Program Description I

Program Title Random Integers

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Program Description, Equations, Variables Given a random seed between 0 and 1, this program will generate as many as 216 pseudo-random integers without repetition.

One possible algorithm is to constantly generate random integers (given M as the maximum) using the formula:

$$INT\left[M \times frac\left(S+\pi\right)^5\right]+1$$ where S is the seed and $frac\,(S+\pi)^5$ is the new seed.

and then to simply check if such a number has been used yet. If so, generate another until M random-integers (1 to M) have been generated. This program is quite fast initially but slows up considerably as more and more numbers are generated (As M increases, running time increases). The algorithm used is similar but uses the loop:

FOR I = M to 1 Random integer = $INT\left[I \times frac\left(S+\pi\right)^5\right]+1$.

Then the integer is calculated by counting up from 1 skipping all previously used integers. Thus, the formula above need only be used M times for M integers. Thus if M = 10 and the random integer is 5, the actual number used ... would be 7.

(1, 4, & 5 already generated) ① 2 3 ④ ⑤ 6 7 ⑧ 9 10

Operating Limits and Warnings Inputting a number larger than 216 for the maximum will result in an error message

Print mode is ON when card is loaded.

Program Description II

~~Sketch(es)~~ Each memory register is a 9 digit number with one decimal:
Memory Register 0: 000000000.9 The 0's from Right to Left represent the digits (9 x R + 1) to (9 x R + 9) where R is the memory register. In this case (for R_0), the numbers represented are 1 to 9 (For Register 23 (R_D), the numbers are 208 to 216). The 9 above means that 9 of the digits are as yet unused. Thus, if the numbers 1, 4, and 8 had already been generated, the register would Look Like: 010001001.6

Sample Problem(s) ① Input the seed .123456789 (STO E)
Generate the random integers using 12 as the maximum.

② Do the same using the seed .987654321 (STO E)

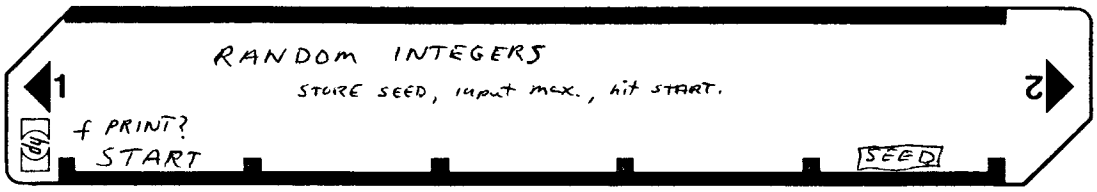
Solution(s) Input 12 [A]

① 1 7 12 8 4 11 9 10 2 3 6 5

② 6 7 9 5 12 1 2 8 3 11 4 10

Reference(s)

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load sides 1 and 2			
2	Input a seed such that $0 \leq S < 1$	S	STO E	
3	Select Pause mode		f a	0.
4	Select Print mode		f a	1.
5	Input Maximum number and begin	M	A	$N_{1 \to m}$
	0 signifies that all numbers have been generated.			0.
6	To start again, Go to step 5			
7	To chang to pause or print mode, Go to steps 3 or 4 respectively.			

