinate structure.

pattern for the digit "8" on the screen. First we make up a pattern of bits to form "8" as shown in Fig. 2.

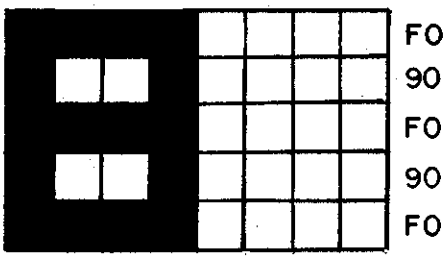


Fig. 2 — Pattern of bits forming digit 8.

In this example we made the "8" pattern five spots high by four spots wide. Patterns to be shown on the screen using the DXYN instruction must always be one byte wide and no more than fifteen bytes high. (Several small patterns can be combined to form larger ones on the screen when required). To the right of the "8" pattern in Fig. 2 are the equivalent byte values in hex form. We could now store this pattern as a list of five bytes at RAM location 020A as follows:

```
020A  F0
020B  90
020C  F0
020D  90
020E  F0
```

Suppose we now want to show this pattern in the upper left corner of the screen. We'll assign V1=VX and V2=VY. Now we let V1=V2=00 and set I=020A. If we now do a D125 instruction, the "8" pattern will be shown on the screen in the upper left corner.

You can write a program to show the "8" pattern on the screen as follows:

```
0200 A20A I=020A
0202 6100 V1=00
0204 6200 V2=00
0206 D125 SHOW 5MI@V1V2
0208 1208 GO 0208
020A F090
020C F090
020E F000
```

The first column of this program shows the memory locations at which the instruction bytes in the second column are stored. The third column indicates the function performed by each instruction in shorthand form. Only the bytes in the second column are actually stored in memory.

With the CHIP-8 interpreter stored at 0000-01FF, you can load the above program in memory and run it. Set V1 and V2 to different values to relocate the "8" pattern on the screen. The VX-VY coordinates always specify the screen position of the upper left-hand bit of your pattern. This bit can be either 0 or 1. The last digit of the DXYN instruction specifies the height of your patterns or the number of bytes in your pattern list.

When a pattern is displayed, it is compared with any pattern already on the screen. If a 1 bit in your pattern matches a 1 bit already on the screen, then a 0 bit will be shown at this spot position and VF will be set to a value of 01. You can test VF following a DXYN instruction to determine if your pattern

touched any part of a previously displayed pattern. This feature permits programming video games which require knowing if one moving pattern touches or hits another pattern.

Because trying to display two 1 spots at the same position on the screen results in a 0 spot, you can use the DXYN instruction to erase a previously displayed pattern by displaying it a second time in the same position. (The entire screen can be erased with a single 00E0 instruction.) The following program shows the "8" pattern, shows it again to erase it, and then changes VX and VY coordinates to create a moving pattern:

```
0200 A210 I=0210
0202 6100 V1=00
0204 6200 V2=00
0206 D125 SHOW 5MI@V1V2
0208 D125 SHOW 5MI@V1V2
020A 7101 V1+01
020C 7201 V2+01
020E 1206 GO 0206
0210 F090
0212 F090
0214 F000
```

The "8" pattern byte list was moved to 0210 to make room for the other instructions. Try changing the values that V1 and V2 are incremented by for different movement speeds and angles. A delay could be inserted between the two DXYN instructions for slower motion.

The FX29 instruction sets I to the RAM address of a five-byte pattern representing the least significant hex digit of VX. If VX=07, then I would be set to the address of a "7" pattern which could then be shown on the screen with a DXYN instruction. N should always be 5 for these built-in hex-digit patterns. Appendix C shows the format for these standard hex patterns. The following program illustrates the use of the FX29 and FX33 instructions:

```
0200 6300 V3=00
0202 A300 I=0300
0204 F333 MI=V3(3DD)
0206 F265 V0:V2=MI
0208 6400 V4=00
020A 6500 V5=00
020C F029 I=V0(LSDP)
020E D455 SHOW 5MI@V4V5
0210 7405 V4+05
0212 F129 I=V1(LSDP)
0214 D455 SHOW 5MI@V4V5
0216 7405 V4+05
0218 F229 I=V2(LSDP)
021A D455 SHOW 5MI@V4V5
021C 6603 V6=03
021E F618 TONE=V6
0220 6620 V6=20
0222 F615 TIME=V6
0224 F607 V6=TIME
0226 3600 SKIP;V6 EQ 00
0228 1224 GO 0224
022A 7301 V3+01
022C 00E0 ERASE
022E 1202 GO 0202
```

This program continuously increments V3, converts it to decimal form, and displays it on the screen.

The FX0A instruction waits for a hex key to be pressed, VX is then set to the value of the pressed key, and program execution continues when the key is released. (If key 3 is pressed, VX=03). A tone is heard while the key is pressed. This instruction is used to wait for keyboard input.

Applying CHIP-8

You should now be able to write some simple CHIP-8 programs of your own. Here are some things to try:

1. Wait for a key to be pressed and show it on the display in decimal form.

2. Show an 8-bit by 8-bit square on the screen and make it move left or right when keys 4 or 6 are held down.

3. Show an 8-bit square on the screen. Make it move randomly around the screen.

4. Show a single bit and make it move randomly around the screen leaving a trail.

5. Program a simple number game. Show 100 (decimal) on the screen. Take turns with another player. On each turn you can subtract 1-9 from the number by pressing key 19. The first player to reach 000 wins. The game is more interesting if you are only allowed to press a key which is horizontally or vertically adjacent to the last key pressed.

If you are unsure of the operation of any CHIP-8 instruction, just write a short program using it. This step should clear up any questions regarding its operation. In your CHIP-8 programs be careful not to write into memory locations 0000-01FF or you will

lose the CHIP-8 interpreter and will have to reload it. You can insert stopping points in your program for debugging purposes. Suppose you want to stop and examine variables when your program reaches the instruction at 0260. Just write a 1260 instruction at location 0260. Flip RUN down and use operating system mode A to examine variables V0-VF. The memory map in Appendix C shows where you can find them.

After the above practice you are ready to design more sophisticated CHIP-8 programs. Always **prepare a flowchart before actually writing a program.** The last 352 bytes of on-card RAM are used for variables and display refresh. In a 2048-byte RAM system you can use locations 0200-069F for your programs. This area is enough for 592 CHIP-8 instructions (1184 bytes). In a 4096-byte RAM system you can use locations 0200-0E8F. This area is equal to 1608-CHIP-8 instructions (3216 bytes).

Some Program Ideas

Here are a few ideas for programs to write using the CHIP-8 language:

1. INTOXICATION TESTER - Display a six-digit random number on the screen for several seconds. You must remember this number and enter it from the keyboard within ten seconds after the screen goes blank to prove that you're sober and score.

2. NUMBER BASE QUIZ - Display numbers in binary or octal on the screen. You must enter their decimal equivalent to score points.

3. DICE - Push any key to simulate rolling dice displayed on the screen.

4. PUPPETS - Show large face on the screen. Let small children move mouth and roll eyes by pushing keys.

5. BUSY BOX - Let small children push keys to make different object appear on the screen, move, and make sounds.

6. SHUFFLEBOARD - Simulate shuffleboard-type games on the screen.

7. COMPUTER ART - Design new programs to generate pleasing geometric moving patterns on the screen.

8. INVISIBLE MAZE - Try to move a spot through an invisible maze. Tones indicate when you bump into a wall.

9. LUNAR LANDING - Program a graphic lunar landing game.

10. COLLIDE - Try to maneuver a spot from one edge of the screen to the other without hitting randomly moving obstacles.

11. CAPTURE - Try to chase and catch randomly moving spots within a specified time limit.

12. LEARNING EXPERIENCES - Program graphic hand and eye coordination exercises for young children or those with learning disabilities.

13. NUMBER RECOGNITION - Show groups of objects or spots on the screen. Young child must press key representing number of objects shown to score.

14. WALL BALL - Program a wall-ball-type paddle game for one player.

15. FOOTBALL - Each player enters his play via the hex keyboard and the computer moves the ball on the screen.

16. BLACKJACK - Play "21" against the computer dealer.

17. HOLIDAY DISPLAYS - Design custom, animated displays for birthdays, Halloween, Christmas, etc.

18. METRIC CONVERSION - Help children learn metric by showing lengths on screen in inches and requiring centimeter equivalent to be entered to score.

19. TURING MACHINE - Simulate a simplifed Turing machine on the screen.

20. TIMER - Use the computer to time chess games, etc.

21. HEXAPAWN - Program Hexapawn so that the computer learns to play a perfect game.

22. NIM - Program Nim with groups of spots shown on the screen.

23. BLOCK PUZZLES - You can simulate a variety of sliding block-type puzzles on the screen.

24. BOMBS AWAY - Show a moving ship at the bottom of the screen. Try to hit the ship by releasing bombs from a moving plane at the top of the screen.

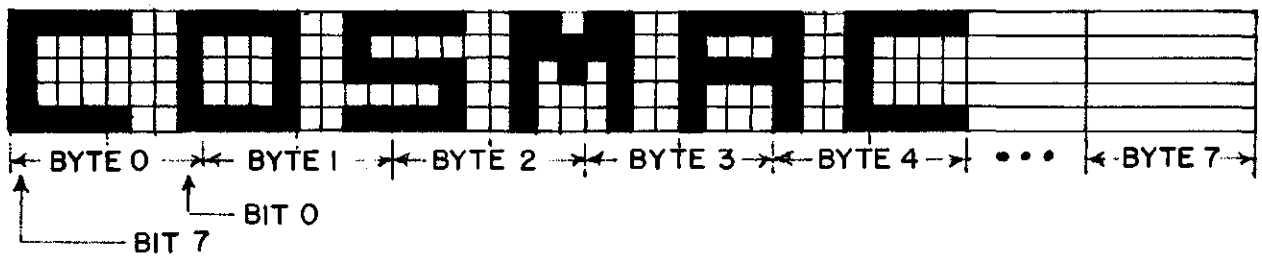
25. PROGRAMMED SPOT - Introduce children to programming concepts by letting them preprogram the movements of a spot or object on the screen.

The next section will discuss machine language programming. You can even combine machine language subroutines with CHIP-8 programs if desired.

Appendix A - Test and Operating Data

Byte Pattern for Displaying "COSMAC"

The following figure shows how the word "COSMAC" would be formed by spots (or bits) on the display screen.



The following bytes when loaded into memory will cause the word "COSMAC" to be shown on the display in a 2048-byte RAM system. Start pattern of bytes at location 0F00 in a 4096-byte system.

```
0700  F9 F3 E6 CF 9F 00 00 00
0708  81 12 07 C8 90 00 00 00
0710  81 13 E5 4F 90 00 00 00
0718  81 10 24 48 90 00 00 00
0720  F9 F3 E4 48 9F 00 00 00
0728  00 00 00 00 00 00 00 00
```

Beeper Program

This machine-language program flashes the Q light and beeps at a rate determined by the byte at location 0002. Change this byte for faster or slower rates.

```
0000  7A F8 0F BF 2F 9F 3A 04
0008  31 00 7B 30 01 00 00 00
```

CHIP-8 Memory Map

Location	Use
0000 • • • 01FF	CHIP-8 LANGUAGE INTERPRETER
0200 • • •	User programs using CHIP-8 instruction set (1184 bytes available in 2048-byte system)
0YA0 • • • 0YCF	CHIP-8 stack (48 bytes max. for up to 12 levels of subroutine nesting)
0YD0 • • • 0YEF	Reserved for CHIP-8 INTERPRETER work area
0YF0	V0
0YF1	V1
0YF2	V2
0YF3	V3
0YF4	V4
0YF5	V5
0YF6	V6
0YF7	V7
0YF8	V8
0YF9	V9
0YFA	VA
0YFB	VB
0YFC	VC
0YFD	VD
0YFE	VE
0YFF	VF
0X00 • • • 0XFF	256-byte RAM area for display refresh

0X = Highest on-card RAM page (07 for 2048-byte system)
0Y = 0X – 1 (06 for 2048-byte system)

CDP1802 Register Use for CHIP-8 Interpreter

R0 = DMA pointer (page 0X for display refresh)
R1 = INTERRUPT routine program counter
R2 = Stack pointer
R3 = INTERPRETER subroutine program counter
R4 = CALL subroutine program counter
R5 = CHIP-8 instruction program counter
R6 = VX pointer (R6.1 must not be changed)
R7 = VY pointer (available for machine-language subroutines)
R8 = Timers (R8.1 = timer, R8.0 = tone duration)
R9 = Random number (+1 in INTERRUPT routine)
RA = I pointer
RB = Display page pointer (RB.1 = 0X)
RC = Available
RD = Available
RE = Available
RF = Available

CHIP-8/Operating System Standard Digit Display Format

HEX DIGIT	ROM ADDRESS	BYTE	BITS 7 6 5 4 3 2 1 0
E-	8110	F0	
	11	80	
F-	8112	F0	
	13	80	
C-	8114	F0	
	15	80	
	16	80	
	17	80	
B-	8118	F0	
	19	50	
	1A	70	
	1B	50	
D-	811C	F0	
	1D	50	
	1E	50	
	1F	50	
5-	8120	F0	
	21	80	
2-	8122	F0	
	23	10	
6-	8124	F0	
	25	80	
8-	8126	F0	
	27	90	
9-	8128	F0	
	29	90	
3-	812A	F0	
	2B	10	
	2C	F0	
	2D	10	
A-	812E	F0	
	2F	90	
0-	8130	F0	
	31	90	
	32	90	
	33	90	
7-	8134	F0	
	35	10	
	36	10	
	37	10	
	38	10	
1-	8139	60	
	3A	20	
	3B	20	
	3C	20	
	3D	70	
4-	813E	A0	
	3F	A0	
	40	F0	
	41	20	
	42	20	

CHIP-8 User Notes

1. Do not use any of the CDP1802 three-cycle machine language instructions in CHIP-8 programs.

2. CDP1802 R5 is used as the CHIP-8 instruction counter. It will be addressing the byte following a 0MMM instruction for machine language subroutines and can be used to pass 2-byte parameters. Refer to the operating system register table in Appendix B to examine this register during CHIP-8 program debugging.

