

## THE ENGLISH ELECTRIC CO., LTD.

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NELSON RESEARCH LABORATORIES

STAFFORD

DEUCE Subroutine No. 152 (Z07)

Report No. NS t 136

Date 4.3.57.

Reference

Order No.

Report by C. Robinson.

Front Sheet.

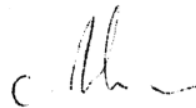
Data Sheet 1.

Figure sheet S6/10534

SUMMARY

This report gives details of a DEUCE subroutine for generating random numbers.

The subroutine was prepared and tested at N.R.L. Blackheath.

MATHEMATICAL PHYSICS LABORATORY.

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NS t 136

Sheet No.: 1.

Description.

First order subroutine to generate a random number of 31 binary digits. A new number is generated at each entry of the subroutine.

The random numbers are the sequence defined by

$$y_n = A y_{n-1} \pmod{2^{31}-1} \text{ where } A = 5^{11} \text{ and } y_0 = 1$$

The 12 most significant digits of the numbers have been subjected to various tests for randomness.

Data.

None.  $y_0 = 1$  is punched on the cards in m.c. 29.

For a different sequence of numbers, any other number may be punched.

Result.

a 31 digit random number in 21<sub>3</sub>.

NOTE.

Some statistics on the first million numbers generated are available at E.E.Co. if required. The sequence of 'random' numbers repeats after 195, 225, 786 numbers.

Instructions for Use.

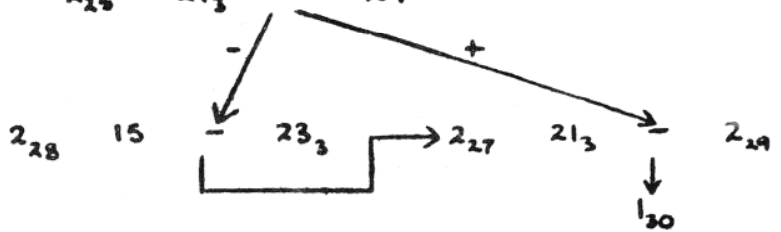
Stores used.	14	15	16	21 <sub>2</sub>	21 <sub>3</sub>	#113
Contents at Entry.	-	Link	-	-	-	
Contents at Exit.	-	2 <sup>31</sup> -1	5 <sup>11</sup>	-	y <sub>n</sub>	
Occupies.	m.c.'s. 17 to 31.					
Entry.	m.c. 22					
Time.	3 m.s. 8 m.c. or 4 m.s. 8 m.c. - Average 3 m.s. 24 m.c.					
Constants available.	5 <sup>11</sup> = 29, 22, 3, 18, 14, 1 in m.c. 24.					
	2 <sup>31</sup> -1 = P <sub>1</sub> to P <sub>31</sub> in m.c. 19.					

mc	NIS	S	D	C	W	T		
							Y	
							X	
							0	
							1	
0							2	
1							3	
2							4	
3							5	
4							6	
5							7	
6							8	
7							9	
8							Y	
9							X	
10							0	
11							1	
12							2	
13							3	
14							4	
15							5	
16							6	
17	2	0	24	0	2		7	
18	2	31	14	0	0		8	
19		P <sub>1</sub> -P <sub>31</sub>					9	
20	2	21	22	2	0	1	Y	
21	2	15	1	7	8		X	
22	2	2	16	0	2		0	
23	2	25	22	0	0		1	
24	A = 29, 22, 5, 18, 14, 1							2
25	2	21	27	0	0		3	
26	2	2	21	1	2		4	
27	1	21	2	0	1		5	
28	2	15	23	1	29		6	
29	V <sub>n</sub> (P <sub>1</sub> initially)							7
30	2	30	21	0	17		8	
31	2	2	15	18	17		9	

$$V_n = A V_{n-1} \pmod{2^{31}-1}$$

$$A = 5^n, V_0 = 1$$

- 2<sub>22</sub> 2<sub>24</sub> - 16 [A = 5<sup>n</sup>]
- 2<sub>26</sub> 2<sub>29</sub> - 21<sub>3</sub> [V<sub>n</sub>]
- 2<sub>30</sub> 30 - 21<sub>2</sub>
- 2<sub>17</sub> 0 - 24
- 2<sub>21</sub> 15 - 1<sub>30</sub>
- 2<sub>31</sub> 2<sub>19</sub> - 15
- 2<sub>18</sub> 21<sub>2</sub> - 14
- 2<sub>10</sub> 21 - 22 (2mc, e, 0)
- 2<sub>23</sub> 25 - 22<sub>3</sub>
- 2<sub>25</sub> 21<sub>3</sub> - 27



Average time 3 major cycles. 24 minor cycles.

uses 14 15 16 7 21

	14	15	16	21 <sub>2</sub>	21 <sub>3</sub>
Entry	-	link	-	-	-
Exit	-	P <sub>1</sub> -P <sub>31</sub>	5 <sup>n</sup>	-	V <sub>n</sub>