Program Listing 1

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	f LBL A	31 25 11	
2	RCL E	34 15	Recall Seed
3	g frac	32 83	
4	h x⇔y	35 52	
5	h ABS	35 64	
6	f INT	31 83	Maximum
7	2	02	
8	1	01	
9	7	07	
010	g x≤y	32 71	IS MAX ≤ 217
11	g sin⁻¹	32 62	NO... ERROR
12	h R↓	35 53	
13	+	61	
14	STO E	33 15	Counter. Seed
15	h LST X	35 82	
16	1	01	
17	−	51	
18	9	09	
19	÷	81	
020	f INT	3183	# of Registers required
21	f x=0	31 51	
22	1	01	
23	h ST I	35 33	
24	.	83	
25	9	09	
26	f LBL 0	31 25 00	
27	STO (i)	33 24	
28	f DSZ	31 33	
29	GTO 0	22 00	
030	STO 0	33 00	
31	f LBL 1	31 25 01	
32	0	00	
33	h ST I	35 33	
34	RCL E	34 15	
35	f INT	31 83	
36	Enter↑	41	
37	Enter↑	41	Counter
38	h LST X	35 82	
39	g frac	32 83	seed
040	h π	35 73	
41	+	61	
42	5	05	
43	h y^x	35 63	
44	g frac	32 83	new seed
45	+	61	
46	STO E	33 15	
47	g frac	32 83	
48	x	71	
49	1	01	
050	+	61	
51	f INT	31 83	Random integer
52	1	01	
53	0	00	
54	÷	81	
55	f LBL 2	31 25 02	Routine to get to register containing number to be used.
56	RCL(i)	34 24	
57	g frac	32 83	Unused #'s in a particular register
58	h x⇔y	35 52	
59	g x≤y	32 71	
060	GTO 3	22 03	
61	h x⇔y	35 52	
62	−	51	
63	f ISZ	31 34	
64	GTO 2	22 02	
65	f LBL 3	31 25 03	
66	h RCI	35 34	Register # which contains number to be used.
67	EEX	43	
68	4	04	
69	÷	81	
070	+	61	
71	1	01	
72	0	00	
73	x	71	
74	RCL(i)	34 24	
75	h x⇔y	35 52	
76	h STI	35 33	
77	f LBL 4	31 25 04	
78	.	83	
79	1	01	
080	h RCI	35 34	
81	+	61	
82	h STI	35 33	
83	h R↓	35 53	
84	h R↓	35 53	
85	f INT	31 83	
86	1	01	
87	0	00	
88	÷	81	
89	Enter↑	41	
090	g frac	32 83	
91	f x=0	31 51	If Number is unused, subtract 1 from R_I
92	f DSZ	31 33	
93	GTO 4	22 04	
94	h RCI	35 34	
95	1	01	
96	0	00	
97	x	71	
98	f INT	31 83	
99	h LST x	35 82	
100	g frac	32 83	
101	EEX	43	
102	2	02	
103	x	71	
104	h STI	35 33	Register # which contains number to be used.
105	9	09	
106	x	71	
107	h x⇔y	35 52	
108	Enter↑	41	
109	Enter↑	41	
110	1	01	
111	−	51	
112	g 10^x	32 53	

REGISTERS

0 9 - 1	1 18 - 10	2 27 - 19	3 36 - 28	4 45 - 37	5 54 - 46	6 63 - 55	7 72 - 64	8 81 - 73	9 90 - 82
S0 99 - 91	S1 108 - 100	S2 117 - 109	S3 126 - 118	S4 135 - 127	S5 144 - 136	S6 153 - 145	S7 162 - 154	S8 171 - 163	S9 180 - 172

A 189 - 181	B 198 - 190	C 207 - 199	D 216 - 208	E Counter. Seed	I A=BC A = # of 1's to Portion of # B = # of 0's and 1's to Add thru the C = Register where # is located

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Program Listing 11

STEP	KEY ENTRY	KEY CODE	COMMENTS
113	STO +(i)	33 61 24	Replace 0 with 1 at # position.
114	h RV	35 53	
115	+	61	Random integer used
116	h F? 0	35 71 00	Print on?
117	f -x-	31 84	Yes
118	h Pause	35 72	No
119	.	83	
120	1	01	
121	STO -(i)	33 51 24	Decrease decimal (# of unused #'s) by 1.
122	2	02	
123	4	04	
124	h ST I [redacted]	35 33	Decrement counter
125	g DSZ	32 33	and skip on 0.
126	GTO 1	22 01	C ≠ 0 - new #
127	CLX	44	C=0 - end
128	h RTN	3522	
129	g LBL a	32 25 11	Print? Mode switch
130	h F? 0	35 71 00	Print? mode on?
131	GTO 5	22 05	Yes ...
132	h SF 0	35 51 00	No - turn on
133	1	01	
134	h RTN	35 22	
135	f LBL 5	31 2505	yes ...
136	h CF 0	35 61 00	Print? mode turned off.
137	0	00	
138	h RTN	35 22	
140			
150			
160			
170			
180			
190			
200			
210			
220			

LABELS					FLAGS	SET STATUS		
START	B	C	D	E	0 ✓	FLAGS	TRIG	DISP
a PRINT?	b	c	d	e	1	ON OFF 0 ☒ ☐ 1 ☐ [redacted] 2 ☐ ☐ 3 ☐ ☐	DEG ☑ GRAD ☐ RAD ☐	FIX ☑ SCI ☐ ENG ☐ n 0
0 ✓	1 ✓	2 ✓	3 ✓	4 ✓	2			
5 ✓	6	7	8	9	3			