

MATHEMATICAL SERVICES DEPARTMENT  
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH

Tabular Interpretive Scheme: Version 1

(Extract from DEUCE News No. 19, Jan. 1958)

INSTRUCTION TO DEUCE OPERATORS

Punching of Data

Data cards are punched in floating decimal  $a \times 10^b$  with  $1 \leq a \leq 10$  in Cols. 2-10 of DEUCE field with sign in Col. 1 b as 9 digit integer in Cols. 12-20 with sign in Col. 11.

Cards should be punched and stacked in columns as set out on data sheet.

Punching of Codewords

Each block of codewords is punched as a triad of cards in the normal fashion but with no initial instructions, the first minor cycle of the first triad should be left blank if more than one triad is to be read in. If only one triad is to be read in, m/c 0 should be filled with the following codeword:-

0 0 1 33

If more than one triad is to be read in (i.e. if m/c 0 of 1st triad is blank), make up to 4 delay lines with blank cards. Codes are punched in binary as integers  $x P_1$ ;  $P_9$ ;  $P_{17}$  and  $P_{25}$  the central bracketed code where this appears should be punched as integer  $x P_{14}$ . A  $P_{32}$  punched against any code behaves as a stopper.

For a programme consisting of not more than four D.L's of codes the codes will precede the data in stacking order. A programme of more than four D.L's will contain an instruction to read more codes and an inspection of the programme will be needed to ascertain the stacking sequence. In front of the code cards a parameter card is required with  $n P_1$  on the y row, where n is the number of rows being worked in the tabulation.

Interpretive Programme and Bricks

Each brick has a fixed position on the drum. The interpretive programme is in two parts, front and back, the bricks being sandwiched between. Only the bricks required for a particular calculation need be assembled into the pack. The front section of the interpretive scheme incorporates "clear drum" and "read to drum". The back section includes A 11 F/1.

Testing Facilities

A  $P_{32}$  on the I.D. will cause the machine to stop on each codeword, displaying the codeword on the O.S. A single shot causes the programme to continue.

To stop on codeword n, put  $n P_{17}$  on I.D. single shot to continue. To punch out intermediate column (or to insert an instruction from I.D.) stop machine to appropriate point by  $P_{32}$  or  $n P_{17}$ ; T.I.L. on, single shot T.I.L. off, put on stop. Insert required codeword on I.D. (a 0 0 5 if column a is to be punched out), give single shot, clear I.D. put on normal.

If the inserted codeword contains a P<sub>32</sub> the machine will stop with the code displayed on O.S. Give a single shot to continue. The next code to be obeyed will be the one due to be obeyed when the I.D. instruction was inserted.

To find out which code is being obeyed when a failure occurs it is only necessary to bring down track 15/7 to D.L.1 on ext. tree and enter in 130 with P<sub>32</sub> on the I.D. The programme will then stop as usual displaying on the O.S. the codeword following that on which the failure occurred.

Failure Indications

		3	21-29	x	See A11/1
		2	31-29		Divisor zero
			21-28		Read failure
			9-24		
			21-29		
Square root A		5	27-29		A negative
Log A	{	6	29-29		A negative
		6	31-31		A zero
Anti log ( A (= a x 2 <sup>b</sup> ))		5	13-29		b > 2 <sup>12</sup>
Sin <sup>-1</sup> A or	{	6	13-29	x	b > 1
Cos <sup>-1</sup> A		3	14-29		b < 1 A > 1.0

Results

These are punched out column by column, one number per card in standard floating decimal. Since they are in the same form as the data and punched in the same fields they can be used as input if required.

SUMMARY OF CODEWORDS

CODEWORD				INTERPRETATION
a	b	c	0	(Col.a) x (Col.b) putting result in Col.c
a	b	c	1	(Col.a) ÷ (Col.b) putting result in Col.c
a	b	c	2	(Col.a) + (Col.b) putting result in Col.c
a	b	c	3	(Col.a) - (Col.b) putting result in Col.c
0	0	c	4	Read column of data from cards and put in Col.c
(n+2)	o	c	4	Read graph of n co-ordinates from cards and put in Col.c
p	o	o	4	Read p constants from data cards
a	o	o	5	Print out column a
a	0	c	6	(Col.a) putting result in Col.c
a	n(0)	c	7	(Col.a) x C <sub>n</sub> putting result in Col.c

CODEWORD				INTERPRETATION
a	n(1)	c	7	$C_n \div$ (Col.a) putting result in Col.c
a	n(2)	c	7	(Col.a) + $C_n$ putting result in Col.c
a	n(3)	c	7	$C_n -$ (Col.a) putting result in Col.c
a	o	c	8	log (Col.a) putting result in Col.c
a	o	c	9	Anti-log (Col.a) or $10^{(\text{Col.a})}$ putting result in Col.c
a	o	c	10	(Col.a) shifted down one place in Col.c
a	o	c	12	Sine (Col.a) in Col.c
a	o	c	12	Cosine (Col.a) in Col.c
a	b	n	13	Store number in Col.a row b in position $C_n$
a	o	c	14	{ Col.a } in Col.c
a	b	c	15	From x's in Col.a and graph of $y = f(x)$ in Col.b find y's and store in Col.c
a	b	c	16	Take as next instruction codeword c if Col.a is all negative or codeword b if Col.a is all positive. Go to next codeword if Col.a contains a mixture of positive and negative numbers.
a	b	c	17	Take as next instruction codeword c if Col.a contains no zeros, codeword b if Col.a is all zeros or next codeword if Col.a contains both zero and non-zero elements.
a	o	c	19	Given $X_i$ in Col.a form $\sum_{i=0}^{x_n} x_i$ in Col.c
a	o	c	20	Given sine x in Col.a, forms x in Col.c
a	o	c	21	Given cosine x in Col.a forms x in Col.c
o	o	o	32	Stop programme
o	o	p	33	Jump to codeword p
o	b	c	34	Read fresh block of codewords into block c and jump to codeword b
a	b	c	35	Replace codeword c by codeword a and jump to codeword b
a	b	c	36	Replace codeword c by a + b.

Transfer of Desk Machine work to DEUCE

M.S. Computing Note B No. 219 gives operating instructions for a new DEUCE interpretive scheme. This scheme can replace desk machines for simple calculations which would normally be set out as operations on columns of numbers. A knowledge of programming is not required by users of this scheme, which is within the scope of Assistants (Scientific).

Further information can be obtained from this Department.

MATHEMATICAL SERVICES DEPARTMENT

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