3. Display page 0X is erased to all 0's before beginning CHIP-8 programs at 0200. To inhibit erasing page 0X, change 00E0 at location 01FC to 11FE.

4. To change the display page from 0X, use a machine language subroutine to set RB.1 equal to the new display page.

5. R7, RC, RD, RE, and RF can be used as working registers in machine language subroutines. Changing other registers can cause the CHIP-8 interpreter to malfunction.

6. Do not turn off the CDP1861 video display chip in machine language subroutines. This will interfere with proper operation of the CHIP-8 interpreter.

7. Program bugs can destroy the CHIP-8 interpreter at locations 0000-01FF. If you suspect that this has happened, reload the interpreter.

8. The CHIP-8 interpreter uses subroutines and digit patterns contained in the operating system ROM. If you modify this operating system, the CHIP-8 interpreter should not be used.

Appendix D - Video Games

This Appendix contains program listings for twenty video games. These games, which illustrate entertainment applications of COSMAC VIP, were developed by Joe Weisbecker (games 1 through 8), Joyce Weisbecker (games 9 and 10), Jef Winsor (games 11, 12, and 13), Tom Chen (games 14, 15, and 16), and Phil Baltzer (games 17 through 20).

In the listing for each game, the first column is the memory location at which the instruction bytes in the second column are stored. The comments in the third column indicate the function of the instruction byte. The comments are not stored in memory.

The game titles are listed below:

1. VIP Kaleidoscope

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Four spots appear in a group at the center of the screen. Press keys 2, 4, 6, or 8 to create a pattern. Keep your pattern smaller than 138 key depressions. Push key 0 to terminate pattern entry. Pushing key 0 causes your pattern to be continuously repeated forming a fascinating, changing kaleidoscope display on the screen. A "44444442220" key sequence provides a very nice effect. Experiment to find other nice patterns. The subroutine at 0232-0274 causes your pattern to be duplicated in the four quadrants of the screen.

```
0200 6000 V0=00
0202 6380 V3=80
0204 611F V1=1F
0206 620F V2=0F
0208 2232 DO 0232
020A A200 I=0200
020C F31E I=I+V3
020E F00A V0=KEY
0210 F055 MI=V0:V0
0212 4000 SKIP;V0 NE 00
0214 121C GO 021C
0216 7301 V3+01
0218 3300 SKIP;V3 EQ 00
021A 1208 GO 0208
021C 6380 V3=80
021E A200 I=0200
0220 F31E I=I+V3
0222 F065 V0:V0=MI
0224 4000 SKIP;V0 NE 00
0226 121C GO 021C
0228 7301 V3+01
022A 4300 SKIP;V3 NE 00
022C 121C GO 021C
022E 2232 DO 0232
0230 121E GO 021E
0232 4002 SKIP;V0 NE 02
0234 72FF V2+FF
0236 4004 SKIP;V0 NE 04
0238 71FF V1+FF
023A 4006 SKIP;V0 NE 06
023C 7101 V1+01
023E 4008 SKIP;V0 NE 08
0240 7201 V2+01
0242 A277 I=0277
0244 6AE0 VA=E0
0246 8A12 VA=VA&V1
0248 6B1F VB=1F
024A 81B2 V1=V1&VB
024C 3A00 SKIP;VA EQ 00
024E 7201 V2+01
0250 6AF0 VA=F0
0252 8A22 VA=VA&V2
0254 6B0F VB=0F
0256 82B2 V2=V2&VB
0258 3A00 SKIP;VA EQ 00
025A 7101 V1+01
025C 6B1F VB=1F
025E 81B2 V1=V1&VB
0260 D121 SHOW 1MI@V1V2
0262 8A10 VA=V1
0264 6B1F VB=1F
0266 8B25 VB=VB-V2
0268 DAB1 SHOW 1MI@VAVB
026A 6A3F VA=3F
026C 8A15 VA=VA-V1
026E DAB1 SHOW 1MI@VAVB
0270 8B20 VB=V2
0272 DAB1 SHOW 1MI@VAVB
0274 00EE RET
0276 0180
0278 0000
```

2. VIP Video Display Drawing Game

This program uses the CHIP-8 INTERPRETER at 0000-01FF. A flashing spot appears in the upper left corner of the screen. You can move the spot by holding key 2, 4, 6, or 8. Press key 5 and you can draw a picture with the spot. Press key 0 and the spot can be moved without drawing or used to erase a previously drawn line. 0245-024E is a list of initial values for V0-V9. In this program, locations 0300-03FF are used for the picture. After drawing a picture, you can change M(0208) from 00E0 to 120A. Write locations 0000-03FF (4 pages) to tape to save your picture. When you load these four pages back into memory you will see your original picture. Changing the 00E0 instruction in the program to 120A prevents your picture from being erased when the program is started.

```
0200 A245 I=0245
0202 F965 V0:V9=MI
0204 A24F I=024F
0206 0236 MLS@0236
0208 00E0 ERASE
020A F915 TIME=V9
020C FA07 VA=TIME
020E 3A00 SKIP;VA EQ 00
0210 120C GO 020C
0212 D121 SHOW 1MI@V1V2
0214 3F00 SKIP;VF EQ 00
0216 D121 SHOW 1MI@V1V2
0218 E3A1 SKIP;V3 NE KEY
021A 8030 V0=V3
021C E4A1 SKIP;V4 NE KEY
021E 8040 V0=V4
0220 4000 SKIP;V0 NE 00
0222 123C GO 023C
0224 E5A1 SKIP;V5 NE KEY
0226 72FF V2+FF
0228 E6A1 SKIP;V6 NE KEY
022A 71FF V1+FF
022C E7A1 SKIP;V7 NE KEY
022E 7101 V1+01
0230 E8A1 SKIP;V8 NE KEY
0232 7201 V2+01
0234 120A GO 020A
0236 01F8
0238 03BB
023A E2D4
023C D121 SHOW 1MI@V1V2
023E 4F00 SKIP;VF NE 00
0240 D121 SHOW 1MI@V1V2
0242 1224 GO 0224
0244 0100
0246 0000
0248 0005
024A 0204
024C 0608
024E 0880
```

3. VIP Wipe Off

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Serve the ball by pressing any key. Move the paddle left or right by pressing key 4 or 6. Try to wipe out as many spots as possible. Each spot counts one point. You get 20 balls. You see your final score at the end of the game. You can make the paddle wider by changing the E0 byte at 02CD to F8 or FF.

```
0200 A2CC I=02CC
0202 6A07 VA=07
0204 6100 V1=00
0206 6B08 VB=08
0208 6000 V0=00
020A D011 SHOW 1MI@V0V1
020C 7008 V0+08
020E 7BFF VB+FF
0210 3B00 SKIP;VB EQ 00
0212 120A GO 020A
0214 7104 V1+04
0216 7AFF VA+FF
0218 3A00 SKIP;VA EQ 00
021A 1206 GO 0206
021C 6600 V6=00
021E 6714 V7=14
0220 A2CD I=02CD
0222 6020 V0=20
0224 611E V1=1E
0226 D011 SHOW 1MI@V0V1
0228 631D V3=1D
022A 623F V2=3F
022C 8202 V2=V2&V0
022E 77FF V7+FF
0230 4700 SKIP;V7 NE 00
0232 12AA GO 02AA
0234 FF0A VF=KEY
0236 A2CB I=02CB
0238 D231 SHOW 1MI@V2V3
023A 65FF V5=FF
023C C401 V4=RND
023E 3401 SKIP;V4 EQ 01
0240 64FF V4=FF
0242 A2CD I=02CD
0244 6C00 VC=00
0246 6E04 VE=04
0248 EEA1 SKIP;VE NE KEY
024A 6CFF VC=FF
024C 6E06 VE=06
024E EEA1 SKIP;VE NE KEY
0250 6C01 VC=01
0252 D011 SHOW 1MI@V0V1
0254 80C4 V0=V0+VC
0256 D011 SHOW 1MI@V0V1
0258 4F01 SKIP;VF NE 01
025A 1298 GO 0298
025C 4200 SKIP;V2 NE 00
025E 6401 V4=01
0260 423F SKIP;V2 NE 3F
0262 64FF V4=FF
0264 4300 SKIP;V3 NE 00
0266 6501 V5=01
0268 431F SKIP;V3 NE 1F
026A 12A4 GO 02A4
026C A2CB I=02CB
026E D231 SHOW 1MI@V2V3
0270 8244 V2=V2+V4
0272 8354 V3=V3+V5
0274 D231 SHOW 1MI@V2V3
0276 3F01 SKIP;VF EQ 01
0278 1242 GO 0242
027A 431E SKIP;V3 NE 1E
027C 1298 GO 0298
027E 6A02 VA=02
0280 FA18 TONE=VA
0282 7601 V6+01
0284 4670 SKIP;V6 NE 70
0286 12AA GO 02AA
0288 D231 SHOW 1MI@V2V3
028A C401 V4=RND
028C 3401 SKIP;V4 EQ 01
028E 64FF V4=FF
0290 C501 V5=RND
0292 3501 SKIP;V5 EQ 01
0294 65FF V5=FF
0296 1242 GO 0242
0298 6A03 VA=03
029A FA18 TONE=VA
029C A2CB I=02CB
029E D231 SHOW 1MI@V2V3
02A0 73FF V3+FF
02A2 1236 GO 0236
02A4 A2CB I=02CB
02A6 D231 SHOW 1MI@V2V3
02A8 1228 GO 0228
02AA A2CD I=02CD
02AC D011 SHOW 1MI@V0V1
02AE A2F0 I=02F0
02B0 F633 MI=V6(3DD)
02B2 F265 V0:V2=MI
02B4 6318 V3=18
02B6 641B V4=1B
02B8 F029 I=V0(LSDP)
02BA D345 SHOW 5MI@V3V4
02BC 7305 V3+05
02BE F129 I=V1(LSDP)
02C0 D345 SHOW 5MI@V3V4
02C2 7305 V3+05
02C4 F229 I=V2(LSDP)
02C6 D345 SHOW 5MI@V3V4
02C8 12C8 GO 02C8
02CA 0180
02CC 44E0
```

4. VIP Space Intercept

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Launch your rocket by pressing key 4, 5, or 6. Hit the UFO's to score. The big UFO counts 5 points. The small UFO counts 15 points. You get 15 rockets as shown in the lower right corner of the screen. Your score is shown in the lower left corner of the screen.

```
0200 A2CD I=02CD
0202 6938 V9=38
0204 6A08 VA=08
0206 D9A3 SHOW 3MI@V9VA
0208 A2D0 I=02D0
020A 6B00 VB=00
020C 6C03 VC=03
020E DBC3 SHOW 3MI@VBVC
0210 A2D6 I=02D6
0212 641D V4=1D
0214 651F V5=1F
0216 D451 SHOW 1MI@V4V5
0218 6700 V7=00
021A 680F V8=0F
021C 22A2 DO 02A2
021E 22AC DO 02AC
0220 4800 SKIP;V8 NE 00
0222 1222 GO 0222
0224 641E V4=1E
0226 651C V5=1C
0228 A2D3 I=02D3
022A D453 SHOW 3MI@V4V5
022C 6E00 VE=00
022E 6680 V6=80
0230 6D04 VD=04
0232 EDA1 SKIP;VD NE KEY
0234 66FF V6=FF
0236 6D05 VD=05
0238 EDA1 SKIP;VD NE KEY
023A 6600 V6=00
023C 6D06 VD=06
023E EDA1 SKIP;VD NE KEY
0240 6601 V6=01
0242 3680 SKIP;V6 EQ 80
0244 22D8 DO 02D8
0246 A2D0 I=02D0
0248 DBC3 SHOW 3MI@VBVC
024A CD01 VD=RND
024C 8BD4 VB=VB+VD
024E DBC3 SHOW 3MI@VBVC
0250 3F00 SKIP;VF EQ 00
0252 1292 GO 0292
0254 A2CD I=02CD
0256 D9A3 SHOW 3MI@V9VA
0258 CD01 VD=RND
025A 3D00 SKIP;VD EQ 00
025C 6DFF VD=FF
025E 79FE V9+FE
0260 D9A3 SHOW 3MI@V9VA
0262 3F00 SKIP;VF EQ 00
0264 128C GO 028C
0266 4E00 SKIP;VE NE 00
0268 122E GO 022E
026A A2D3 I=02D3
026C D453 SHOW 3MI@V4V5
026E 4500 SKIP;V5 NE 00
0270 1286 GO 0286
0272 75FF V5+FF
0274 8464 V4=V4+V6
0276 D453 SHOW 3MI@V4V5
0278 3F01 SKIP;VF EQ 01
027A 1246 GO 0246
027C 6D08 VD=08
027E 8D52 VD=VD&V5
0280 4D08 SKIP;VD NE 08
0282 128C GO 028C
0284 1292 GO 0292
0286 22AC DO 02AC
0288 78FF V8+FF
028A 121E GO 021E
028C 22A2 DO 02A2
028E 7705 V7+05
0290 1296 GO 0296
0292 22A2 DO 02A2
0294 770F V7+0F
0296 22A2 DO 02A2
0298 6D03 VD=03
029A FD18 TONE=VD
029C A2D3 I=02D3
029E D453 SHOW 3MI@V4V5
02A0 1286 GO 0286
02A2 A2F8 I=02F8
02A4 F733 MI=V7(3DD)
02A6 6300 V3=00
02A8 22B6 DO 02B6
02AA 00EE RET
02AC A2F8 I=02F8
02AE F833 MI=V8(3DD)
02B0 6332 V3=32
02B2 22B6 DO 02B6
02B4 00EE RET
02B6 6D1B VD=1B
02B8 F265 V0:V2=MI
02BA F029 I=V0(LSDP)
02BC D3D5 SHOW 5MI@V3VD
02BE 7305 V3+05
02C0 F129 I=V1(LSDP)
02C2 D3D5 SHOW 5MI@V3VD
02C4 7305 V3+05
02C6 F229 I=V2(LSDP)
02C8 D3D5 SHOW 5MI@V3VD
02CA 00EE RET
02CC 017C
02CE FE7C
02D0 60F0
02D2 6040
02D4 E0A0
02D6 F8D4
02D8 6E01 VE=01
02DA 6D10 VD=10
02DC FD18 TONE=VD
02DE 00EE RET
```

