DEUCE Programme No.213 (ZF06/1)

Check Detailed Coding.

SUMMARY.

This programme reads in a triad of cards to fill one delay line and punches out the contents of the delay line in decimal, one minor cycle per card. As well as punching the N.I.S., source, destination, characteristic, wait and timing numbers and go digit of each instruction it punches on each card the delay line and minor cycle of the instruction, the first minor cycle of transfer, the minor cycle of the next instruction and the length of transfer, and also the "spare" digits of the instruction, P_1, P_{22} to P_{25}, and P_{31}. Alternatively, if the user wishes, specified minor cycles can be treated as numbers and punched in decimal in the scale of 32.

This programme can be used both as a check on the accuracy of the punching and also to reconstruct the flow diagram of the programme being checked.

This programme was prepared and tested by R.A.E.

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Check Detailed Coding.

OPERATING INSTRUCTIONS.

Order of cards. Programme cards 0-21, followed by any number of triads of cards to be checked.

On input dynamicizer. For each triad set P_{r_1} P_{r_2} ... on the I.D. Where the contents of minor cycles r_1 r_2 ... are to be treated as numbers, not instructions. (Set P_{32} for m.c.0)

The machine stops on 1, 0-14 to read this, then reads the triad of cards and punches out 32 decimal cards. The setting of the I.D. can be changed as soon as the machine has started to read the triad.

Output. 32 decimal cards. If the instruction in delay line A, minor cycle m, is regarded as

$$aP_1 + NP_2 + SP_5 + DP_{10} + CP_{15} + WP_{17} + bP_{22} + TP_{26} + oP_{31} + GP_{32},$$

the numbers are punched as follows:-

Columns.	21 - 26	Blank
	27, 28	b
	29, 30	A
	31, 32	m
	33	a
	34	N
	35, 36	m+T+2 (Mod. 32)-next instruction minor cycle.
	37, 38	S
	39, 40	D
	41	Zero
	42	C
	43, 44	W
	45, 46	T
	47	c
	48	G
	49, 50	m+W+2 (Mod.32)-first minor cycle of transfer.
	51, 52	Length of transfer.

If the word is treated as a number of the form

$$\alpha + \beta 2^5 + \gamma.2^{10} + \delta.2^{15} + \epsilon.2^{20} + \zeta.2^{25} + \eta.2^{30}.$$

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OPERATING INSTRUCTIONS CONT'D.

Columns	21 - 26	are blank
	27, 28	ξ
	29, 30	A
	31, 32	m
	33, 34	Zero
	35, 36	α
	37, 38	β
	39, 40	γ
	41, 42	δ
	43, 44	ε
	45	Zero
	46	η
	47 - 52	Zero.

DESCRIPTION OF PROGRAMME.

The programme consists of the following nine parts, but is all read into the delay lines (the magnetics are not used) and can be used to check several triads.

(i) Read marker word from I.D., (giving minor cycles whose contents are to be treated as numbers) and read delay line number from destination position on X row of first card of three. This will be correct if the triad is designed to be read into the mercury, whether or not the delay line has an N.I.S. If the programme for reading to the magnetic drum described in §8.2 of the programming manual is used, 31 will be punched as the number of the D.L. . In later programmes for reading to the magnetic drum (e.g. EMM No. 36) the X row is not used and the destination can be punched.

(ii) Read the 32 instructions into D.L.9. In order to ignore the single shots from the 0 and 1 rows of the first card, these two rows are read into 9_{30} and 9_{31} and later over-written.

(iii) Fetch minor cycle m from 9_m (starting with m = 0) and find whether an instruction or a number. If the latter go to part (ix).

(iv) If an instruction, unpack it and put b, A, m, (10a+N), S.D,C,W,T, (10c + G) into $10_0, 10_1, 10_2, 10_3, 10_5, 10_6, 10_7, 10_8, 10_9, 10_{10}$.

