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For TI Use onlyTEXAS INSTRUMENTS
Calculator Products Division

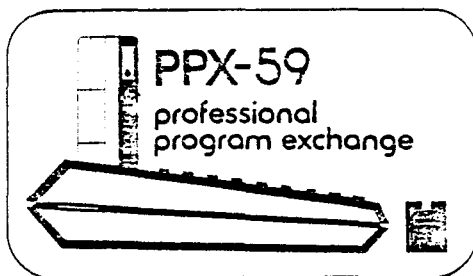
Submission Abstract

Program Title		Happy Numbers		Rev.	A
Abstract of Program					
<p>Add up the squares of the digits of a number. Repeat this process with the result, and continue doing so. If you reach the number one, eventually, then the number you started with is called a "happy number." This program produces a list of such numbers, starting at a user-given number.</p>					
User Benefits:					
<p>Aids research in number theory. Eliminates need for tables.</p>					
Category	Required	Prog.	PC-100A Needed		
Number <u>39</u>	Progs. <u>none</u>	Steps <u>63</u>	Library		
			Module ID	<u>none</u>	
Submittal Agreement			Submission Checklist		
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Signature <u>David Kentrowitz</u>			<input checked="" type="checkbox"/> Submission Abstract		
Name <u>David Kentrowitz</u>			<input checked="" type="checkbox"/> Program Description		
Mbr. No. <u>101115</u>			<input checked="" type="checkbox"/> User Instructions		
Address <u>81 Stanton Road</u>			<input checked="" type="checkbox"/> Sample Problem		
Tel. No. <u>617/232-2993</u>			<input checked="" type="checkbox"/> Listing		
City <u>Brookline</u> State <u>Mass.</u> Zip <u>02146</u>			<input type="checkbox"/> _____		
			<input type="checkbox"/> _____		

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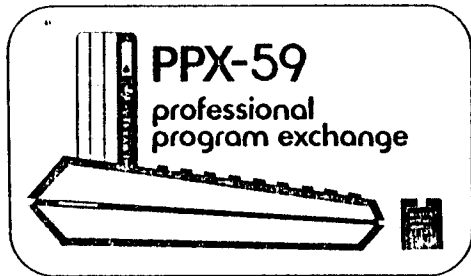
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Program Description

Program Title:	Happy Numbers	Rev.	A
Method, Equations, Sketches, Limitations, References, Error Recovery:			
<p>This program is based on the fact that in the process of summing the squares of the digits, a number that is not "happy" will eventually end up in a repeating cycle containing the number 89.</p>			
<p>References:</p>			
<p>Billie E. Sparks, "Happiness is Some Intriguing Numbers", The Arithmetic Teacher, February 1974, pp. 128-129.</p>			
<p>Eli Maor, "Number Theory on the Programmable Calculator", Didactic Programming, Spring, 1979, pp. 29-31.</p>			
<p><input type="checkbox"/> See Continuation Sheet</p>			

To print list, insert 2nd PRT at step 049. To stop program, press R/S.



User Instructions

Program Title					HAPPY NUMBERS				
					run				
Partition (OP 17)					Parentheses Levels				
479.59					none				
Angular Mode					t Register				
(if applicable)					Absolute				
any					Addresses				
SBR Levels					Disturbs				
none					Pending				
Library Module ID					Operations				
none									

USER DEFINED KEYS	
A	
B	
C	
D	
E	generate happy numbers
A'	
B'	
C'	
D'	
E'	

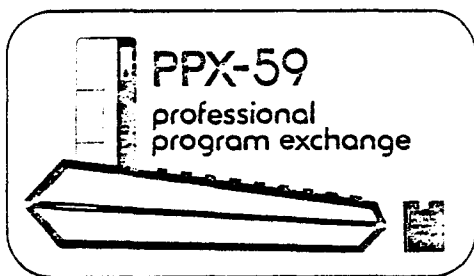
DATA REGISTERS (INV)	
00	used
01	intermediate result
02	current # tested
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	

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

STEP	PROCEDURE	ENTER	PRESS			OUTPUT/MODE (see legend below)
1.	Load Program.					0
2.	Enter starting number. A_1 is lowest happy number such that $A_1 \geq n$.	n	E			A_1
3.	For more happy numbers: etc.	.	R/S R/S			A_2 A_3 etc.
4.	To start at new number, go to step 2. Make sure the starting number entered in step 2 is a positive integer.					

Modes: n* — Printed only (n) — Displayed briefly (Pause)
(n)* — Printed and displayed

See Continuation Sheet



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Sample Problem

Statement of Example

Generate a list of happy numbers starting with 1.

☐ See Continuation Sheet

ENTER	PRESS	OUTPUT/MODE (see legend below)	COMMENT
1	E	1	allow about 3 secs
	R/S	7	1 1/2 minutes
	R/S	10	30 seconds
	R/S	13	30 seconds
	R/S	19	1 minute, 20 secs
	R/S	23	50 seconds
	R/S	28	1 minute
	R/S	31	30 seconds
	R/S	32	10 seconds
	R/S	44	2 1/2 minutes
	R/S	49	1 minute, 10 secs
	R/S	68	4 minutes
	R/S	70	1/2 minute
	R/S	79	2 minutes
	etc.	etc.	

Modes: n' — Printed only (n) — Displayed Briefly (Pause)
(n)' — Printed and displayed

☐ Over

PPX-59 Professional Program Exchange

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LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
000	43	RCL	add up the squares of the digits of register zero, put result into register 1.	047	43	RCL	if it is happy, display it.				
001	00	00		048	02	02					
002	29	CP		049	91	R/S					
003	67	EQ		050	61	GTO					
004	00	00		051	00	00	initialize				
005	22	22		052	40	40					
006	55	+		053	76	LBL					
007	01	1		054	15	E					
008	00	0		055	42	STD					
009	75	-		056	02	02					
010	59	INT		057	25	CLR					
011	42	STD		058	42	STD					
012	00	00		059	01	01					
013	95	=		060	61	GTO					
014	65	x		061	00	00					
015	01	1		062	42	42					
016	00	0									
017	95	=									
018	33	X ²									
019	44	SUM									
020	01	01									
021	81	RST									
022	43	RCL									
023	01	01									
024	42	STD									
025	00	00									
026	32	X/T									
027	25	CLR									
028	42	STD									
029	01	01									
030	01	1	is it a happy #?								
031	67	EQ									
032	00	00									
033	47	47									
034	08	8	is it a non- happy #?								
035	09	9									
036	22	INV									
037	67	EQ	if nature unknown, repeat process								
038	00	00									
039	00	00									
040	69	OP	if it is not happy, test the next #.								
041	22	22									
042	43	RCL									
043	02	02									
044	42	STD									
045	00	00									
046	81	RST									

MERGED CODES

62	PRN	Ind	72	STO	Ind	83	GTO	Ind
63	TRN	Ind	73	RCL	Ind	84	OP	Ind
64	STP	Ind	74	SUM	Ind	92	INV	SBR