6. VIP Figure Shooting at Moving Target

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Fire the gun by pressing key 3(up), 6(straight), or 9(down) to hit the moving target. You get 25 shots (bottom number). Each hit scores 10 points (top number).

```
0200 6719 V7=19
0202 6800 V8=00
0204 22C2 DO 02C2
0206 22DE DO 02DE
0208 6525 V5=25
020A 660D V6=0D
020C 22E6 DO 02E6
020E D565 SHOW 5MI@V5V6
0210 CD01 VD=RND
0212 3D01 SKIP;VD EQ 01
0214 6D07 VD=07
0216 230C DO 030C
0218 6410 V4=10
021A 630B V3=0B
021C 83D4 V3=V3+VD
021E A2BF I=02BF
0220 D341 SHOW 1MI@V3V4
0222 6C00 VC=00
0224 6B80 VB=80
0226 6003 V0=03
0228 E0A1 SKIP;V0 NE KEY
022A 6BFF VB=FF
022C 6006 V0=06
022E E0A1 SKIP;V0 NE KEY
0230 6B00 VB=00
0232 6009 V0=09
0234 E0A1 SKIP;V0 NE KEY
0236 6B01 VB=01
0238 3B80 SKIP;VB EQ 80
023A 229A DO 029A
023C A2B3 I=02B3
023E D565 SHOW 5MI@V5V6
0240 8594 V5=V5+V9
0242 86A4 V6=V6+VA
0244 4520 SKIP;V5 NE 20
0246 22F6 DO 02F6
0248 453B SKIP;V5 NE 3B
024A 22FA DO 02FA
024C 4600 SKIP;V6 NE 00
024E 22FE DO 02FE
0250 461B SKIP;V6 NE 1B
0252 2308 DO 0308
0254 D565 SHOW 5MI@V5V6
0256 3F00 SKIP;VF EQ 00
0258 1280 GO 0280
025A 4C00 SKIP;VC NE 00
025C 1224 GO 0224
025E A2BF I=02BF
0260 D341 SHOW 1MI@V3V4
0262 333E SKIP;V3 EQ 3E
0264 126E GO 026E
0266 4700 SKIP;V7 NE 00
0268 1268 GO 0268
026A 230C DO 030C
026C 1210 GO 0210
026E 7302 V3+02
0270 4400 SKIP;V4 NE 00
0272 6B01 VB=01
0274 441D SKIP;V4 NE 1D
0276 6BFF VB=FF
0278 84B4 V4=V4+VB
027A D341 SHOW 1MI@V3V4
027C 4F00 SKIP;VF NE 00
027E 123C GO 023C
0280 6002 V0=02
0282 F018 TONE=V0
0284 A2BF I=02BF
0286 D341 SHOW 1MI@V3V4
0288 A2B3 I=02B3
028A D565 SHOW 5MI@V5V6
028C 22DE DO 02DE
028E 780A V8+0A
0290 22DE DO 02DE
0292 4700 SKIP;V7 NE 00
0294 1294 GO 0294
0296 230C DO 030C
0298 1208 GO 0208
029A 6C01 VC=01
029C 6007 V0=07
029E F018 TONE=V0
02A0 22C2 DO 02C2
02A2 77FF V7+FF
02A4 22C2 DO 02C2
02A6 00EE RET
02A8 017C
02AA 7CFE
02AC 7C7C
02AE 707C
02B0 387F
02B2 7F7C
02B4 7C7C
02B6 7C7C
02B8 3838
02BA 3838
02BC 383E
02BE E080
02C0 00D4
02C2 A3F8 I=03F8
02C4 F733 MI=V7(3DD)
02C6 6E1B VE=1B
02C8 6F10 VF=10
02CA F265 V0:V2=MI
02CC F029 I=V0(LSDP)
02CE DFE5 SHOW 5MI@VFVE
02D0 6F15 VF=15
02D2 F129 I=V1(LSDP)
02D4 DFE5 SHOW 5MI@VFVE
02D6 6F1A VF=1A
02D8 F229 I=V2(LSDP)
02DA DFE5 SHOW 5MI@VFVE
02DC 00EE RET
02DE A3F8 I=03F8
02E0 F833 MI=V8(3DD)
02E2 6E00 VE=00
02E4 12C8 GO 02C8
02E6 C901 V9=RND
02E8 3901 SKIP;V9 EQ 01
02EA 69FF V9=FF
02EC CA01 VA=RND
02EE 3A01 SKIP;VA EQ 01
02F0 6AFF VA=FF
02F2 A2B3 I=02B3
02F4 00EE RET
02F6 6901 V9=01
02F8 12EC GO 02EC
02FA 69FF V9=FF
02FC 12EC GO 02EC
02FE 6A01 VA=01
0300 C901 V9=RND
0302 3901 SKIP;V9 EQ 01
0304 69FF V9=FF
0306 00EE RET
0308 6AFF VA=FF
030A 1300 GO 0300
030C 6E08 VE=08
030E A2A9 I=02A9
0310 DDEF SHOW FMI@VDVE
0312 7E0F VE+0F
0314 A2B8 I=02B8
0316 DDE6 SHOW 6MI@VDVE
0318 6E10 VE=10
031A 6008 V0=08
031C 80D4 V0=V0+VD
031E 8F00 VF=V0
0320 A2BE I=02BE
0322 DFE2 SHOW 2MI@VFVE
0324 00EE RET
```

7. VIP Tick-Tack-Toe Game

This program uses the CHIP-8 INTERPRETER at 0000-01FF. You are "O", VIP is "X". You move first. Press key 1-9 to put your "O" into a square. Squares are in the same positions as keys 1-9. VIP then puts an "X" into an empty square. If you get three "O" 's in a row you win the game. If VIP gets three "X" 's in a row you lose the game. The game is a draw when all squares are filled without getting 3 in a row. You can beat VIP because it is programmed to make a mistake once in a while.

```
0200 02E4 MLS@02E4
0202 232E DO 032E
0204 FD0A VD=KEY
0206 6009 V0=09
0208 9D00 SKIP;VD NE V0
020A 1214 GO 0214
020C 70FF V0+FF
020E 3000 SKIP;V0 EQ 00
0210 1208 GO 0208
0212 1204 GO 0204
0214 A3F0 I=03F0
0216 FD1E I=I+VD
0218 F065 V0:V0=MI
021A 3000 SKIP;V0 EQ 00
021C 1204 GO 0204
021E 22F2 DO 02F2
0220 6130 V1=30
0222 6002 V0=02
0224 F018 TONE=V0
0226 C007 V0=RND
0228 F015 TIME=V0
022A F007 V0=TIME
022C 3000 SKIP;V0 EQ 00
022E 122A GO 022A
0230 71FF V1+FF
0232 3100 SKIP;V1 EQ 00
0234 1222 GO 0222
0236 6403 V4=03
0238 6C01 VC=01
023A 2390 DO 0390
023C 3510 SKIP;V5 EQ 10
023E 134C GO 034C
0240 2314 DO 0314
0242 4D00 SKIP;VD NE 00
0244 1356 GO 0356
0246 6402 V4=02
0248 6C02 VC=02
024A 2390 DO 0390
024C 3510 SKIP;V5 EQ 10
024E 135A GO 035A
0250 6402 V4=02
0252 6C01 VC=01
0254 2390 DO 0390
0256 3510 SKIP;V5 EQ 10
0258 1360 GO 0360
025A C703 V7=RND
025C 4700 SKIP;V7 NE 00
025E 1268 GO 0268
0260 A3F5 I=03F5
0262 F065 V0:V0=MI
0264 4000 SKIP;V0 NE 00
0266 1364 GO 0364
0268 A3F2 I=03F2
026A F065 V0:V0=MI
026C 4001 SKIP;V0 NE 01
026E 1368 GO 0368
0270 A3F4 I=03F4
0272 F065 V0:V0=MI
0274 4001 SKIP;V0 NE 01
0276 1368 GO 0368
0278 A3F5 I=03F5
027A F065 V0:V0=MI
027C 4001 SKIP;V0 NE 01
027E 1368 GO 0368
0280 C703 V7=RND
0282 4700 SKIP;V7 NE 00
0284 1296 GO 0296
0286 A3F6 I=03F6
0288 F065 V0:V0=MI
028A 4001 SKIP;V0 NE 01
028C 1374 GO 0374
028E A3F8 I=03F8
0290 F065 V0:V0=MI
0292 4001 SKIP;V0 NE 01
0294 1374 GO 0374
0296 C703 V7=RND
0298 4700 SKIP;V7 NE 00
029A 12A4 GO 02A4
029C A3F5 I=03F5
029E F065 V0:V0=MI
02A0 3001 SKIP;V0 EQ 01
02A2 1380 GO 0380
02A4 A3F3 I=03F3
02A6 F065 V0:V0=MI
02A8 4000 SKIP;V0 NE 00
02AA 138C GO 038C
02AC 2314 DO 0314
02AE 22F8 DO 02F8
02B0 1204 GO 0204
02B2 0100
02B4 1401
02B6 1C01
02B8 2401
02BA 1409
02BC 1C09
02BE 2409
02C0 1411
02C2 1C11
02C4 2411
02C6 0104
02C8 0303
02CA 0203
02CC 0103
02CE 0701
02D0 0401
02D2 0101
02D4 0302
02D6 4224
02D8 1818
02DA 2442
02DC 7E42
02DE 4242
02E0 427E
02E2 FFFF
02E4 F803
02E6 BFF8
02E8 F0AF
```

(Continued on next page)

7. VIP Tick-Tack-Toe Game (Continued)

```
02EA F800
02EC 5F1F
02EE 8F3A
02F0 EAD4
02F2 6C01 VC=01
02F4 22FC DO 02FC
02F6 00EE RET
02F8 6C02 VC=02
02FA 12F4 GO 02F4
02FC A3F0 I=03F0
02FE FD1E I=I+VD
0300 80C0 V0=VC
0302 F055 MI=V0:V0
0304 A2B2 I=02B2
0306 13D0 GO 03D0
0308 F165 V0:V1=MI
030A A2DC I=02DC
030C 3C01 SKIP;VC EQ 01
030E A2D6 I=02D6
0310 D016 SHOW 6MI@V0V1
0312 00EE RET
0314 6D00 VD=00
0316 6101 V1=01
0318 A3F0 I=03F0
031A F11E I=I+V1
031C F065 V0:V0=MI
031E 4000 SKIP;V0 NE 00
0320 132A GO 032A
0322 4109 SKIP;V1 NE 09
0324 00EE RET
0326 7101 V1+01
0328 1318 GO 0318
032A 8D10 VD=V1
032C 00EE RET
032E A2E2 I=02E2
0330 6303 V3=03
0332 6014 V0=14
0334 6100 V1=00
0336 6218 V2=18
0338 D011 SHOW 1MI@V0V1
033A 72FF V2+FF
033C 7101 V1+01
033E 3200 SKIP;V2 EQ 00
0340 1338 GO 0338
0342 73FF V3+FF
0344 7008 V0+08
0346 3300 SKIP;V3 EQ 00
0348 1334 GO 0334
034A 00EE RET
034C A2DC I=02DC
034E 601C V0=1C
0350 611A V1=1A
0352 D016 SHOW 6MI@V0V1
0354 1354 GO 0354
0356 1358 GO 0358
0358 1358 GO 0358
035A 22F8 DO 02F8
035C A2D6 I=02D6
035E 134E GO 034E
0360 22F8 DO 02F8
0362 1204 GO 0204
0364 6D05 VD=05
0366 1360 GO 0360
0368 A3F1 I=03F1
036A F065 V0:V0=MI
036C 3000 SKIP;V0 EQ 00
036E 1280 GO 0280
0370 6D01 VD=01
0372 1360 GO 0360
0374 A3F9 I=03F9
0376 F065 V0:V0=MI
0378 3000 SKIP;V0 EQ 00
037A 1296 GO 0296
037C 6D09 VD=09
037E 1360 GO 0360
0380 A3F2 I=03F2
0382 F065 V0:V0=MI
0384 3000 SKIP;V0 EQ 00
0386 12A4 GO 02A4
0388 6D02 VD=02
038A 1360 GO 0360
038C 6D03 VD=03
038E 1360 GO 0360
0390 6500 V5=00
0392 A2C6 I=02C6
0394 6603 V6=03
0396 F51E I=I+V5
0398 F165 V0:V1=MI
039A 8200 V2=V0
039C 6300 V3=00
039E 6D00 VD=00
03A0 A3F0 I=03F0
03A2 23BE DO 03BE
03A4 3600 SKIP;V6 EQ 00
03A6 13A0 GO 03A0
03A8 9340 SKIP;V3 NE V4
03AA 13B4 GO 03B4
03AC 7502 V5+02
03AE 4510 SKIP;V5 NE 10
03B0 00EE RET
03B2 1392 GO 0392
03B4 4403 SKIP;V4 NE 03
03B6 00EE RET
03B8 3D00 SKIP;VD EQ 00
03BA 00EE RET
03BC 13AC GO 03AC
03BE F21E I=I+V2
03C0 F065 V0:V0=MI
03C2 90C0 SKIP;V0 NE VC
03C4 7301 V3+01
03C6 4000 SKIP;V0 NE 00
03C8 8D20 VD=V2
03CA 8214 V2=V2+V1
03CC 76FF V6+FF
03CE 00EE RET
03D0 FD1E I=I+VD
03D2 FD1E I=I+VD
03D4 1308 GO 0308
```

8. VIP Spooky Spot

This program uses the CHIP-8 INTERPRETER at locations 0000-01FF. Now you can let the computer make your big decisions or predict the future just like government or industry leaders do.

