S.R.43

THE ENGLISH ELECTRIC CO., LTD.

NELSON RESEARCH LABORATORIES
STAFFORD
MATHEMATICAL PHYSICS LABORATORY.

Telephone:—Stafford 700.

Report No. NS t 102
Date 5.1.56.
Reference
Order No.

Front Sheet.
Data Sheets 1 - 2
Figure sheets S6/10385-8

DEUCE Subroutine Nos. 111,112. (P13F, P13F/1)

Report by N.G.Dowell.

SUMMARY.

The attached document contains details of two DEUCE subroutines for punching floating numbers in a manner convenient for tabulation. The subroutines have been prepared and tested at N.R.L., Blackheath.

N. G. Dowell

MATHEMATICAL PHYSICS LABORATORY.

NW

Description.

NOTE: P13F/3 replaces this routine.

Converts standard floating binary to decimal and punches S significant digits ($S \leq 9$) in such a position on a card that the decimal point can always be taken to lie between columns 12 and 13 of the DEUCE field. This position is selected by a scaling process which must be completed before the card arrives and consequently very large or very small numbers cannot be punched continuously.

However, P13F/1 includes safety devices which clear punch:
(a) if the exponent lies outside a specified range, or
(b) if TIL arrives too 'early' i.e. if the single shot from the Y row has been lost.
(The number is still retrievable one row down and punching may be continued).

P13F/1 is most useful if it is expected that the numbers supplied will mostly lie in the range $10^{-20} < |x| < 10^{6}$ and it is recommended that the timing be carefully studied.
First Order.

Data.

$x = a \cdot 2^{b}$ in s.f.b.

S the number of significant decimal digits required.

Result.

$x = A \cdot 10^{B}$ $(1 \leq A < 10)$ converted to decimal and punched as above with the sign always in column 1.

If $|x| \geq 10^{12}$ or $< 10^{-12}$ the number will be punched in columns 1 to S or columns 24 to (23+S) as appropriate and a positive binary number EP_{17} will appear on the X row, together with a P_{32} as marker indicating that a further

E decimal shifts are required to obtain the correct position relative to the decimal point. With this convention it is possible to deal with numbers between $10^{-\beta}$ and 10^{β} where

$$\beta = 2^{23-\omega} + 11$$

(ω is the wait number in 3_{26}, normally punched as 15).

Failure.

13 - 29 X E requires more than $23 - \omega$ binary digits. Single shot 'stopped' puts EP_{17} on OPS.
Clear OPS and continue on normal.

10 - 24 X (P13F/1 only). TIL too early.
Note card No. and continue by giving single shot.

The subroutine may round off numbers like $9.9999 \ldots\ldots \times 10^{6}$ to $10.000 \ldots\ldots \times 10^{6}$. It then drops the 10 & punches 0×10^{6}

P13F/3 will avoid this.

Error Rounded off to S significant digits as in normal punch routines.

NOTE P13F Leaves punch cleared.
Rapid on-off working occasionally gives trouble for easily converted numbers and it may be necessary to introduce a protective delay count in the main programme.

P13F/1 Leaves punch called.
The upper and lower bounds of the exponent consistent with continuous punching (b_u , b_l) must be estimated with reference to the time available between cards and any other calculation necessary using the given time formulae. Punch is cleared when $b \leq b_l$ or $\geqslant b_u$ but is recalled when the calculation is completed.
The subroutine may round-off numbers like $9.999 \ldots \times 10^b$ to $10.00 \ldots \times 10^b$. It then drops the "10" and punches 0×10^b. P13F/3 will avoid this.

Instructions for Use.

Stores Used.	13	14	15	16	19_3	20	21
Contents at entry.	Link	-	-	-	-	-	x
Contents at exit.	-	-	-	-	-	-	-

Occupies. P13F: $2_{0-5,\ 7-31}$, 3, 4, $5_{11-25,\ 27-30}$

P13F/1: 2, 3, 4, 5.

