

## DAY 4

### *The Stack, Registers, and Programming*

#### **Where are we?**

You have read to and worked all the examples up to p. 59 in the *Owner's Handbook*. For now, we are going to skip most of the rest of Section 4. What we are skipping is HMS conversion, which is some stuff for converting things like 12h 15m 30s to 12.25833333h and back, polar coordinate conversion, and finally, some handy and sophisticated stuff for statistics using the  $\Sigma+$  and  $\Sigma-$  keys. As we are doing applications later in the course, we will get back to those things.

However, some things buried in the pages we are skipping that we should learn are logarithms, exponentials, and powers. The calculator has base 10 logarithms and exponentials, it has natural logarithms and exponentials (base  $e$ ), and if that isn't enough it will raise any base to any power using the  $y^x$  key. So read pp. 63-65 starting with "Logarithmic and Exponential Functions" and finishing with the horribly complicated formula for Mach number on p. 65. Key the whole thing in and make sure you get the expected answer.

The reason we are skipping most of pp. 60-71 is that we want to get to programming!

#### **The Stack and Registers**

We have the stack (X, Y, Z, and T), Last X, and REG 0, REG 1, REG 2, ..., REG 7 at our disposal. We have these both when we are doing calculations manually and when we are programming the calculator. It is extremely common, when running a program, to have to enter initial values into one or more of these locations before starting the program.

#### **Our First Program**

We will do the program alluded to in the reading: the area of a sphere. The formula is  $A = 4\pi r^2$ .

#### **Your Second Program**

To test yourself that you know how to do another simple program, do a program for  $V = \frac{4}{3}\pi r^3$ .

#### **Your Third Program: Nimb**

Key in and play the attached program. People in the combinatorics class call this "Baby Nim." We just call it Nimb. Find somebody in the combinatorics class and show it to them.

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## Nimb for the HP-25

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The program presented below will play the game of Nimb on the HP-25. It was written by R. L. Pekar and appeared in the V4N6P55 issue of the PPC Journal (June 1977). Thanks!

The game of NIMB is an old calculator game. You start with 15 sticks in a pile and take turns removing 1, 2, or 3 sticks. The object is to leave the pile with only 1 stick remaining to make your opponent take the last stick.

### Instructions:

0) Key the program in. Switch to RUN mode and press f PRGM.

1) Store these constants: -1 STO 0, 55178 STO 3 (This is "BLISS" when viewed upside down), 3507.1 STO 2 (I.LOSE upside down).

2) Set the display mode to FIX 0 and press R/S. 15 will be displayed (this is the number of sticks on the pile).

**Note:** The next two steps are exactly backwards from the HP-55 Nimb game on my site!

3) A negative display means that it is your turn. Remove either 1, 2, or 3 sticks from the pile (by entering 1, 2 or 3) and pressing R/S.

4) A positive number will be shown indicating the number left on the pile and that it is the HP-25's turn. Press R/S to give the machine a turn.

5) Continue with steps 3 and 4 until either BLISS or I.LOSE is displayed upside down. For a new game, goto step 2.

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**Program Listing:** Note: Email if you have any questions.

Line	Instruction	Keycode
01	ENTER	31
02	f INT	14 01
03	g ABS	15 03
04	f X NE Y	14 61
05	GTO 22	13 22
06	g X = 0	15 71
07	GTO 22	13 22
08	4	04
09	X <> Y	21
10	f X > = Y	14 51
11	GTO 22	13 22
12	RCL 1	24 01
13	+	51
14	CHS	32
15	STO 1	23 01
16	g X < 0	15 41
17	GTO 46	13 46
18	g X = 0	15 71
19	GTO 46	13 46
20	R/S	74
21	GTO 25	13 25
22	RCL 0	24 00
23	f SQRT	14 02
24	GTO 46	13 46
25	RCL 1	24 01
26	1	01
27	-	41
28	g X = 0	15 71

29	GTO 48	13 48
30	4	04
31	/	71
32	f INT	14 01
33	4	04
34	*	61
35	1	01
36	+	51
37	f X = Y	14 71
38	GTO 40	13 40
39	GTO 42	13 42
40	1	01
41	-	41
42	CHS	32
43	STO 1	23 01
44	R/S	74
45	GTO 01	13 01
46	RCL 3	24 03
47	GTO 00	13 00
48	RCL 2	24 02
49	GTO 00	13 00

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That's it!

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