Flip RUN up. You will see the words YES and NO at the right of the screen. Ask the computer any question that can be answered with YES or NO. Press KEY 0 and the spooky spot will show you the computer's answer. This program replaces your old fashioned mechanical OUIJA board.

```
0200 00E0 ERASE
0202 2242 DO 0242
0204 2254 DO 0254
0206 FA0A VA=KEY
0208 A290 I=0290
020A 6100 V1=00
020C 6210 V2=10
020E D121 SHOW 1MI@V1V2
0210 3F00 SKIP;VF EQ 00
0212 1236 GO 0236
0214 6A04 VA=04
0216 FA18 TONE=VA
0218 6A0A VA=0A
021A FA15 TIME=VA
021C FA07 VA=TIME
021E 3A00 SKIP;VA EQ 00
0220 121C GO 021C
0222 7101 V1+01
0224 CA01 VA=RND
0226 3A01 SKIP;VA EQ 01
0228 6AFF VA=FF
022A 82A4 V2=V2+VA
022C 4207 SKIP;V2 NE 07
022E 7201 V2+01
0230 4218 SKIP;V2 NE 18
0232 72FF V2+FF
0234 120E GO 020E
0236 6A10 VA=10
0238 8A22 VA=VA&V2
023A 3A00 SKIP;VA EQ 00
023C 1240 GO 0240
023E 225A DO 025A
0240 226A DO 026A
0242 A270 I=0270
0244 6408 V4=08
0246 6330 V3=30
0248 D348 SHOW 8MI@V3V4
024A 6A08 VA=08
024C FA1E I=I+VA
024E 7308 V3+08
0250 D348 SHOW 8MI@V3V4
0252 00EE RET
0254 A280 I=0280
0256 6410 V4=10
0258 1246 GO 0246
025A 6408 V4=08
025C 6331 V3=31
025E A290 I=0290
0260 D348 SHOW 8MI@V3V4
0262 7301 V3+01
0264 3340 SKIP;V3 EQ 40
0266 1260 GO 0260
0268 1268 GO 0268
026A 6410 V4=10
026C 125C GO 025C
026E 0101
0270 7F7F
0272 6A6A
0274 6276
0276 767F
0278 FFFF
027A 23EF
027C 63FB
027E 23FF
0280 7F76
0282 7270
0284 7476
0286 7F7F
0288 FF87
028A B7B7
028C B787
028E FFFF
0290 8080
0292 8080
0294 8080
0296 8080
0298 80D4
```

9. VIP Jackpot

This program uses the CHIP-8 INTERPRETER at 0000-01FF. You start with $10. It costs you $1 each time you play. Push any key to start the 3 wheels spinning. Push keys 1, 2, and 3 (one at a time) to stop the wheels. You win $3 if you stop with 3 different symbols. You win $5 if you stop with 3 identical symbols. You get a $5 bonus for 3 solid squares. You break the bank if you get your winnings up to $50.

```
0200 6E0A VE=0A
0202 00E0 ERASE
0204 601A V0=1A
0206 610B V1=0B
0208 A333 I=0333
020A D017 SHOW 7MI@V0V1
020C 22D6 DO 02D6
020E FF0A VF=KEY
0210 22D6 DO 02D6
0212 7EFF VE+FF
0214 22D6 DO 02D6
0216 6102 V1=02
0218 6216 V2=16
021A 631E V3=1E
021C 6426 V4=26
021E 6501 V5=01
0220 6602 V6=02
0222 6A01 VA=01
0224 6B01 VB=01
0226 6C01 VC=01
0228 6D03 VD=03
022A C70C V7=RND
022C C80C V8=RND
022E C90C V9=RND
0230 22BE DO 02BE
0232 22C6 DO 02C6
0234 22CE DO 02CE
0236 4A00 SKIP;VA NE 00
0238 1240 GO 0240
023A 22BE DO 02BE
023C C70C V7=RND
023E 22BE DO 02BE
0240 4B00 SKIP;VB NE 00
0242 124A GO 024A
0244 22C6 DO 02C6
0246 C80C V8=RND
0248 22C6 DO 02C6
024A 4C00 SKIP;VC NE 00
024C 1254 GO 0254
024E 22CE DO 02CE
0250 C90C V9=RND
0252 22CE DO 02CE
0254 6000 V0=00
0256 80A4 V0=V0+VA
0258 80B4 V0=V0+VB
025A 80C4 V0=V0+VC
025C 4000 SKIP;V0 NE 00
025E 126E GO 026E
0260 E5A1 SKIP;V5 NE KEY
0262 6A00 VA=00
0264 E6A1 SKIP;V6 NE KEY
0266 6B00 VB=00
0268 EDA1 SKIP;VD NE KEY
026A 6C00 VC=00
026C 1236 GO 0236
026E 6D00 VD=00
0270 8670 V6=V7
0272 8685 V6=V6-V8
0274 4600 SKIP;V6 NE 00
0276 1286 GO 0286
0278 8895 V8=V8-V9
027A 4800 SKIP;V8 NE 00
027C 1292 GO 0292
027E 8795 V7=V7-V9
0280 3700 SKIP;V7 EQ 00
0282 6D03 VD=03
0284 1292 GO 0292
0286 8895 V8=V8-V9
0288 3800 SKIP;V8 EQ 00
028A 1292 GO 0292
028C 4700 SKIP;V7 NE 00
028E 6D05 VD=05
0290 7D05 VD+05
0292 4D00 SKIP;VD NE 00
0294 129C GO 029C
0296 2302 DO 0302
0298 22F6 DO 02F6
029A 2302 DO 0302
029C 22F6 DO 02F6
029E 22D6 DO 02D6
02A0 8ED4 VE=VE+VD
02A2 22D6 DO 02D6
02A4 4E00 SKIP;VE NE 00
02A6 1326 GO 0326
02A8 6631 V6=31
02AA 86E5 V6=V6-VE
02AC 3F00 SKIP;VF EQ 00
02AE 1202 GO 0202
02B0 A368 I=0368
02B2 6419 V4=19
02B4 6518 V5=18
02B6 22EC DO 02EC
```

(Continued on next page)

9. VIP Jackpot (Continued)

```
02B8 22EC DO 02EC
02BA 22F6 DO 02F6
02BC 12B0 GO 02B0
02BE A33A I=033A
02C0 F71E I=I+V7
02C2 D214 SHOW 4MI@V2V1
02C4 00EE RET
02C6 A33A I=033A
02C8 F81E I=I+V8
02CA D314 SHOW 4MI@V3V1
02CC 00EE RET
02CE A33A I=033A
02D0 F91E I=I+V9
02D2 D414 SHOW 4MI@V4V1
02D4 00EE RET
02D6 A400 I=0400
02D8 FE33 MI=VE(3DD)
02DA F265 V0:V2=MI
02DC 601E V0=1E
02DE 630C V3=0C
02E0 F129 I=V1(LSDP)
02E2 D035 SHOW 5MI@V0V3
02E4 7005 V0+05
02E6 F229 I=V2(LSDP)
02E8 D035 SHOW 5MI@V0V3
02EA 00EE RET
02EC D455 SHOW 5MI@V4V5
02EE 6605 V6=05
02F0 F61E I=I+V6
02F2 7408 V4+08
02F4 00EE RET
02F6 6660 V6=60
02F8 F615 TIME=V6
02FA F607 V6=TIME
02FC 3600 SKIP;V6 EQ 00
02FE 12FA GO 02FA
0300 00EE RET
0302 A34A I=034A
0304 640D V4=0D
0306 6518 V5=18
0308 22EC DO 02EC
030A 22EC DO 02EC
030C 22EC DO 02EC
030E 22EC DO 02EC
0310 652A V5=2A
0312 6318 V3=18
0314 A400 I=0400
0316 FD33 MI=VD(3DD)
0318 F265 V0:V2=MI
031A F129 I=V1(LSDP)
031C D535 SHOW 5MI@V5V3
031E 7505 V5+05
0320 F229 I=V2(LSDP)
0322 D535 SHOW 5MI@V5V3
0324 00EE RET
0326 A35E I=035E
0328 6418 V4=18
032A 6518 V5=18
032C 22EC DO 02EC
032E 22EC DO 02EC
0330 1330 GO 0330
0332 0140
0334 E0C0
0336 E060
0338 E040
033A F0F0
033C F0F0
033E 60F0
0340 F060
0342 9060
0344 6090
0346 F090
0348 90F0
034A F42A
034C 2E2A
034E EAEA
0350 8C8C
0352 8AEA
0354 EEAA
0356 EA8A
0358 8EE0
035A 4040
035C 4040
035E 8E8A
0360 8A8A
0362 EEEE
0364 88EC
0366 28EE
0368 8B89
036A A9F9
036C DBA4
036E 343C
0370 2CA4
```

10. VIP Snake Race

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Flip the RUN switch up to see the four snakes race to the finish line. You and your friends can have hours of fun betting on the winner.

```
0200 6400 V4=00
0202 6500 V5=00
0204 6101 V1=01
0206 F129 I=V1(LSDP)
0208 D455 SHOW 5MI@V4V5
020A 6102 V1=02
020C 6508 V5=08
020E F129 I=V1(LSDP)
0210 D455 SHOW 5MI@V4V5
0212 6103 V1=03
0214 6510 V5=10
0216 F129 I=V1(LSDP)
0218 D455 SHOW 5MI@V4V5
021A 6104 V1=04
021C 6518 V5=18
021E F129 I=V1(LSDP)
0220 D455 SHOW 5MI@V4V5
0222 6105 V1=05
0224 6205 V2=05
0226 6305 V3=05
0228 6405 V4=05
022A 6501 V5=01
022C 6609 V6=09
022E 6711 V7=11
0230 6819 V8=19
0232 A2CF I=02CF
0234 D153 SHOW 3MI@V1V5
0236 D263 SHOW 3MI@V2V6
0238 D373 SHOW 3MI@V3V7
023A D483 SHOW 3MI@V4V8
023C 693F V9=3F
023E 6A00 VA=00
0240 D9A8 SHOW 8MI@V9VA
0242 6A08 VA=08
0244 D9A8 SHOW 8MI@V9VA
0246 6A10 VA=10
0248 D9A8 SHOW 8MI@V9VA
024A 6A18 VA=18
024C D9A5 SHOW 5MI@V9VA
024E C901 V9=RND
0250 3901 SKIP;V9 EQ 01
0252 126E GO 026E
0254 F518 TONE=V5
0256 7101 V1+01
0258 D153 SHOW 3MI@V1V5
025A 603E V0=3E
025C 8015 V0=V0-V1
025E 3000 SKIP;V0 EQ 00
0260 126E GO 026E
0262 D153 SHOW 3MI@V1V5
0264 F715 TIME=V7
0266 FA07 VA=TIME
0268 3A00 SKIP;VA EQ 00
026A 1266 GO 0266
026C 1262 GO 0262
026E C901 V9=RND
0270 3901 SKIP;V9 EQ 01
0272 128E GO 028E
0274 F518 TONE=V5
0276 7201 V2+01
0278 D263 SHOW 3MI@V2V6
027A 603E V0=3E
027C 8025 V0=V0-V2
027E 3000 SKIP;V0 EQ 00
0280 128E GO 028E
0282 D263 SHOW 3MI@V2V6
0284 F715 TIME=V7
0286 FA07 VA=TIME
0288 3A00 SKIP;VA EQ 00
028A 1286 GO 0286
028C 1282 GO 0282
028E C901 V9=RND
0290 3901 SKIP;V9 EQ 01
0292 12AE GO 02AE
0294 F518 TONE=V5
0296 7301 V3+01
0298 D373 SHOW 3MI@V3V7
029A 603E V0=3E
029C 8035 V0=V0-V3
029E 3000 SKIP;V0 EQ 00
02A0 12AE GO 02AE
02A2 D373 SHOW 3MI@V3V7
02A4 F715 TIME=V7
02A6 FA07 VA=TIME
02A8 3A00 SKIP;VA EQ 00
02AA 12A6 GO 02A6
02AC 12A2 GO 02A2
02AE C901 V9=RND
02B0 3901 SKIP;V9 EQ 01
02B2 124E GO 024E
02B4 F518 TONE=V5
02B6 7401 V4+01
02B8 D483 SHOW 3MI@V4V8
02BA 603E V0=3E
02BC 8045 V0=V0-V4
02BE 3000 SKIP;V0 EQ 00
02C0 124E GO 024E
02C2 D483 SHOW 3MI@V4V8
02C4 F715 TIME=V7
02C6 FA07 VA=TIME
02C8 3A00 SKIP;VA EQ 00
02CA 12C6 GO 02C6
02CC 12C2 GO 02C2
02CE 0180
02D0 8080
02D2 8080
02D4 8080
02D6 80D4
```

11. VIP Card Matching Game

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Two players, A and B, alternately try to match up pairs of symbols arranged in a four by four matrix. The positions in the matrix correspond to the arrangement of the input keyboard of the COSMAC VIP. The player whose turn it is will be shown at the left or right of the screen. When a player successfully matches a pair, his letter replaces the symbols and he goes again. The positions of the symbols are shown for a brief time at the beginning of the game. If it is too brief or too long a time, change location 0316 from 6020 to 60——.

```
0200 A385 I=0385
0202 6002 V0=02
0204 6102 V1=02
0206 6202 V2=02
0208 6302 V3=02
020A 6402 V4=02
020C 6502 V5=02
020E 6602 V6=02
0210 6702 V7=02
0212 F755 MI=V0:V7
0214 6300 V3=00
0216 A385 I=0385
0218 C107 V1=RND
021A F11E I=I+V1
021C F065 V0:V0=MI
021E 4000 SKIP;V0 NE 00
0220 1216 GO 0216
0222 70FF V0+FF
0224 A385 I=0385
0226 F11E I=I+V1
0228 F055 MI=V0:V0
022A A38E I=038E
022C F31E I=I+V3
022E 8010 V0=V1
0230 F055 MI=V0:V0
0232 7301 V3+01
0234 3310 SKIP;V3 EQ 10
0236 1216 GO 0216
0238 2314 DO 0314
023A C501 V5=RND
023C 22C4 DO 02C4
023E 6B00 VB=00
0240 6D10 VD=10
0242 F00A V0=KEY
0244 A375 I=0375
0246 F01E I=I+V0
0248 F065 V0:V0=MI
024A 90D0 SKIP;V0 NE VD
024C 1242 GO 0242
024E 8D00 VD=V0
0250 22D8 DO 02D8
0252 3B00 SKIP;VB EQ 00
0254 125E GO 025E
0256 6B0F VB=0F
0258 8CD0 VC=VD
025A 89A0 V9=VA
025C 1242 GO 0242
025E 6020 V0=20
0260 F015 TIME=V0
0262 F007 V0=TIME
0264 3000 SKIP;V0 EQ 00
0266 1262 GO 0262
0268 99A0 SKIP;V9 NE VA
026A 1278 GO 0278
026C 22C4 DO 02C4
026E 7501 V5+01
0270 6001 V0=01
0272 8502 V5=V5&V0
0274 22A0 DO 02A0
0276 123C GO 023C
0278 6020 V0=20
027A F018 TONE=V0
027C 7E01 VE+01
027E 22A0 DO 02A0
0280 A385 I=0385
0282 FA1E I=I+VA
0284 60DD V0=DD
0286 F055 MI=V0:V0
0288 4500 SKIP;V5 NE 00
028A 1296 GO 0296
028C A367 I=0367
028E D346 SHOW 6MI@V3V4
0290 A367 I=0367
0292 D126 SHOW 6MI@V1V2
0294 12B8 GO 02B8
0296 A33F I=033F
0298 D346 SHOW 6MI@V3V4
029A A33F I=033F
029C D126 SHOW 6MI@V1V2
029E 12B8 GO 02B8
02A0 22D8 DO 02D8
02A2 8130 V1=V3
02A4 8240 V2=V4
02A6 8DC0 VD=VC
02A8 22D8 DO 02D8
02AA 00EE RET
02AC A36D I=036D
02AE FA1E I=I+VA
02B0 F065 V0:V0=MI
02B2 A334 I=0334
02B4 F01E I=I+V0
02B6 00EE RET
02B8 3E07 SKIP;VE EQ 07
02BA 123E GO 023E
```