Entry. 5_{14}

Time. (P13F/1, up to Y row arrival)
$B \geqslant 0$ $b + 18B - 2$ m.s.
$B < 0$ $12 - 2B - b$ m.s.

Parameters. Put $2^{31}\ 10^{1-S}$ in 2_{12}

Add (19-S) P_{17} to 3_{22}

(P13F/1 only) Put $|b_l|$ in 5_1
Put b_u in 5_4 (see note)

Constamts available. P13 in 2_{30} . P_{29} in 3_{11} . $P_{28} + P_{30}$ in 3_{12} . P_{24} in 4_{15}.

$P_{19} + P_{20}$ in 4_{22} . P_{28} in 5_{23} , $P_{29} + P_{31}$ in 5_{27}.

S_{14} $13 - 1_{30}$ → 2_{4}

2_0 $30 - 16$

2_3 $30 - 13$

3_0 $21_3 - 27$ $x = a.2^b$

+ −

3_4 $21_3 - 13$ 3_5 $21_3 - 26$ Take $|a|$

2_7 $27 - 15$ S_{11} $30 - 15$ Record sign of a

S_{13} $13 - 21_3$

S_{16} $21_2 - 13$ [b]

P13F/1 P13F

S_0 $13 - 27$

− +

S_3 $13 - 14$

S_6 $14 - 26$ (2m.c)

S_{26} $S_1 - 26$ $|b_L|$

$S_4: |b_1|$

S_2 $S_4 - 26$

S_5 $13 - 27$

+ −

S_7 $9 - 24$

S_8 $21_2 - 13$

3_{18} $30 - 21_2$

3_{28} $27 - 26$ (3m.c) Form $b' = b - 3$ to compensate for change of b.p

S_{30} → 4_0 $13 - 14$

4_3 $21_3 - 13$

4_5 $14 - 27$

− $b' < 0$ + $b' \geq 0$

4_7 $14 - 28$

Z NZ

4_{10} $3_{12} - 26$ [5 P28]

4_{12} $13 - 27$

+ − $|a| < 5$

4_{16} $22 - 21$ (8m.c)

4_{25} $22 - 22_{2,3}$

4_{29} $21 - 20$ (2m.c)

4_{31} $28 - 13$

4_1 $22 - 21$ (8m.c)

4_4 $20 - 22_{2,3}$ $|a| \div 10$

2_{16} $13 - 25$ double

4_{18} $13 - 27$ length.

− +

4_2 $16 - 13$ $B \rightarrow$

4_6 $28 - 25$ $B + 1$

2_9 $13 - 16$

4_{17} $21 - 22_{2,3}$ $|a| \times 2$

4_{21} $14 - 13$

4_{30} $27 - 26$ $b' \rightarrow b' - 1$

4_8 $3_4 - 26$ [2 P28]

3_{14} $13 - 27$

$|a| \geq 2$ + −

$|a| \div 2$ 4_9 $22 - 21_{2,3}$

$|a| \times 5$ 4_{20} $21 - 20$ (2m.c)

4_{23} $20 - 22$ (8m.c)

