(2) Carry Save Addition Problem

1001 – A	(9)
1101 – B	(13)
1110 – C	(14)
1111 – D	(15)
1010 – E	(10)
1100 – F	(12)
	73

Answer should be 73

A + B + C

```
 1 0 0 1
 1 1 0 1
 1 1 1 0
-------
 0 1 0 1 0  ← S1
 1 1 0 1 X  ← C1
```

D + E + F

```
 1 1 1 1
 1 0 1 0
 1 1 0 0
-------
 0 1 0 0 1  S2
 1 1 1 0 X  C2
```

$S_1 + S_2 + C_1$

```
 0 1 0 1 0
 0 1 0 0 1
 1 1 0 1 X
---------
 0 1 1 0 0 1  → S3
 0 1 0 1 0 X  → C3
```

$S_3 + C_3 + C_2$

```
 0 1 1 0 0 1
 0 1 0 1 0 X
 0 1 1 1 0 X
-----------
 0 1 0 0 0 1  - S4
 1 1 1 0 0 X  → C4
```

$S_4 + C_4 \Rightarrow$

```
 0 1 0 0 0 1
 1 1 1 0 0 X
-----------
 1 0 0 1 0 0 1  ⇒ 73
```

$S_4 \Rightarrow 0\,1\,0\,0\,0\,1$

$C_4 \Rightarrow 1\,1\,1\,0\,0\,X$

(15) * (12) → Shift and add multiplier:

M ⇒ 1111 (15) → multiplicand

B ⇒ 1100 (12) → multiplier

C	A	B	D	
0	0000	1100	4	
0	0000	0110	3	Right shift . CAB
0	0000	0011	2	Right shift "CA B
0	1111	0011	2	A = A+M
0	0111	1001	1	Right shift CAB
0	0110	1001	1	A = A+M
0	1011	0100	0	Right shift CAB
				stop

Result.

(15 × 12) = 180

2	180
2	90 – 0
2	45 – 0
2	22 – 1
2	11 – 0
2	5 – 1
2	2 – 1
	1 – 0

Final Answer:

10110100

Booth Multiplication

M = −14 (10010)

Q = −5 (11011)

14 → 01110

1's co 10001

+ 1

10010

(−5) 00101

11010

+ 1

11011

m	A	B	q_0	
5	00000	11011	0	
	01110	11011	0	A = A − M
	00111	01101	1	ASR
4	00011	10110	1	ASR
3	10101	10110	1	A = A + M
	11010	11011	0	ASR
2	01000	11011	0	A = A − M
	00100	01101	1	ASR
1	00010	00110	1	

0 0 0 1 0 0 0 1 1 0

$1 \times 2^1 = 2$

$1 \times 2^2 = 4$

$1 \times 2^6 = 64$

70

−14 × −5 => 70

Divide 12 by 5

$12 \rightarrow 1100$

$5 \rightarrow 0101 \Rightarrow -M = 1011$

$+\ 1011$

C	A	Q	
4	0000	1100	
	0001	100□	SL, AQ
	1100	100□	A → A−M
	1100	1000	$Q_0 \Rightarrow 0$
3	0001	1000	A ⇒ A+M
	0011	000□	SL, AQ
	1110	000□	A → A−M
	1110	0000	$Q_0 \rightarrow 0$
2	0110	000□	SL, AQ
	0001	000□	A = A−M
	0001	0001	$Q_0 = 1$
1	0010	001□	SL, AQ
	1101	001□	A = A−M
	1101	0010	$Q_0 = 0$
	0010	0010	A = A+M

Remainder = 2

Quotient = 2

$$5 \overline{)12}\ 2$$
$$\underline{10}$$
$$2$$