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11. VIP Card Matching Game (Continued)

```
02BC 22C4 DO 02C4
02BE 6060 V0=60
02C0 F018 TONE=V0
02C2 12C2 GO 02C2
02C4 6300 V3=00
02C6 6408 V4=08
02C8 A33F I=033F
02CA 4500 SKIP;V5 NE 00
02CC 12D2 GO 02D2
02CE 633A V3=3A
02D0 A367 I=0367
02D2 D346 SHOW 6MI@V3V4
02D4 00EE RET
02D6 5555 SKIP;V5 EQ V5
02D8 A38E I=038E
02DA FD1E I=I+VD
02DC F065 V0:V0=MI
02DE 8A00 VA=V0
02E0 A385 I=0385
02E2 F01E I=I+V0
02E4 F065 V0:V0=MI
02E6 40DD SKIP;V0 NE DD
02E8 1242 GO 0242
02EA 22AC DO 02AC
02EC 6310 V3=10
02EE 6400 V4=00
02F0 600C V0=0C
02F2 80D2 V0=V0&VD
02F4 4004 SKIP;V0 NE 04
02F6 6408 V4=08
02F8 4008 SKIP;V0 NE 08
02FA 6410 V4=10
02FC 400C SKIP;V0 NE 0C
02FE 6418 V4=18
0300 6003 V0=03
0302 80D2 V0=V0&VD
0304 4001 SKIP;V0 NE 01
0306 6318 V3=18
0308 4002 SKIP;V0 NE 02
030A 6320 V3=20
030C 4003 SKIP;V0 NE 03
030E 6328 V3=28
0310 D346 SHOW 6MI@V3V4
0312 00EE RET
0314 2324 DO 0324
0316 6020 V0=20
0318 F015 TIME=V0
031A F007 V0=TIME
031C 3000 SKIP;V0 EQ 00
031E 131A GO 031A
0320 2324 DO 0324
0322 00EE RET
0324 6D00 VD=00
0326 22D8 DO 02D8
0328 7D01 VD+01
032A 4D10 SKIP;VD NE 10
032C 1330 GO 0330
032E 1326 GO 0326
0330 00EE RET
0332 0101
0334 1010
0336 1E78
0338 0808
033A 1818
033C 7E7E
033E 1818
0340 2424
0342 3C24
0344 2466
0346 6618
0348 1866
034A 667E
034C 2424
034E 7E66
0350 4224
0352 1818
0354 2442
0356 7E52
0358 5252
035A 527E
035C 4242
035E 7E42
0360 7E14
0362 7C26
0364 643E
0366 287C
0368 243C
036A 2424
036C 7C00
036E 0611
0370 161C
0372 2227
0374 2D0D
0376 0001
0378 0204
037A 0506
037C 0809
037E 0A0C
0380 0E03
0382 070B
0384 0FD4
```

12. VIP Armored Vehicle Clash

This program uses the CHIP-8 INTERPRETER at 0000-01FF. At the start of the game and after every score change, the score, on the left, and number of shots remaining, on the right, are shown. The tank may be moved by pressing keys 2, 4, 6, or 8 for up, left, right, or down, respectively. To fire a shell press key F. After the score is shown the target will come on the screen at one of eight positions and change direction randomly. Every time you hit the target you score 10 points, but if you are hit by the target you lose 5 shots.

```
0200 6E00 VE=00
0202 6DA0 VD=A0
0204 6A08 VA=08
0206 6906 V9=06
0208 6804 V8=04
020A 6702 V7=02
020C 6619 V6=19
020E 6410 V4=10
0210 630C V3=0C
0212 6200 V2=00
0214 6106 V1=06
0216 A412 I=0412
0218 FA55 MI=V0:VA
021A 23A4 DO 03A4
021C 6040 V0=40
021E F015 TIME=V0
0220 F007 V0=TIME
0222 3000 SKIP;V0 EQ 00
0224 1220 GO 0220
0226 23A4 DO 03A4
0228 22DA DO 02DA
022A 2332 DO 0332
022C A412 I=0412
022E F565 V0:V5=MI
0230 227E DO 027E
0232 2296 DO 0296
0234 22BC DO 02BC
0236 3F01 SKIP;VF EQ 01
0238 22E4 DO 02E4
023A 3F01 SKIP;VF EQ 01
023C 22BC DO 02BC
023E 3F01 SKIP;VF EQ 01
0240 22BC DO 02BC
0242 3F01 SKIP;VF EQ 01
0244 224C DO 024C
0246 4F01 SKIP;VF NE 01
0248 1336 GO 0336
024A 1232 GO 0232
024C A412 I=0412
024E F565 V0:V5=MI
0250 4600 SKIP;V6 NE 00
0252 3500 SKIP;V5 EQ 00
0254 1258 GO 0258
0256 135C GO 035C
0258 E7A1 SKIP;V7 NE KEY
025A 6202 V2=02
025C E8A1 SKIP;V8 NE KEY
025E 6204 V2=04
0260 E9A1 SKIP;V9 NE KEY
0262 6206 V2=06
0264 EAA1 SKIP;VA NE KEY
0266 6208 V2=08
0268 4200 SKIP;V2 NE 00
026A 00EE RET
026C 227E DO 027E
026E 8120 V1=V2
0270 236A DO 036A
0272 237C DO 037C
0274 6C01 VC=01
0276 6200 V2=00
0278 6F00 VF=00
027A A412 I=0412
027C F555 MI=V0:V5
027E A3CF I=03CF
0280 4102 SKIP;V1 NE 02
0282 6000 V0=00
0284 4104 SKIP;V1 NE 04
0286 6013 V0=13
0288 4106 SKIP;V1 NE 06
028A 600D V0=0D
028C 4108 SKIP;V1 NE 08
028E 6006 V0=06
0290 F01E I=I+V0
0292 D347 SHOW 7MI@V3V4
0294 00EE RET
0296 600F V0=0F
0298 E09E SKIP;V0 EQ KEY
029A 00EE RET
029C 450F SKIP;V5 NE 0F
029E 00EE RET
02A0 650F V5=0F
02A2 76FF V6+FF
02A4 A412 I=0412
02A6 F555 MI=V0:V5
02A8 7403 V4+03
02AA 7303 V3+03
02AC 236A DO 036A
02AE 236A DO 036A
02B0 236A DO 036A
02B2 A423 I=0423
02B4 F555 MI=V0:V5
02B6 A3E9 I=03E9
02B8 D341 SHOW 1MI@V3V
02BA 00EE RET
02BC A423 I=0423
02BE F565 V0:V5=MI
02C0 4500 SKIP;V5 NE 0
02C2 00EE RET
02C4 A3E9 I=03E9
02C6 D341 SHOW 1MI@V3V
02C8 236A DO 036A
02CA 6C02 VC=02
02CC 238E DO 038E
02CE 4BBB SKIP;VB NE B
02D0 12DA GO 02DA
02D2 D341 SHOW 1MI@V3V
02D4 A423 I=0423
02D6 F555 MI=V0:V5
02D8 00EE RET
02DA 6500 V5=00
02DC 6000 V0=00
02DE A417 I=0417
02E0 F055 MI=V0:V0
02E2 12D4 GO 02D4
02E4 A41D I=041D
02E6 F565 V0:V5=MI
02E8 350F SKIP;V5 EQ 0F
02EA 1314 GO 0314
02EC A3EA I=03EA
02EE D345 SHOW 5MI@V3V
02F0 3200 SKIP;V2 EQ 0
02F2 1302 GO 0302
02F4 C103 V1=RND
02F6 A419 I=0419
02F8 F11E I=I+V1
02FA F065 V0:V0=MI
02FC 8100 V1=V0
02FE C20F V2=RND
0300 7201 V2+01
0302 236A DO 036A
0304 A3EA I=03EA
0306 6C03 VC=03
0308 72FF V2+FF
030A 6F00 VF=00
```

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12. VIP Armored Vehicle Clash (Continued)

```
030C D345 SHOW 5MI@V3V4
030E A41D I=041D
0310 F555 MI=V0:V5
0312 00EE RET
0314 C407 V4=RND
0316 A3EF I=03EF
0318 F41E I=I+V4
031A F065 V0:V0=MI
031C 8300 V3=V0
031E A3F7 I=03F7
0320 F41E I=I+V4
0322 F065 V0:V0=MI
0324 8400 V4=V0
0326 A3EA I=03EA
0328 D345 SHOW 5MI@V3V4
032A 6020 V0=20
032C F018 TONE=V0
032E 650F V5=0F
0330 130E GO 030E
0332 6500 V5=00
0334 130E GO 030E
0336 4C01 SKIP;VC NE 01
0338 1400 GO 0400
033A 4C02 SKIP;VC NE 02
033C 1352 GO 0352
033E A423 I=0423
0340 F565 V0:V5=MI
0342 4500 SKIP;V5 NE 00
0344 1400 GO 0400
0346 A3E9 I=03E9
0348 D341 SHOW 1MI@V3V4
034A 6F00 VF=00
034C D341 SHOW 1MI@V3V4
034E 3F01 SKIP;VF EQ 01
0350 1400 GO 0400
0352 7E0A VE+0A
0354 6040 V0=40
0356 F018 TONE=V0
0358 00E0 ERASE
035A 121A GO 021A
035C 00E0 ERASE
035E 23A4 DO 03A4
0360 6060 V0=60
0362 F018 TONE=V0
0364 1364 GO 0364
0366 6E00 VE=00
0368 1354 GO 0354
036A 4102 SKIP;V1 NE 02
036C 74FF V4+FF
036E 4104 SKIP;V1 NE 04
0370 73FF V3+FF
0372 4106 SKIP;V1 NE 06
0374 7301 V3+01
0376 4108 SKIP;V1 NE 08
0378 7401 V4+01
037A 00EE RET
037C 4400 SKIP;V4 NE 00
037E 7401 V4+01
0380 4300 SKIP;V3 NE 00
0382 7301 V3+01
0384 4338 SKIP;V3 NE 38
0386 73FF V3+FF
0388 4418 SKIP;V4 NE 18
038A 74FF V4+FF
038C 00EE RET
038E 6B00 VB=00
0390 4400 SKIP;V4 NE 00
0392 139E GO 039E
0394 4300 SKIP;V3 NE 00
0396 139E GO 039E
0398 433F SKIP;V3 NE 3F
039A 139E GO 039E
039C 441F SKIP;V4 NE 1F
039E 6BBB VB=BB
03A0 6F00 VF=00
03A2 00EE RET
03A4 6308 V3=08
03A6 6408 V4=08
03A8 A429 I=0429
03AA FE33 MI=VE(3DD)
03AC F265 V0:V2=MI
03AE 23BC DO 03BC
03B0 6328 V3=28
03B2 A429 I=0429
03B4 F633 MI=V6(3DD)
03B6 F265 V0:V2=MI
03B8 23C2 DO 03C2
03BA 00EE RET
03BC F029 I=V0(LSDP)
03BE D345 SHOW 5MI@V3V4
03C0 7306 V3+06
03C2 F129 I=V1(LSDP)
03C4 D345 SHOW 5MI@V3V4
03C6 7306 V3+06
03C8 F229 I=V2(LSDP)
03CA D345 SHOW 5MI@V3V4
03CC 00EE RET
03CE 0110
03D0 547C
03D2 6C7C
03D4 7C44
03D6 7C7C
03D8 6C7C
03DA 5410
03DC 00FC
03DE 786E
03E0 78FC
03E2 003F
03E4 1E76
03E6 1E3F
03E8 0080
03EA A870
03EC F870
03EE A80B
03F0 1B28
03F2 3830
03F4 2010
03F6 0000
03F8 0000
03FA 081B
03FC 1B1B
03FE 13D4
0400 76FB V6+FB
0402 6020 V0=20
0404 8065 V0=V0-V6
0406 4F00 SKIP;VF NE 00
0408 6600 V6=00
040A 1354 GO 0354
```