(v) Calculate (m + T + 2) and (m + W + 2) modulo 32, and the length of transfer, and put them in $10_4, 10_{11}, 10_{12}$. These are of use in reconstructing the flow diagram, but the first two will not be the minor cycle of the next instruction and the first minor cycle of transfer if the instruction is obeyed in another minor cycle from that in which it is stored; e.g. if it is a link.

(vi) If minor cycle n of delay line 10 $(0 \leq n \leq 12)$ contains α $(0 \leq \alpha \leq 31)$ and if $\alpha = 10\beta + \gamma$, where $0 \leq \gamma \leq 9$, put $\gamma P1 + \beta P_{17}$ in 11_n.

(vii) Punch the card. The method used to calculate the r's row is to fetch 11_n (n = 0,1 ... 12 in turn) to add a P_{32} to 21_2 if $\gamma_n = r$, and a P_1 to 21_3 if $\beta_n = r_1$ then to shift 21 down two places. When n = 12 DS 21 is doubled and 21_2 is punched.

(viii) If less than 32 minor cycles have been decimalised increase the number of the minor cycle by 1 and go back to part (iii). If all 32 cards have been punched go back to the beginning, part (i).

(ix) When the word is a number, it is unpacked by putting successive groups of five digits (least significant first) into $10_4, 10_5, 10_6, 10_7, 10_8, 10_9$, the most significant two digits into 10_2 and clear $10_3, 10_{10}, 10_{11}, 10_{12}$. This is followed by part (vi).

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

D.L. 2	Track	Card Nos. 4-6					
mc	NIS	S	D	C	W	T	
0	2	23	14	1	0	3	
1	2	23	14	2	0	1	
2	2	25	17		1	2	
3	3	18	0	1	2	5	
4	2	6	15		1	8	
5	2	6	15		0	0	
6	2	23	14	1	0	4	
7	2	25	18		0	1	
8							
9	2	6	15		1	2	
10	2	23	14	1	0	4	
11							
12	2	25	17		0	3	
13	2	25	25		0	0	
14	2	25	18		0	6	
15	2	13	17		2	2	
16	2	27	15		0	0	
7	2	23	14	1	0	4	
18	2	25	13		0	0	
9	2	23	14	1	2	4	
20	2	13	25	1	0	2	
21	3	16	25		0	13	
22	2	23	14	1	0	4	
23	2	6	15		0	1	
24	2	25	25	2	0	1	
25	2	6	15		4	7	
26	2	25	18		3	5	
27	2	23	14		0	0	
28	2	6	15		0	0	
29	2	25	25		0	0	
30	2	25	10		0	0	
31	2	13	18		1	2	

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

N.123

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Date

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D.L. 4 Track

Card Nos. 10 - 12

mc	NIS	S	D	C	W	T	
0	4	6	15		0	0	
1	4	13	14		0	0	
2	4	30	17		0	0	
3	4	6	13		0	1	
4	4	6	13		0	0	
5							
6	4	17	25		0	0	
7							
8	0	13	0		0	0	
9							
10							
11							
12	4	15	26		0	1	
13	4	17	13		1	1	
14	4	8	24		0	1	X
15	4	13	27		0	1	
16	4	28	25		0	3	
17	1	30	20	2	0	29	X
18	4		26		0	0	
19	4	30	14		0	8	
20	4	13	27		0	0	
21	4	13	17		1	13	
22	4	15	26		0	0	
23	4	28	14		0	4	
24	4	13	27		0	0	
25							
26	4	6	14		0	3	
27			14		0	0	
28							
29	4	15	25		0	0	
30		33P1					
31	4	14	25		0	0	

