Z501/1

THE ENGLISH ELECTRIC CO., LTD.

Tel. 700 NELSON RESEARCH LABORATORIES STAFFORD

Report No. NS t 202

Date 5.12.57.

DEUCE Subroutine No. 235 (E05/1)

Reference

Order No.

Report by N.P.L.

Front Sheet.

Data Sheet 1.

Figure Sheets S6/11015.

SUMMARY.

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

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MATHEMATICS DEPARTMENT.

HEF

E05/1 e^x in s.f.b. DEUCE SUBROUTINE No. 235

NELSON RESEARCH LABORATORIES NS t 202

STAFFORD E. E. CO. LTD. Sheet No.: 1.

Description Given x in s.f.b. this subroutine forms e^x in s.f.b. 2nd Order.
It is an improved version of E05.

Data. x in s.f.b. $2^{-512} < |x| < 2^{12}$.

Uses. Subroutines M04/1 (No. 64) and S01/1 (No. 65) in D.L. A+1 m.c.'s 2-18, 27-31. The waste instruction in S01/1 has been replaced and an additional instruction inserted before going to 1_{31}. These instructions are however, innocuous if S01/1 is used in another context M04/1 finishes with a shift of 1.

Result. e^x in s.f.b.

Failure. If $|x| \geqslant 2^{12}$, 2, 7-246

If $|x| < 2^{-512}$, a loop of 6 instructions.

Instructions for Use.

Stores Used.	13	14	15	16	20	21
Contents at Entry.	-	-	Link	-	x	-
Contents at Exit.	-	-	-	-	x	e^x

Occupies. D.L. A, A+1 ~~m.c.'s 1-31~~ (M04/1 and S01/1 being punched on the cards).

Entry. A_{25}

Time. 40 m.s.

Parameters. None. The requisite shift in M04/1 is planted by the subroutine.

D.L. 2 Track							D.L. 3 Track							
Card Nos.							Card Nos.							
mc	NIS	S	D	C	W	T	mc	NIS	S	D	C	W	T	
														Y
														X
														0
														1
0	2	22	21	l	6	31	0		S01/1					2
1	2	22	21	l	1	0	1	3	3	21		15	19	3
2	2	7	24		0	30	2							4
3	2	27	22	d	0	1	3							5
4	2	29	22		0	0	4							6
5	2	2	16		0	1	5							7
6	2	21	14		1	1	6							8
7	3	21	22	l	7	8	7		M04/1					9
8	3	16	3		7	10	8		+ S01/1					Y
9	3	14	3		7	8	9							X
10	0, 0, 0, 0, 0, 0, 1,						10							0
11	25, 15, 1, 25, 5, 22,						11							1
12	8, 20, 23, 31, 21, 7,						12							2
13	27, 11, 23, 26, 24, 1,						13							3
14	25, 31, 1, 27, 9, 0,						14							4
15	11, 11, 15, 11, 1, 0,						15							5
16	10, 24, 25, 4, 0, 0,						16							6
17	11, 5, 11, 0, 0, 0,						17							7
18	2	13	27		0	0	18							8
19	2	2	13		15	16	19	3	31	21		0	0	9
20	2	13	25		0	0	20	3	3	16		2	18	Y
21	2	2	25		0	1	21	3	15	13		0	0	X
22	2	2	25		5	6	22	1	13	21		1	7	0
23	2	23	14	l	32	31	23	3	3	15		0	1	1
24	0	13	0		0	0	24	21, 13, 1, 10, 5, 14, 1,						2
25	2	20	14		0	1	25	3	2	25		6	23	3
26	2	30	21	d	0	7	26	3	22	16		0	1	4
27	2	2	13		0	1	27							5
28	2	20	13		0	1	28							6
29	2	22	21	l	6(15)	31	29		M04/1					7
30	2	13	2		0	19	30		+ S01/1					8
31	2	13	25	l	2	17	31							9

2_{25} 20_3 - 14 (a)
2_{28} 20_2 - 13 (b.P1)
2_{31} 13 - 25 (16m.c.)(b.P11)
2_{18} 13 - 27

yes (b < 0) | no (b ≥ 0)

2_{21} 2_{23} - 25 [2 23 - 14 l 32, 31]
2_{24} 13 - 0
Q_{26} (2_{23} 23 - 14) (32m.c.)
2_{27} 2_{29} - 13 [2 22-21 l 6 (15) 31]

2_{20} 13 - 25
2_{22} 2_{29} - 25 [2 22-21 l 6 (15) 31]

(-b > 32)

2_{26} 30 - 21 (2m.c.)

2_{30} 13 - 20
2_{19} 2_4 - 13 [2 29 - 22 0 0]
2_5 2_4 - 16 [3 21 - 22 l 7 8]
2_8 16 - 3_{17} (Shift for M04/1)
3_{20} 3_{24} - 16 [$2^{30}\log_2 e$]
3_{18} $\boxed{\text{M04/1}}$

1_{30} (2_4 24 - 22) (Remove round off)
2_0 22 - 21 ($\overline{2p}$ - 34m.c.) (p = 30 - b)
2_1 22 - 21 (32m.c.)
2_5 27 - 22 (2m.c.)
2_6 21_3 - 14
2_9 14 - 3_{18}
3_{19} 31 - 21_3
3_{21} 15 - 13 (link)
3_{23} 3_{25} - 15 [3 2 - 25 6 23.]
3_{26} 22_2 - 16
3_{29} $\boxed{\text{S01/1}}$

3_1 3_{18} - 21
3_{22} 13 - 21
1_{31} (   )

2_2 7-24

If b ≥ 13 the instruction sent to 2_0
becomes 2 22 - 21 l 0 0
This then leads to 2_2 1 - 24)

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e^x in s.f.b.

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