13. VIP Hi-Lo

This program uses the CHIP-8 INTERPRETER at 0000-01FF. You have 10 chances to guess the value of a random number between 00 and 99 selected by the program. The number at the right of the screen shows the number of the guess you are using. Enter a two digit number and the computer tells you if you are high or low. Press any key to erase this number and then, try again. If you have failed after ten guesses, press any key and the number will be shown. If you are good you will never need more than seven guesses. If you are not so good, alter the program to allow more guesses by changing location 0292 from 4E0A to 4E99.

```
0200 6C09 VC=09
0202 CD0F VD=RND
0204 8CD5 VC=VC-VD
0206 4F00 SKIP;VF NE 00
0208 1200 GO 0200
020A 89D0 V9=VD
020C 6C09 VC=09
020E CD0F VD=RND
0210 8CD5 VC=VC-VD
0212 4F00 SKIP;VF NE 00
0214 120C GO 020C
0216 8AD0 VA=VD
0218 6E00 VE=00
021A A2AA I=02AA
021C 7E01 VE+01
021E FE33 MI=VE(3DD)
0220 F265 V0:V2=MI
0222 6B30 VB=30
0224 6C10 VC=10
0226 680F V8=0F
0228 F129 I=V1(LSDP)
022A DBC5 SHOW 5MI@VBVC
022C 7B05 VB+05
022E F229 I=V2(LSDP)
0230 DBC5 SHOW 5MI@VBVC
0232 4800 SKIP;V8 NE 00
0234 1254 GO 0254
0236 660A V6=0A
0238 F10A V1=KEY
023A 8165 V1=V1-V6
023C 3F00 SKIP;VF EQ 00
023E 1236 GO 0236
0240 710A V1+0A
0242 660A V6=0A
0244 F20A V2=KEY
0246 8265 V2=V2-V6
0248 3F00 SKIP;VF EQ 00
024A 1242 GO 0242
024C 720A V2+0A
024E 6B10 VB=10
0250 6800 V8=00
0252 1228 GO 0228
0254 8195 V1=V1-V9
0256 3100 SKIP;V1 EQ 00
0258 1272 GO 0272
025A 82A5 V2=V2-VA
025C 3200 SKIP;V2 EQ 00
025E 1286 GO 0286
0260 6B20 VB=20
0262 6518 V5=18
0264 F929 I=V9(LSDP)
0266 DBC5 SHOW 5MI@VBVC
0268 7B05 VB+05
026A FA29 I=VA(LSDP)
026C DBC5 SHOW 5MI@VBVC
026E FC18 TONE=VC
0270 1270 GO 0270
0272 65F0 V5=F0
0274 8152 V1=V1&V5
0276 3100 SKIP;V1 EQ 00
0278 128E GO 028E
027A A29F I=029F
027C 6B10 VB=10
027E 6C18 VC=18
0280 DBC5 SHOW 5MI@VBVC
0282 F60A V6=KEY
0284 1292 GO 0292
0286 65F0 V5=F0
0288 8252 V2=V2&V5
028A 4200 SKIP;V2 NE 00
028C 127A GO 027A
028E A2A4 I=02A4
0290 127C GO 027C
0292 4E0A SKIP;VE NE 0A
0294 129A GO 029A
0296 00E0 ERASE
0298 121A GO 021A
029A DBC5 SHOW 5MI@VBVC
029C 1260 GO 0260
029E 0197
02A0 92F2
02A2 9297
02A4 8F89
02A6 8989
02A8 EFD4
```

14. VIP Hex Reflex

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Key 1 selects decimal-to-hexadecimal conversion. Key 2 selects binary-to-hexadecimal conversion. Convert the decimal or binary number as quickly as possible and press the corresponding hexadecimal key. UA is the random number counter. M(0225) is the limit of the count for the random numbers. By changing this memory location, the amount of random numbers per game can be increased or decreased. The score is a function of your response time. The faster you respond, the higher the score.

```
0200 F80A V8=KEY
0202 3801 SKIP;V8 EQ 01
0204 4802 SKIP;V8 NE 02
0206 120A GO 020A
0208 1200 GO 0200
020A 6700 V7=00
020C 6A00 VA=00
020E 00E0 ERASE
0210 A2DD I=02DD
0212 F733 MI=V7(3DD)
0214 A2DD I=02DD
0216 F665 V0:V6=MI
0218 F029 I=V0(LSDP)
021A D435 SHOW 5MI@V4V3
021C F129 I=V1(LSDP)
021E D535 SHOW 5MI@V5V3
0220 F229 I=V2(LSDP)
0222 D635 SHOW 5MI@V6V3
0224 4A0F SKIP;VA NE 0F
0226 1200 GO 0200
0228 C90F V9=RND
022A 4801 SKIP;V8 NE 01
022C 2296 DO 0296
022E 4802 SKIP;V8 NE 02
0230 22A8 DO 02A8
0232 6BFF VB=FF
0234 FB15 TIME=VB
0236 7A01 VA+01
0238 6000 V0=00
023A E0A1 SKIP;V0 NE KEY
023C 1252 GO 0252
023E 7001 V0+01
0240 4010 SKIP;V0 NE 10
0242 1238 GO 0238
0244 FB07 VB=TIME
0246 3B00 SKIP;VB EQ 00
0248 123A GO 023A
024A 6C80 VC=80
024C FC18 TONE=VC
024E 2280 DO 0280
0250 120E GO 020E
0252 5090 SKIP;V0 EQ V9
0254 124A GO 024A
0256 6C10 VC=10
0258 FC18 TONE=VC
025A A2E4 I=02E4
025C F265 V0:V2=MI
025E 63F0 V3=F0
0260 83B2 V3=V3&VB
0262 3300 SKIP;V3 EQ 00
0264 126A GO 026A
0266 7701 V7+01
0268 127C GO 027C
026A 81B2 V1=V1&VB
026C 8114 V1=V1+V1
026E 83F0 V3=VF
0270 8224 V2=V2+V2
0272 8234 V2=V2+V3
0274 7001 V0+01
0276 3004 SKIP;V0 EQ 04
0278 126C GO 026C
027A 8724 V7=V7+V2
027C 2280 DO 0280
027E 120E GO 020E
0280 A2E7 I=02E7
0282 F365 V0:V3=MI
0284 D013 SHOW 3MI@V0V1
0286 F929 I=V9(LSDP)
0288 D235 SHOW 5MI@V2V3
028A 6B80 VB=80
028C FB15 TIME=VB
028E FB07 VB=TIME
0290 3B00 SKIP;VB EQ 00
0292 128E GO 028E
0294 00EE RET
0296 A2DD I=02DD
0298 F933 MI=V9(3DD)
029A A2DA I=02DA
029C F565 V0:V5=MI
029E F429 I=V4(LSDP)
02A0 D025 SHOW 5MI@V0V2
02A2 F529 I=V5(LSDP)
02A4 D125 SHOW 5MI@V1V2
02A6 00EE RET
02A8 A2D3 I=02D3
02AA F665 V0:V6=MI
02AC 6E08 VE=08
02AE 22C6 DO 02C6
02B0 D045 SHOW 5MI@V0V4
02B2 6E04 VE=04
02B4 22C6 DO 02C6
02B6 D145 SHOW 5MI@V1V4
02B8 6E02 VE=02
02BA 22C6 DO 02C6
02BC D245 SHOW 5MI@V2V4
02BE 6E01 VE=01
02C0 22C6 DO 02C6
02C2 D345 SHOW 5MI@V3V4
02C4 00EE RET
02C6 8E92 VE=VE&V9
02C8 4E00 SKIP;VE NE 00
02CA F529 I=V5(LSDP)
02CC 3E00 SKIP;VE EQ 00
02CE F629 I=V6(LSDP)
02D0 00EE RET
02D2 0114
02D4 1A20
02D6 260D
02D8 0001
02DA 2026
02DC 0D00
02DE 0009
02E0 0030
02E2 363C
02E4 00F0
02E6 002B
02E8 0E30
02EA 0DE0
02EC 00E0
02EE 00D4
```

15. VIP Dot-Dash

This program uses the CHIP-8 INTERPRETER at 0000-01FF. The track or obstacle pattern is copied from 0400-04FF into the display page. The direction of the dot is controlled by keys 2, 4, 6, and 8. The dot is accelerated so long as key 0 is not pressed. Key 0 is used as a brake. New tracks or obstacle patterns can be created by using the VIP Video Display Drawing Game. When you create new patterns, the timer area (upper right corner) should be left blank. The dot starts at the left and the finish is any opening on the right edge of the display. The dot can wrap around at the top and bottom but not the right or left edges. A crash stops the clock and the dot blinks at the crash site. The finish blinks the final clock time.

```
0200 A2EC I=02EC
0202 FE65 V0:VE=MI
0204 FE18 TONE=VE
0206 00E0 ERASE
0208 A400 I=0400
020A 6400 V4=00
020C D451 SHOW 1MI@V4V5
020E F71E I=I+V7
0210 8464 V4=V4+V6
0212 633F V3=3F
0214 8342 V3=V3&V4
0216 3300 SKIP;V3 EQ 00
0218 120C GO 020C
021A 8574 V5=V5+V7
021C 631F V3=1F
021E 8352 V3=V3&V5
0220 3300 SKIP;V3 EQ 00
0222 120A GO 020A
0224 122A GO 022A
0226 22CE DO 02CE
0228 7C01 VC+01
022A 22CE DO 02CE
022C 6D15 VD=15
022E FD15 TIME=VD
0230 FD07 VD=TIME
0232 4D00 SKIP;VD NE 00
0234 1226 GO 0226
0236 A2EC I=02EC
0238 F365 V0:V3=MI
023A E0A1 SKIP;V0 NE KEY
023C 8B00 VB=V0
023E E1A1 SKIP;V1 NE KEY
0240 8B10 VB=V1
0242 E2A1 SKIP;V2 NE KEY
0244 8B20 VB=V2
0246 E3A1 SKIP;V3 NE KEY
0248 8B30 VB=V3
024A 1254 GO 0254
024C 7602 V6+02
024E FD07 VD=TIME
0250 56D0 SKIP;V6 EQ VD
0252 124E GO 024E
0254 7701 V7+01
0256 57AD SKIP;V7 EQ VA
0258 1230 GO 0230
025A 67FF V7=FF
025C 6100 V1=00
025E E1A1 SKIP;V1 NE KEY
0260 126A GO 026A
0262 7AFF VA+FF
0264 4AFF SKIP;VA NE FF
0266 6A00 VA=00
0268 1270 GO 0270
026A 7A01 VA+01
026C 4A00 SKIP;VA NE 00
026E 6AFF VA=FF
0270 A2FB I=02FB
0272 D891 SHOW 1MI@V8V9
0274 3F01 SKIP;VF EQ 01
0276 D891 SHOW 1MI@V8V9
0278 3B04 SKIP;VB EQ 04
027A 1282 GO 0282
027C 3800 SKIP;V8 EQ 00
027E 78FF V8+FF
0280 8000 V0=V0
0282 4B06 SKIP;VB NE 06
0284 7801 V8+01
0286 4B02 SKIP;VB NE 02
0288 79FF V9+FF
028A 4B08 SKIP;VB NE 08
028C 7901 V9+01
028E 6FFF VF=FF
0290 A2FB I=02FB
0292 D891 SHOW 1MI@V8V9
0294 4F01 SKIP;VF NE 01
0296 12BA GO 02BA
0298 383F SKIP;V8 EQ 3F
029A 1230 GO 0230
029C 6E80 VE=80
029E FE18 TONE=VE
02A0 22CE DO 02CE
02A2 6D20 VD=20
02A4 FD15 TIME=VD
02A6 FD07 VD=TIME
02A8 3D00 SKIP;VD EQ 00
02AA 12A6 GO 02A6
02AC 22CE DO 02CE
02AE 6D40 VD=40
02B0 FD15 TIME=VD
02B2 FD07 VD=TIME
02B4 3D00 SKIP;VD EQ 00
02B6 12B2 GO 02B2
02B8 12A0 GO 02A0
02BA A2FB I=02FB
02BC D891 SHOW 1MI@V8V9
02BE 6E10 VE=10
02C0 FE18 TONE=VE
02C2 6D20 VD=20
02C4 FD15 TIME=VD
02C6 FD07 VD=TIME
02C8 3D00 SKIP;VD EQ 00
02CA 12C6 GO 02C6
02CC 12BA GO 02BA
02CE A2FD I=02FD
02D0 FC33 MI=VC(3DD)
02D2 F265 V0:V2=MI
02D4 F229 I=V2(LSDP)
02D6 643C V4=3C
02D8 6500 V5=00
02DA D455 SHOW 5MI@V4V5
02DC 6436 V4=36
02DE F129 I=V1(LSDP)
02E0 D455 SHOW 5MI@V4V5
02E2 6430 V4=30
02E4 F029 I=V0(LSDP)
02E6 D455 SHOW 5MI@V4V5
02E8 00EE RET
02EA 0100
02EC 0406
02EE 0208
02F0 0000
02F2 0801
02F4 000E
02F6 1506
02F8 0030
02FA 2080
02FC D4D4
02FE 0100
```

(Continued on next page)

15. VIP Dot-Dash (Continued)

```
0400 FFC0
0402 0000
0404 3F82
0406 0000
0408 8FC0
040A 0000
040C 3F82
040E 0000
0410 DF00
0412 3000
0414 3F82
0416 0000
0418 DF00
041A 0000
041C 7F82
041E 0000
0420 F800
0422 7800
0424 FF82
0426 0000
0428 8800
042A 7801
042C AA82
042E 0000
0430 B83F
0432 F800
0434 2A83
0436 FFFF
0438 883F
043A F800
043C 2A80
043E 010F
0440 F800
0442 0000
0444 2A00
0446 010F
0448 F000
044A 0080
044C 0804
044E 0387
0450 F0F8
0452 01C0
0454 000E
0456 0387
0458 0070
045A 03E0
045C 001F
045E 0003
0460 0020
0462 03FF
0464 FFFF
0466 0003
0468 0020
046A 03E0
046C 001F
046E 0001
0470 0020
0472 01C0
0474 000E
0476 0001
0478 07FF
047A 0080
047C 0004
047E 1DC0
0480 03FE
0482 0000
0484 0000
0486 0880
0488 00F8
048A 0000
048C 7800
048E 3FC0
0490 0020
0492 0001
0494 8600
0496 0880
0498 0020
049A 0001
049C 0200
049E 1DC0
04A0 0020
04A2 C002
04A4 4900
04A6 0001
04A8 0000
04AA C002
04AC 0100
04AE 0003
04B0 0000
04B2 C002
04B4 8500
04B6 70E1
04B8 0000
04BA C002
04BC 4900
04BE F9F0
04C0 0000
04C2 C001
04C4 3200
04C6 3F78
04C8 0000
04CA C001
04CC 8400
04CE 0FF8
04D0 0000
04D2 C000
04D4 7830
04D6 0788
04D8 0000
04DA C000
04DC 0078
04DE C708
04E0 0003
04E2 F00E
04E4 00FC
04E6 7F08
04E8 000F
04EA FC1F
04EC 00FC
04EE 1FF8
04F0 003F
04F2 FFFF
04F4 8078
04F6 07C0
04F8 003F
04FA FFFF
04FC C031
04FE FFFF
0500 00D4
```