D.L. 5 Track

Card Nos. 13 - 15

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

D.L. 6 Track

Card Nos. 16 - 18

mc	NIS	S	D		W	T		
								Y
								X
								0
								1
0								2
1								3
2		10P1						4
								5
4								6
5	4	14	11		20 (15)	1		7
6	4	10	13		20	0		8
7		31P1						9
8	1	0	9		3 (14)	20	X	Y
9								X
10								0
1								
2		7P1						
13								3
14		15P1						4
5								5
16								6
17		12P17						7
18		32P1						8
19								9
20								Y
21								X
22		13P17						0
23								1
24								2
25		3P1						3
26	7	9	13		1	7		4
27	5	11	15		1	13		5
28		3P17						
29		2-17						7
30		15P1						8
31		31P						

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Deuce Programme No. 213 (ZPO6/1)

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D.L. 7 Track

Card Nos. 19 - 21

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

D.L. Track

Card Nos.

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

D.L. Track

Card Nos.

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

N.123

S_{21} → 1_1 0 - 14 X Marker word to show words which are numbers.
1_3 12 - 24
1_7 14 - 27

+ / -

1_9 30 - 15 1_{10} 27 - 15

1_{12} 24 - 14
1_{17} 26 - 19_3

Shift marker word up one place and put P_{32} digit in P_1 position

1_8 6_8 - 13 X [1 0-9 31 14) 20 X] Y row of card.
1_{11} 0 - 14 X X row of card. A is in ... position.
1_{15} 23 14 (mc)
1_{25} 6_{31} 15 [31 P]
1_{31} 25 - 10 A.P_1 — number of delay lines
→ 1_{27} 13 - 0
Q_{20}(b_8 - n-2) X Read 34 rows into 9_{20}, 9_{31}, 9_0 . 9_{30} 31 thus overwriting 0 & 1 rows first car.

1_{19} 28 - 25

Spill over.
n 33

1_{20} 9 24
1_{22} 10 24
1_{29} 30 - 13 m 0
S_{10} → 1_0 13 - 10
1 16 P_1
1_4 13 25 (16 mc) m P_{17}
1_{24} 6_{26} 25 [7 9 -13 1]
1_{27} 13 0
Q_{29}(9_m 13) Fetch minor cycle m
6 27 - 15 P_1
8 19_3 - 14 Marker word
1_1 23 - 19_3 Shift down marker word
7_5 5 - 28 Is minor cycle " " a number?

Yes n2 / 2 No → 7_{17}

7_{18} 6_{21}
7_{31} 13 4 Minor cycle "m" to 14
. - 17_0 Bottom 5 digits as (m+ 2)
7_{21} 23 - 14 (5 mc)
7_{27} 25 17_1 Second 5 digits as S
7_{29} 3 14 (5 mc)
7_4 2 - Third 5 digits as D
7_7 23 - 14 (5 mc)
7_3 - 18_3 Fourth 5 digits as C
7_6 23 - 14 (5 mc)
7_{22} 2 - 18_0 F 5 digits as W

→ 7_{24} 23 - 14 (5 mc)
7_{30} 25 - 10_0 Sixth 5 digits as 6
6 30 a N 0
7_2 30 - 18_2 c = 0
7_{23} 6_{25} - 15 [$3P_1$]
25 . ts as
$18_{3,0,1,2}$ 10 ,8 4 10
7_{10} 30 - 20 (mc) 1 + W + , L = 0
↓
3_1

$7_{15} \rightarrow 7_{17}$ 13 – 14

1_{23} 25 – 13 aP_1; where the instruction is $aP_1 + NP_2 + SP_5 + 2P_{10} + CP_{15} + WP_{17} + {}^{\prime}P_{22} + TP_{26} + eP_{31} + GP_{32}$

1_{28} 25 – 25 (4mc) $10a\,P_1$

1_6 23 – 14

2_4 6_{12} – 15 [$7P_1$]

2_{13} 25 – 25 $(10a\ N).P_1$

2_{15} 13 – 17_3

2_{19} 23 14 (3mc)

2_{25} 6_{31} 15 [$31P_1$]

2_2 25 – 17_1 SP_1

2_6 23 – 14 (5mc)

2_{12} 25 – 17_2 DP_1

2_7 2 – 14 (5mc)