3_1 $16 - 13$ } $B \rightarrow$

4_4 $28 - 26$ } $B - 1$

2_{14} $13 - 16$ }

4_{24} $14 - 13$

S_{30} $27 - 25$ $b' \rightarrow b' + 1$

$\boxed{4_0}$

$x = A.10^B$ $(0 \leq A < 10)$

4_{19} $16 - 13$

S_{22} $29 - 23_2$ Round off A

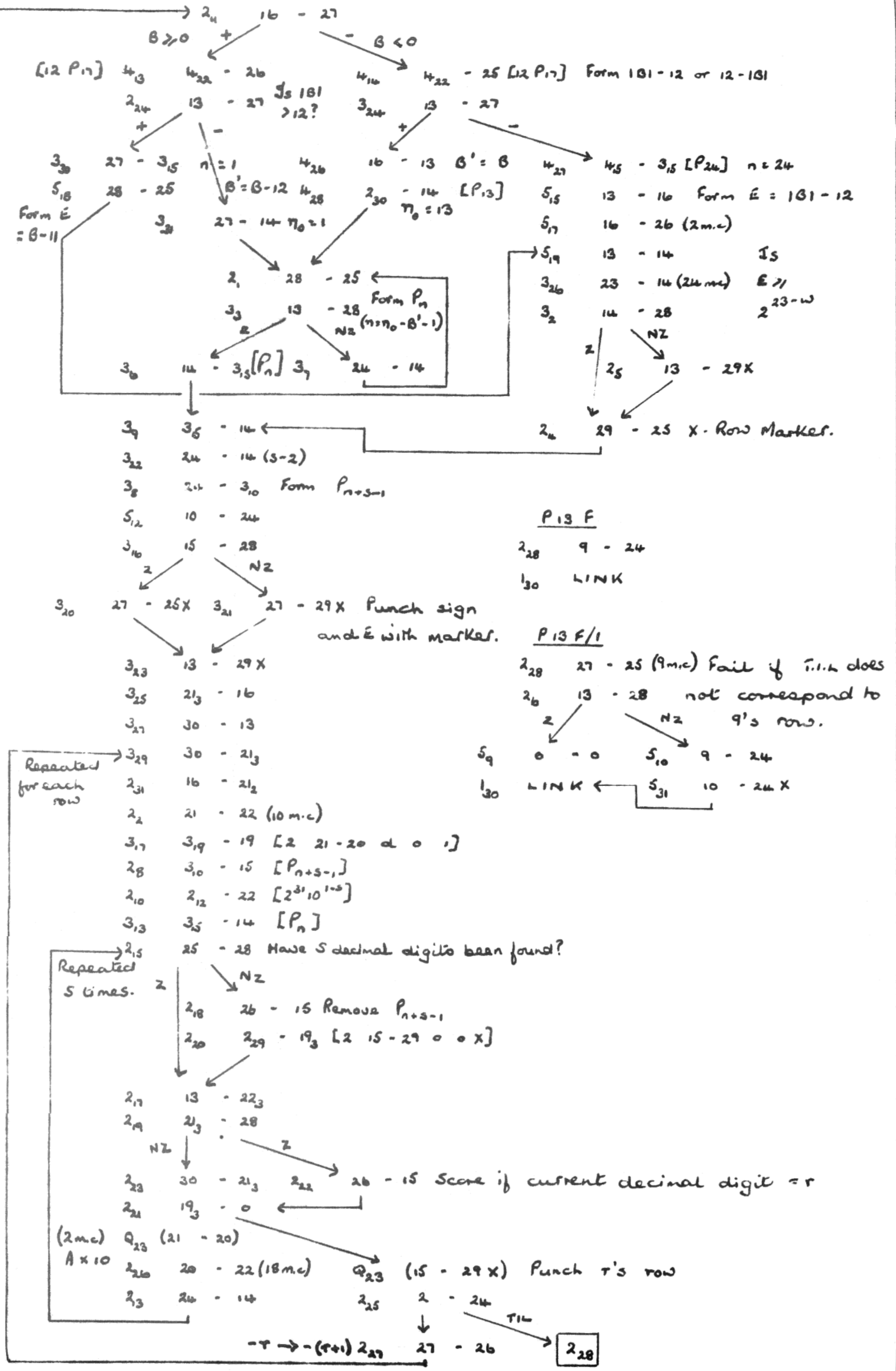
S_{25} $S_{27} - 23$ [10 P28]

S_{28} $21_3 - 28$ Has round off made $A = 10$?

NZ Z

S_{21} S_{27} 22_3 [10 P28] S_{20} $S_{23} - 21$ [P28] $A \rightarrow 1$

S_{29} 13 16 S_{24} $28 - 25$ $B \rightarrow B + 1$



FLOW DIAGRAM FOR SUBROUTINES P 13 F AND P 13 F/1 Nos. 111 and 112

Punch floating number in a floating field

Date DEC. 1955

File Ref.