16. VIP A-Mazing

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Key 1 or key 2 starts the program. Key 1 is used to generate a maze at 0400-04FF. Key 2 skips the generation of a maze. The maze pattern at 0400-04FF is copied into the display page. Traversing the maze is controlled by keys 2, 4, 6, or 8. The spot always starts on the left (the 15th line (0E-hex) from the top), and the finish is any opening on the right border. The maze wraps around at the top and bottom but not from left-to-right or right-to-left. An internal clock keeps track of the time used to traverse the maze but is also incremented whenever a collision occurs. This clock is displayed in the upper right corner when the end of the maze is reached. The background pattern may be changed by changing 0211 to: 8F for a checker-board pattern; 90 for a cross-hatch pattern; and 91 for a solid pattern. The starting location can be changed by setting 0381 and 0388 to the X-coordinate and setting 0382 and 0389 to the Y-coordinate. V6=M(0386) and V7=M(0387) are parameters used in generating a new maze. V6 is used to determine how often moving to the left of the screen is disallowed (1/V6). V7 is used to determine the length of randomly occurring excursions. M(0251) is the bit mask which is used to set the probability of excursions occurring. Maze patterns can be saved on cassette tape and reloaded into 0400-04FF using the operating system.

```
0200 6001 V0=01
0202 6102 V1=02
0204 E1A1 SKIP;V1 NE KEY
0206 1280 GO 0280
0208 E09E SKIP;V0 EQ KEY
020A 1204 GO 0204
020C 036C MLS@036C
020E 00E0 ERASE
0210 A391 I=0391
0212 6100 V1=00
0214 6000 V0=00
0216 D012 SHOW 2MI@V0V1
0218 7008 V0+08
021A 6240 V2=40
021C 8205 V2=V2-V0
021E 3200 SKIP;V2 EQ 00
0220 1216 GO 0216
0222 7102 V1+02
0224 6220 V2=20
0226 8215 V2=V2-V1
0228 3200 SKIP;V2 EQ 00
022A 1214 GO 0214
022C A380 I=0380
022E F965 V0:V9=MI
0230 CB03 VB=RND
0232 4600 SKIP;V6 NE 00
0234 1240 GO 0240
0236 73FF V3+FF
0238 3300 SKIP;V3 EQ 00
023A 1240 GO 0240
023C 8360 V3=V6
023E 7B01 VB+01
0240 A377 I=0377
0242 D891 SHOW 1MI@V8V9
0244 3F01 SKIP;VF EQ 01
0246 D891 SHOW 1MI@V8V9
0248 4700 SKIP;V7 NE 00
024A 1266 GO 0266
024C 5470 SKIP;V4 EQ V7
024E 125A GO 025A
0250 C501 V5=RND
0252 3500 SKIP;V5 EQ 00
0254 1266 GO 0266
0256 8180 V1=V8
0258 8290 V2=V9
025A 74FF V4+FF
025C 3400 SKIP;V4 EQ 00
025E 1266 GO 0266
0260 8810 V8=V1
0262 8920 V9=V2
0264 8470 V4=V7
0266 2332 DO 0332
0268 4FED SKIP;VF NE ED
026A 1278 GO 0278
026C D891 SHOW 1MI@V8V9
026E 3F01 SKIP;VF EQ 01
0270 D891 SHOW 1MI@V8V9
0272 2332 DO 0332
0274 3FED SKIP;VF EQ ED
0276 1230 GO 0230
0278 D891 SHOW 1MI@V8V9
027A 3F01 SKIP;VF EQ 01
027C D891 SHOW 1MI@V8V9
027E 0373 MLS@0373
0280 00E0 ERASE
0282 A400 I=0400
0284 6001 V0=01
0286 6200 V2=00
0288 6100 V1=00
028A D121 SHOW 1MI@V1V2
028C F01E I=I+V0
028E 7108 V1+08
0290 6540 V5=40
0292 8515 V5=V5-V1
0294 3500 SKIP;V5 EQ 00
0296 128A GO 028A
0298 7201 V2+01
029A 6520 V5=20
029C 8525 V5=V5-V2
029E 3500 SKIP;V5 EQ 00
02A0 1288 GO 0288
02A2 A380 I=0380
```

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16. VIP A-Mazing (Continued)

```
02A4 FE65 V0:VE=MI
02A6 A377 I=0377
02A8 D891 SHOW 1MI@V8V9
02AA FE18 TONE=VE
02AC 6D40 VD=40
02AE FD15 TIME=VD
02B0 7C01 VC+01
02B2 FD07 VD=TIME
02B4 4D00 SKIP;VD NE 00
02B6 12AC GO 02AC
02B8 85A0 V5=VA
02BA 85D2 V5=V5&VD
02BC 3500 SKIP;V5 EQ 00
02BE 12B2 GO 02B2
02C0 D891 SHOW 1MI@V8V9
02C2 6BBD VB=BD
02C4 6502 V5=02
02C6 E5A1 SKIP;V5 NE KEY
02C8 6B02 VB=02
02CA 6508 V5=08
02CC E5A1 SKIP;V5 NE KEY
02CE 6B01 VB=01
02D0 6504 V5=04
02D2 E5A1 SKIP;V5 NE KEY
02D4 6B00 VB=00
02D6 6506 V5=06
02D8 E5A1 SKIP;V5 NE KEY
02DA 6B03 VB=03
02DC 84B0 V4=VB
02DE 4BBD SKIP;VB NE BD
02E0 12B2 GO 02B2
02E2 D891 SHOW 1MI@V8V9
02E4 3F01 SKIP;VF EQ 01
02E6 D891 SHOW 1MI@V8V9
02E8 2332 DO 0332
02EA 3FED SKIP;VF EQ ED
02EC 130C GO 030C
02EE D891 SHOW 1MI@V8V9
02F0 3F01 SKIP;VF EQ 01
02F2 1314 GO 0314
02F4 D891 SHOW 1MI@V8V9
02F6 4402 SKIP;V4 NE 02
02F8 6B01 VB=01
02FA 4401 SKIP;V4 NE 01
02FC 6B02 VB=02
02FE 4400 SKIP;V4 NE 00
0300 6B03 VB=03
0302 4403 SKIP;V4 NE 03
0304 6B00 VB=00
0306 7C01 VC+01
0308 FE18 TONE=VE
030A 12E8 GO 02E8
030C D891 SHOW 1MI@V8V9
030E 4F01 SKIP;VF NE 01
0310 12F4 GO 02F4
0312 12B2 GO 02B2
0314 0356 MLS@0356
0316 A378 I=0378
0318 FC33 MI=VC(3DD)
031A A378 I=0378
031C F665 V0:V6=MI
031E F029 I=V0(LSDP)
0320 D435 SHOW 5MI@V4V3
0322 F129 I=V1(LSDP)
0324 D535 SHOW 5MI@V5V3
0326 F229 I=V2(LSDP)
0328 D635 SHOW 5MI@V6V3
032A 6E80 VE=80
032C FE18 TONE=VE
032E F00A V0=KEY
0330 1200 GO 0200
0332 4B00 SKIP;VB NE 00
0334 78FF V8+FF
0336 4B01 SKIP;VB NE 01
0338 7901 V9+01
033A 4B02 SKIP;VB NE 02
033C 79FF V9+FF
033E 4B03 SKIP;VB NE 03
0340 7801 V8+01
0342 4920 SKIP;V9 NE 20
0344 6900 V9=00
0346 48FF SKIP;V8 NE FF
0348 6800 V8=00
034A 4840 SKIP;V8 NE 40
034C 683F V8=3F
034E 483F SKIP;V8 NE 3F
0350 6FED VF=ED
0352 00EE RET
0354 0100
0356 9BBD
0358 F806
035A ADAF
035C F800
035E 5D1D
0360 5D8D
0362 FC07
0364 AD2F
0366 8F3A
0368 5CD4
036A 0100
036C 9BBE
036E F804
0370 BBD4
0372 109E
0374 BBD4
0376 0180
0378 0007
037A 0500
037C 3237
037E 3C00
0380 0000
0382 0E02
0384 0000
0386 0220
0388 000E
038A 0F06
038C 0010
038E 20AA
0390 55FF
0392 FFD4
```

17. VIP Deduce

This program uses the CHIP-8 INTERPRETER at 0000-01FF. This game is an old favorite, described as BAGELS in David Ahl's "101 Computer Games"; "What to Do After You Hit Return", p. 10 and 11 (People's Computer Company); and many other places. The computer is thinking of a secret three-digit number. You should determine this secret number in a minimum of turns, indicated in lower right corner. Enter your guess - using any number 0-9. Each digit will be examined in the same way. For example, the digit in the first location is checked to see if it is the same as in the secret number. If it is, it receives a score of 2; if not, but does occur elsewhere in number, it receives a score of 1; and if not at all, a score of 0. The computer then gives you the total score below your guess as a clue. A score of 6 indicates that you have determined the secret number.

```
0200 6E00 VE=00
0202 A3F0 I=03F0
0204 22A0 DO 02A0
0206 22A0 DO 02A0
0208 22A0 DO 02A0
020A 6500 V5=00
020C 6000 V0=00
020E 6100 V1=00
0210 6200 V2=00
0212 F255 MI=V0:V2
0214 22AE DO 02AE
0216 6534 V5=34
0218 22D0 DO 02D0
021A A3F6 I=03F6
021C 22E2 DO 02E2
021E 22E2 DO 02E2
0220 22E2 DO 02E2
0222 6500 V5=00
0224 22AE DO 02AE
0226 A3F6 I=03F6
0228 F265 V0:V2=MI
022A A3F3 I=03F3
022C F255 MI=V0:V2
022E 6500 V5=00
0230 22AE DO 02AE
0232 6402 V4=02
0234 6D00 VD=00
0236 A3F3 I=03F3
0238 22F4 DO 02F4
023A A3F3 I=03F3
023C F255 MI=V0:V2
023E 8500 V5=V0
0240 A3F0 I=03F0
0242 22F4 DO 02F4
0244 A3F0 I=03F0
0246 F255 MI=V0:V2
0248 9500 SKIP;V5 NE V0
024A 1300 GO 0300
024C 9510 SKIP;V5 NE V1
024E 1252 GO 0252
0250 9520 SKIP;V5 NE V2
0252 7D01 VD+01
0254 4400 SKIP;V4 NE 00
0256 125C GO 025C
0258 74FF V4+FF
025A 1236 GO 0236
025C 6508 V5=08
025E 22D0 DO 02D0
0260 6534 V5=34
0262 22D0 DO 02D0
0264 7E01 VE+01
0266 6534 V5=34
0268 22D0 DO 02D0
026A 4D06 SKIP;VD NE 06
026C 1288 GO 0288
026E 4E63 SKIP;VE NE 63
0270 1282 GO 0282
0272 61C0 V1=C0
0274 F115 TIME=V1
0276 F107 V1=TIME
0278 3100 SKIP;V1 EQ 00
027A 1276 GO 0276
027C 6508 V5=08
027E 22D0 DO 02D0
0280 121A GO 021A
0282 A3F0 I=03F0
0284 652C V5=2C
0286 22AE DO 02AE
0288 6108 V1=08
028A 6002 V0=02
028C F018 TONE=V0
028E 6F10 VF=10
0290 71FF V1+FF
0292 FF15 TIME=VF
0294 FF07 VF=TIME
0296 3F00 SKIP;VF EQ 00
0298 1294 GO 0294
029A 3100 SKIP;V1 EQ 00
029C 128A GO 028A
029E 129E GO 029E
02A0 6409 V4=09
02A2 C00F V0=RND
02A4 8405 V4=V4-V0
02A6 4F00 SKIP;VF NE 00
02A8 12A0 GO 02A0
02AA F055 MI=V0:V0
02AC 00EE RET
02AE 6600 V6=00
02B0 3500 SKIP;V5 EQ 00
02B2 12C6 GO 02C6
02B4 A3F3 I=03F3
02B6 F265 V0:V2=MI
02B8 F029 I=V0(LSDP)
02BA 22CA DO 02CA
02BC F129 I=V1(LSDP)
02BE 22CA DO 02CA
02C0 F229 I=V2(LSDP)
02C2 22CA DO 02CA
02C4 00EE RET
02C6 A3F0 I=03F0
02C8 12B6 GO 02B6
02CA D565 SHOW 5MI@V5V6
02CC 7508 V5+08
02CE 00EE RET
02D0 6618 V6=18
02D2 3508 SKIP;V5 EQ 08
02D4 12DA GO 02DA
02D6 FD29 I=VD(LSDP)
02D8 12CA GO 02CA
02DA A3F6 I=03F6
02DC FE33 MI=VE(3DD)
02DE F265 V0:V2=MI
02E0 12BC GO 02BC
02E2 F00A V0=KEY
02E4 400F SKIP;V0 NE 0F
02E6 1282 GO 0282
02E8 6109 V1=09
02EA 8105 V1=V1-V0
02EC 4F00 SKIP;VF NE 00
02EE 12E2 GO 02E2
02F0 F055 MI=V0:V0
02F2 00EE RET
02F4 F265 V0:V2=MI
02F6 8300 V3=V0
02F8 8010 V0=V1
02FA 8120 V1=V2
02FC 8230 V2=V3
02FE 00EE RET
0300 7D02 VD+02
0302 1254 GO 0254
```