2_{23} 6_{25} 15 [$3P_1$]

2_6 5 18 CP_1

2_1 23 – 14 (2mc)

2_{16} 6_7 – 15 [$31P_1$]

2_{14} 2 8_0 WP_1

2_{22} 23 – 14 (5mc)

2_{28} – [$15P_1$]

2_{30} 25 – 15_0 P_1

2_0 23 – 14 (5mc)

2_5 6_7 – 15 [31 1]

2_7 25 – 18_1 TP_1

2_{10} 23 – 14 (5mc)

2_{16} 27 – 15

2_{18} 25 – 13 eP_1

2_{20} 13 – 25 (3mc) $10eP_1$

2_{24} 25 25 (2) $10eP_1$

2_{27} 23 – 14

2_{29} 25 25 (0e +)

2_{31} 13 – 18_2

2_3 $18_{3,0,1,2}$ – $10_{7,8,9,10}$ [$C, W, T+(10e+G)$]

3_{10} 18_0 – 13 W

3_{21} 16 – 25 m

3_4 27 – 25 (2mc), $(W+m+2)P_1$

3_{13} 6_{18} – 26 [$32P_1$]

3_{31} 13 – 27

+ –

3_{14} 6_{18} – 25 [$32P_1$]

3_{19} 13 20 $(m+W+2)$ mod 32

3_3 18 – 13 T

7 16 – 25 m

$_{11}$ 27 – 25 (2mc), $(m+T+2)P_1$

3_{15} 6_{18} – 26 [$32P_1$]

3_0 13 – 27

+ –

3_{16} 6_{18} – 25 [$32P_1$]

3_{18} 13 – 17_0 $(m+T+2)$, mod 32.

3_{22} 18_1 – 13 T

3_{29} 18_0 – 26 W

3_2 30 – 21_3

3_5 18_3 – 28 C

nz z $C=0$

3_9 18_3 – 21 3_8 2 – 13 [P_1] → 3_{30}

3_{12} 27 – 23 (2mc. c.o)

3_7 21 – 28 $-P_1$ in 21_2, $(C-2)P_1$ in 21_3

$C=1$ or 3 nz z $C=2$

3_{21} 13 – 27 (T–W) 3_{20} 18_1 – 13 [$2P_1$]

–

3_{23} 13 – 28 3_{24} 4_{30} – 25 [$33P_1$] if $T<W$

z nz

3_{25} 21_3 – 27 3_{26} 27 – 25 [P_1] if $T>W$

$C=3$ + – $C=1$

3_{27} 4_{30} – 13 [$33P_1$] 3_{28} 27 – 13 [P_1]

$3_8 \rightarrow 3_{30}$ 13 – 20_2

$7_{10} \rightarrow 3_1$ $17_{3,0,1,2}$ – $10_{3,4,5,6}$ [$(10a+N)$, $m+T+2$ (mod 32). S, D]

3_6 $20_{,2}$ – $10_{11,12}$ [$m+W+2$ (mod 32) + the length of transfer]

4_0 6_2 – 15 [$10P_1$]

4_2 30 – 17_0 $n=0$

$4_{31} \rightarrow 4_4$ 6_0 – 13 [4 10–13 20 0]

4_6 17_0 – 25 nP_{17}

4_8 13 – 0

Q_{10}(w_6 10_n – 13) α, say

4_{12} 15 – 26 [$10P_1$]

