S.R.43

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DEUCE Subroutine No. 283 (Z07/1)

Report by
C.J.Taylor

SUMMARY

The attached document contains details of a DEUCE Subroutine which has been prepared and tested by N.R.L. Marconi House.

C. J. Taylor.

RF.

LONDON COMPUTING SERVICE,
N.R.L., MARCONI HOUSE.

V.E.P.
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Description. First order subroutine to generate a pseudo-random number of 31 binary digits. A new number is generated at each entry of the subroutine, the sequence being defined by $\nu_n = (2^{13} - 3)\,\nu_{n-1} - 1 \pmod{2^{31}}$

This routine uses slightly less storage space than Z07, is approximately three times as fast, and has the maximum possible period for the sequence generated (the sequence embracing all possible combinations of 0's and 1's for the binary digits). Itsupersedes Z07 (No. 152).

Data. Any number ν_0 may be punched in mc 25 to initiate the sequence.

Result. A 31 digit pseudo-random number is generated in 21_3.

Note. The results of statistical tests carried out on batches of numbers generated are available at London Computing Service, Marconi House.

One point which could be disadvantageous in certain specialised uses of this subroutine arises from the fact that the least significant d digits have a period of 2^d and hence the last few digits follow a recognisable pattern from generation to generation. This may be overcome at the expense of losing information about the period of the sequence, by changing the waste instruction in mc 20 to add or subtract a further P1 from the number generated whenever $(2^{13}-3)\,\nu_{n-1}-1$ does not contain P32 (by replacing the waste instruction by $27\text{-}22_3$ or $27\text{-}23_3$).

Instructions for Use.

Stores Used.	14	15	21_3
Contents at Entry.	-	link	-
Contents at Exit.	$2^{12}\nu_{n-1}$ (mod 2^{32})	link	ν_n

Occupies. mcs 1,13,15,17,20-23,25,27-29,31.

Entry. mc 22.

Time. $1\frac{1}{3}$ ms.

Note. It is most inadvisable to treat the nos generated as random sequences of 0's and 1's or to take the least sign. p digits with $p \le 13$ say. To generate say 10 digit random nos it will still be 2x fast (per no.) to generate them two at a time with this subroutine (taking the most sig. 20 bits) as it will to generate them 3 at a time using Z07 (taking 30 bits).

October, 1958.

D.L. 2 Track

Card Nos. 1 - 3

mc	NIS	S	D	C	W	T		
								Y
								X
								0
								1
0								2
1	2	24	14	1	0	10		3
2								4
3								5
4								6
5								7
6								8
7								9
8								Y
9								X
10								0
11								1
12								2
13	2	24	22		0	0		3
14								4
15	2	27	23		0	0		5
16								6
17	2	21	27		0	1		7
18								8
19								9
20	2	1	1		0	1		Y
21	2	29	23		0	0		X
22	2	2	14		1	3		0
23	2	21	2		0	3		1
24								2
25		used						3
26								4
27	2	14	21		0	0		5
28	1	15	1		0	0		6
29	2	24	14		0	0		7
30								8
31	2	24	23		0	0		9

2_{22} 2_{25} - 14

2_{27} 14 - 21_3

2_{29} 24 - 14

2_{31} 24 - 23_3

2_1 24 - 14 (11 mc)

2_{13} 24 - 22_3

2_{15} 27 - 23_3

2_{17} 21_3 - 27

+ve: 2_{20} 1 - 1

-ve: 2_{21} 29 - 23_3

2_{23} 21_3 - 2_{25}

2_{28} 15 - 1_{30}

1_{30} LINK

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Random Number Generator.

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