18. VIP Shooting Stars

This program uses the CHIP-8 INTERPRETER at 0000-01FF. Each location in universe is either a Black Hole or a Star. The goal is to obtain a central Black Hole surrounded by all Stars in a minimum number of turns. To shoot Star, press corresponding number (1-9) on keyboard. When Star is shot, it will turn into a Black Hole and all other states in its galaxy are complemented. If your universe becomes all Black Holes, you lose and are given a score of 99. For further discussion of game, see "What to Do After You Hit Return", p. 54, 55 (People's Computer Company) and BYTE Magazine, May 1976, p. 42-49, W. I. Nico.

```
0200 00E0 ERASE
0202 6E00 VE=00
0204 A2E9 I=02E9
0206 67FF V7=FF
0208 6801 V8=01
020A 228E DO 028E
020C 6900 V9=00
020E 6A00 VA=00
0210 A2E4 I=02E4
0212 228E DO 028E
0214 225A DO 025A
0216 4E63 SKIP;VE NE 63
0218 12D2 GO 02D2
021A 3900 SKIP;V9 EQ 00
021C 1222 GO 0222
021E 4A00 SKIP;VA NE 00
0220 12CC GO 02CC
0222 3A00 SKIP;VA EQ 00
0224 122A GO 022A
0226 49FF SKIP;V9 NE FF
0228 12D2 GO 02D2
022A A2EE I=02EE
022C 2270 DO 0270
022E 4100 SKIP;V1 NE 00
0230 122C GO 022C
0232 71FF V1+FF
0234 8114 V1=V1+V1
0236 8114 V1=V1+V1
0238 F11E I=I+V1
023A F365 V0:V3=MI
023C 6402 V4=02
023E F418 TONE=V4
0240 8092 V0=V0&V9
0242 3000 SKIP;V0 EQ 00
0244 124C GO 024C
0246 81A2 V1=V1&VA
0248 4100 SKIP;V1 NE 00
024A 122A GO 022A
024C 8720 V7=V2
024E 8830 V8=V3
0250 A2E4 I=02E4
0252 228E DO 028E
0254 225A DO 025A
0256 7E01 VE+01
0258 1214 GO 0214
025A 6520 V5=20
025C 6608 V6=08
025E A3FD I=03FD
0260 FE33 MI=VE(3DD)
0262 F265 V0:V2=MI
0264 F129 I=V1(LSDP)
0266 D565 SHOW 5MI@V5V6
0268 7505 V5+05
026A F229 I=V2(LSDP)
026C D565 SHOW 5MI@V5V6
026E 00EE RET
0270 6109 V1=09
0272 E1A1 SKIP;V1 NE KEY
0274 00EE RET
0276 4100 SKIP;V1 NE 00
0278 00EE RET
027A 71FF V1+FF
027C 1272 GO 0272
027E 60FF V0=FF
0280 61FF V1=FF
0282 8035 V0=V0-V3
0284 8125 V1=V1-V2
0286 8202 V2=V2&V0
0288 8132 V1=V1&V3
028A 8211 V2=V2/V1
028C 00EE RET
028E 8370 V3=V7
0290 8290 V2=V9
0292 227E DO 027E
0294 8920 V9=V2
0296 8380 V3=V8
0298 82A0 V2=VA
029A 227E DO 027E
029C 8A20 VA=V2
029E 6409 V4=09
02A0 6610 V6=10
02A2 6510 V5=10
02A4 4400 SKIP;V4 NE 00
02A6 00EE RET
02A8 4405 SKIP;V4 NE 05
02AA 12C6 GO 02C6
02AC 4406 SKIP;V4 NE 06
02AE 12B4 GO 02B4
02B0 3403 SKIP;V4 EQ 03
02B2 12B8 GO 02B8
02B4 76F8 V6+F8
02B6 6510 V5=10
02B8 8774 V7=V7+V7
02BA 4F00 SKIP;VF NE 00
02BC 12C0 GO 02C0
02BE D565 SHOW 5MI@V5V6
02C0 75F8 V5+F8
02C2 74FF V4+FF
02C4 12A4 GO 02A4
02C6 4800 SKIP;V8 NE 00
02C8 12C0 GO 02C0
02CA 12BE GO 02BE
02CC 225A DO 025A
02CE 6E63 VE=63
02D0 225A DO 025A
02D2 6002 V0=02
02D4 F018 TONE=V0
02D6 6F10 VF=10
02D8 FF15 TIME=VF
02DA FF07 VF=TIME
02DC 3F00 SKIP;VF EQ 00
02DE 12DA GO 02DA
02E0 12D2 GO 02D2
02E2 01FF
02E4 1C3E
02E6 3E3E
02E8 1C14
02EA 2200
02EC 2214
02EE 0100
02F0 0B01
02F2 0200
02F4 0700
02F6 0400
02F8 1601
02FA 0800
02FC 2900
02FE 0001
0300 5A01
0302 1000
0304 9400
0306 2000
0308 6801
030A 4000
030C E000
030E 8000
0310 D001
0312 00D4
```

19. VIP Strike-9

This program uses the CHIP-8 INTERPRETER at 0000-01FF. STRIKE-9 is based on the roll of dice. To roll dice, press key "0". Select from the numbers 1-9 those adding up to total on dice, then roll again. To win you must just eliminate all the starting nine numbers. You are given up to 4 seconds to hit any valid key. Refer to Creative Computing, Vol. 3, 88 (1977), Bruce Grembowski.

```
0200 00E0 ERASE
0202 6401 V4=01
0204 60FF V0=FF
0206 22EA DO 02EA
0208 F055 MI=V0:V0
020A 7401 V4+01
020C 340A SKIP;V4 EQ 0A
020E 1206 GO 0206
0210 6401 V4=01
0212 22EA DO 02EA
0214 F265 V0:V2=MI
0216 F429 I=V4(LSDP)
0218 D125 SHOW 5MI@V1V2
021A 7401 V4+01
021C 340A SKIP;V4 EQ 0A
021E 1212 GO 0212
0220 6108 V1=08
0222 22B4 DO 02B4
0224 6112 V1=12
0226 22B4 DO 02B4
0228 6000 V0=00
022A 22FA DO 02FA
022C 6109 V1=09
022E 22BC DO 02BC
0230 8700 V7=V0
0232 6113 V1=13
0234 22BC DO 02BC
0236 8800 V8=V0
0238 8980 V9=V8
023A 8974 V9=V9+V7
023C 60FF V0=FF
023E F015 TIME=V0
0240 F007 V0=TIME
0242 4000 SKIP;V0 NE 00
0244 1284 GO 0284
0246 6401 V4=01
0248 E4A1 SKIP;V4 NE KEY
024A 1254 GO 0254
024C 7401 V4+01
024E 340A SKIP;V4 EQ 0A
0250 1248 GO 0248
0252 1240 GO 0240
0254 22EA DO 02EA
0256 F265 V0:V2=MI
0258 4000 SKIP;V0 NE 00
025A 1240 GO 0240
025C F618 TONE=V6
025E F429 I=V4(LSDP)
0260 D125 SHOW 5MI@V1V2
0262 22EA DO 02EA
0264 6000 V0=00
0266 F055 MI=V0:V0
0268 8945 V9=V9-V4
026A 4F00 SKIP;VF NE 00
026C 1284 GO 0284
026E 3900 SKIP;V9 EQ 00
0270 12A4 GO 02A4
0272 22AC DO 02AC
0274 620A V2=0A
0276 6109 V1=09
0278 F729 I=V7(LSDP)
027A D125 SHOW 5MI@V1V2
027C 6113 V1=13
027E F829 I=V8(LSDP)
0280 D125 SHOW 5MI@V1V2
0282 1228 GO 0228
0284 A310 I=0310
0286 128A GO 028A
0288 A301 I=0301
028A 6005 V0=05
028C 6218 V2=18
028E 6108 V1=08
0290 D125 SHOW 5MI@V1V2
0292 6110 V1=10
0294 F01E I=I+V0
0296 D125 SHOW 5MI@V1V2
0298 6118 V1=18
029A F01E I=I+V0
029C D125 SHOW 5MI@V1V2
029E 6077 V0=77
02A0 F018 TONE=V0
```

(Continued on next page)

19. VIP Strike-9 (Continued)

```
02A2 12A2 GO 02A2
02A4 22D8 DO 02D8
02A6 3000 SKIP;V0 EQ 00
02A8 123C GO 023C
02AA 1284 GO 0284
02AC 22D8 DO 02D8
02AE 3000 SKIP;V0 EQ 00
02B0 00EE RET
02B2 1288 GO 0288
02B4 A33A I=033A
02B6 6208 V2=08
02B8 D129 SHOW 9MI@V1V2
02BA 00EE RET
02BC 6601 V6=01
02BE 620A V2=0A
02C0 6001 V0=01
02C2 F029 I=V0(LSDP)
02C4 D125 SHOW 5MI@V1V2
02C6 F618 TONE=V6
02C8 C307 V3=RND
02CA 4300 SKIP;V3 NE 00
02CC 00EE RET
02CE 7001 V0+01
02D0 D125 SHOW 5MI@V1V2
02D2 3007 SKIP;V0 EQ 07
02D4 12C2 GO 02C2
02D6 12C0 GO 02C0
02D8 6401 V4=01
02DA 22EA DO 02EA
02DC F065 V0:V0=MI
02DE 3000 SKIP;V0 EQ 00
02E0 00EE RET
02E2 7401 V4+01
02E4 340A SKIP;V4 EQ 0A
02E6 12DA GO 02DA
02E8 00EE RET
02EA 6203 V2=03
02EC 8340 V3=V4
02EE A31F I=031F
02F0 4301 SKIP;V3 NE 01
02F2 00EE RET
02F4 F21E I=I+V2
02F6 73FF V3+FF
02F8 12F0 GO 02F0
02FA E09E SKIP;V0 EQ KEY
02FC 12FA GO 02FA
02FE 00EE RET
0300 0189
0302 89A9
0304 A9F9
0306 2232
0308 2A26
030A 2222
030C 2222
030E 0022
0310 8382
0312 8282
0314 F3CF
0316 484F
0318 41CF
031A 3C20
031C 3820
031E 3C00
0320 2808
0322 0030
0324 0800
0326 3808
0328 0028
032A 1000
032C 3010
032E 0038
0330 1000
0332 2818
0334 0030
0336 1800
0338 3818
033A FCFC
033C FCFC
033E FCFC
0340 FCFC
0342 FC00
```

20. VIP Card Game
(like the well-known acey-ducey)

This program uses the CHIP-8 INTERPRETER at 0000-01FF. ACEY-DUCEY is a card game in which the dealer shows two cards from deck. You bet (from 1 to 9) that the next dealer card lies between or equal to the first two cards in face value (ACES are low).

In order to obtain a new deal, press the zero key, and then bet as before. Try for a score of 100 or greater.

```
0200 A350 I=0350
0202 600A V0=0A
0204 F055 MI=V0:V0
0206 00E0 ERASE
0208 2284 DO 0284
020A 6113 V1=13
020C 22A2 DO 02A2
020E 8540 V5=V4
0210 6127 V1=27
0212 22A2 DO 02A2
0214 8740 V7=V4
0216 6801 V8=01
0218 E8A1 SKIP;V8 NE KEY
021A 1224 GO 0224
021C 7801 V8+01
021E 380A SKIP;V8 EQ 0A
0220 1218 GO 0218
0222 1216 GO 0216
0224 A350 I=0350
0226 F065 V0:V0=MI
0228 8085 V0=V0-V8
022A 3F01 SKIP;VF EQ 01
022C 1216 GO 0216
022E 6002 V0=02
0230 F018 TONE=V0
0232 22C4 DO 02C4
0234 611D V1=1D
0236 22A2 DO 02A2
0238 8640 V6=V4
023A 8565 V5=V5-V6
023C 4500 SKIP;V5 NE 00
023E 124E GO 024E
0240 3F00 SKIP;VF EQ 00
0242 126C GO 026C
0244 8675 V6=V6-V7
0246 4600 SKIP;V6 NE 00
0248 124E GO 024E
024A 3F00 SKIP;VF EQ 00
024C 1276 GO 0276
024E 6000 V0=00
0250 8085 V0=V0-V8
0252 8085 V0=V0-V8
0254 8800 V8=V0
0256 22C4 DO 02C4
0258 6164 V1=64
025A A350 I=0350
025C F065 V0:V0=MI
025E 8015 V0=V0-V1
0260 3F00 SKIP;VF EQ 00
0262 127E GO 027E
0264 6000 V0=00
0266 E09E SKIP;V0 EQ KEY
0268 1266 GO 0266
026A 1206 GO 0206
026C 8675 V6=V6-V7
026E 4600 SKIP;V6 NE 00
0270 124E GO 024E
0272 3F00 SKIP;VF EQ 00
0274 124E GO 024E
0276 A350 I=0350
0278 F065 V0:V0=MI
027A 3000 SKIP;V0 EQ 00
027C 1264 GO 0264
027E 6040 V0=40
0280 F018 TONE=V0
0282 1282 GO 0282
0284 A350 I=0350
0286 F065 V0:V0=MI
0288 F033 MI=V0(3DD)
028A 641B V4=1B
028C 6318 V3=18
028E F265 V0:V2=MI
0290 F029 I=V0(LSDP)
0292 D345 SHOW 5MI@V3V4
0294 7306 V3+06
0296 F129 I=V1(LSDP)
0298 D345 SHOW 5MI@V3V4
029A 7306 V3+06
029C F229 I=V2(LSDP)
029E D345 SHOW 5MI@V3V4
02A0 00EE RET
02A2 C40F V4=RND
02A4 4400 SKIP;V4 NE 00
02A6 12A2 GO 02A2
02A8 600D V0=0D
02AA 8045 V0=V0-V4
02AC 3F01 SKIP;VF EQ 01
02AE 12A2 GO 02A2
02B0 6002 V0=02
02B2 F018 TONE=V0
02B4 6200 V2=00
02B6 A311 I=0311
02B8 D127 SHOW 7MI@V1V2
02BA 7201 V2+01
02BC 7101 V1+01
02BE 22D4 DO 02D4
02C0 D125 SHOW 5MI@V1V2
02C2 00EE RET
02C4 2284 DO 0284
02C6 A350 I=0350
02C8 F065 V0:V0=MI
02CA 8085 V0=V0-V8
02CC A350 I=0350
02CE F055 MI=V0:V0
02D0 2284 DO 0284
02D2 00EE RET
02D4 6001 V0=01
02D6 8045 V0=V0-V4
02D8 4000 SKIP;V0 NE 00
02DA 12F2 GO 02F2
02DC 6009 V0=09
02DE 8045 V0=V0-V4
02E0 3F00 SKIP;VF EQ 00
02E2 12EE GO 02EE
02E4 A2ED I=02ED
02E6 F41E I=I+V4
02E8 F065 V0:V0=MI
02EA F01E I=I+V0
02EC 00EE RET
02EE F429 I=V4(LSDP)
02F0 00EE RET
02F2 A303 I=0303
02F4 00EE RET
02F6 0114
02F8 0205
02FA 0C10
02FC 1010
02FE 90F0
0300 9090
0302 B0F0
0304 90F0
0306 9090
0308 B0E0
030A B090
030C F060
030E 6060
0310 60FC
0312 FCFC
0314 FCFC
0316 FCFC
```