Sheet Ref. 56/19385

NELSON RESEARCH LABORATORIES,
THE ENGLISH ELECTRIC CO. LTD.,
STAFFORD, ENGLAND.

NELSON RESEARCH LABORATORIES, STAFFORD | Date DEC. 1955
THE ENGLISH ELECTRIC CO. LTD. | Sheet No. 56/10386

Deuce Programme

CODING FOR SUBROUTINE No 111 (P13 F)

Punch floating number in a floating field.

D. L. 2. Track

Card Nos.

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

D. L. 3 Track

Card Nos.

mc	NIS	S	D	C	W	T	
	3	0	3	1	26	25	X
	3	0	3		30	31	X
	1	0	3		30	31	X
0	3	21	27		1	2	
1	4	16	13		0	1	
2	2	14	28		0	0	
3	3	13	28		0	1	
4	2	21	13		1	1	
5	5	21	26		0	4	
6	3	14	3		7	1	
7	2	24	14		0	2[illegible]	
8	5	24	3		0	2	
9	3	3	14		4	11	
10	store for P_{n+s-1}						
11		$2P_{28}$					
12		$5P_{28}$					
13	2	3	14		0	0	
14	4	13	27		0	3	
15	Store for P_n						
16	3	15	28		0	2	
17	2	3	19		0	21	
18	3	30	21		0	8	
19	2	21	20	2	0	1	
20	3	27	25		0	1	X
21	3	27	29		0	0	X
22	3	24	14	1	(19-s)	16	
23	3	13	29		0	0	X
24	4	13	27		0	0	
25	3	21	16		0	0	
26	3	23	14	1	15	6	
27	3	30	13		0	0	
28	4	27	26	1	0	2	
29	2	30	21		0	0	
30	5	27	3		15	18	
31	2	27	14		0	0	

D.L. 4 Track

Card Nos.

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

NELSON RESEARCH LABORATORIES, STAFFORD
THE ENGLISH ELECTRIC CO. LTD.

Date Dec. 1955
Sheet No. 56/10387

Deuce Programme

CODING FOR SUBROUTINE No. 111 (P13 F)

Punch floating number in a floating field.

D. L. 5 Track

Card Nos.

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

NELSON RESEARCH LABORATORIES, STAFFORD
THE ENGLISH ELECTRIC CO. LTD.

Date DEC. 1955
Sheet No. 06/10388

Deuce Programme

CODING FOR SUBROUTINE NO. 112 (P14F/1)

Punch floating number in a floating field.

D.L. 2 Track
Card Nos.

mc	NIS	S	D	C	W	T	
	2	0	2	1	26	25	X
	2	0	2		30	31	X
	1	0	2		30	31	X
6	5	13	28		0	1	
12	AS $P_{13}F$						
28	2	27	25	1	0	8	

D.L.'s 3 4 Track
Card Nos.

mc	NIS	S	D	C	W	T	
	n	0	n	1	26	25	X
	n	0	n		30	31	X
	1	0	n		30	31	X
12	AS $P_{13}F$						

D.L. 5 Track
Card Nos.

mc	NIS	S	D	C	W	T		
								Y
	5	0	5	1	26	25	X	X
	5	0	5		30	31	X	0
	1	0	5		30	31	X	1
0	5	13	27		0	0		2
1	$10_\ell 1 \times P_1$							3
2	5	5	26		0	1		4
3	5	13	14		0	1		5
4	$16_u 1 \times P_1$							6
5	5	13	27		0	0		7
6	5	14	26	2	0	18		8
7	5	9	24		0	31		9
8	3	21	13		0	8		Y
9	1	0	0		0	19		X
10	5	9	24		0	19		0
13	AS $P_{13}F$							3
16	5	21	13		0	14		6
22	AS $P_{13}F$							0
26	5	5	26		5	9		4
29	AS $P_{13}F$							7
31	1	10	14		0	29	X	9