15 3 – 27

+ –

4_{18} 15 – 26 4_{19} 30 – 14 $(0 \leq \alpha \leq 9)$

4_{20} 4_{29}

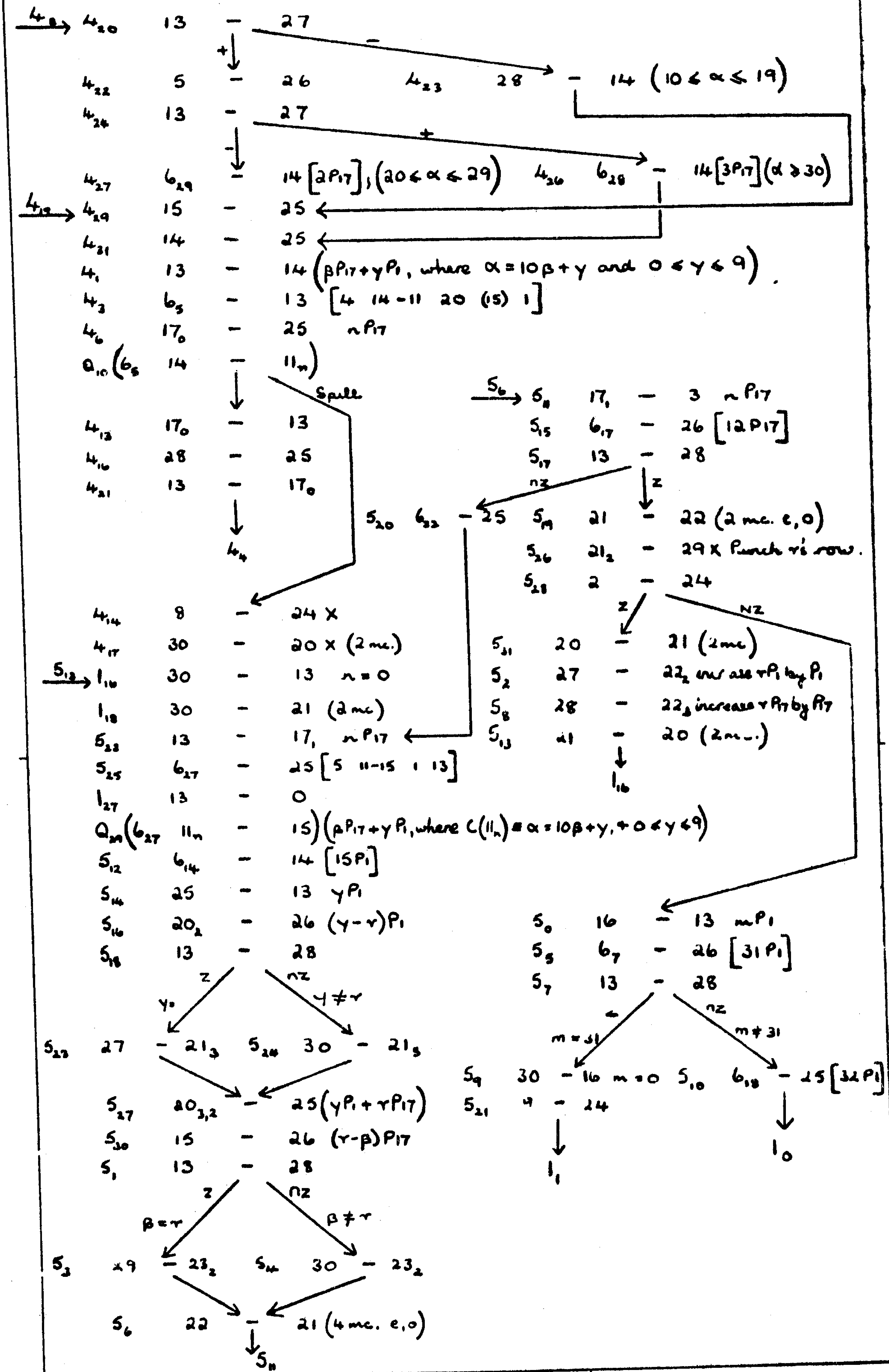
FLOW DIAGRAM FOR DEUCE PROGRAMME

NO. 213 (2POU/1) Check [illegible]

Date

File Ref. R.A.E. 148.

Sheet Ref. S6/10474



FLOW DIAGRAM FOR DEUCE PROGRAMME

Date

File Ref. ?AC. 14 8