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A022

PEE Assignment 5

1. Truth table of 16:1 Multiplexer:

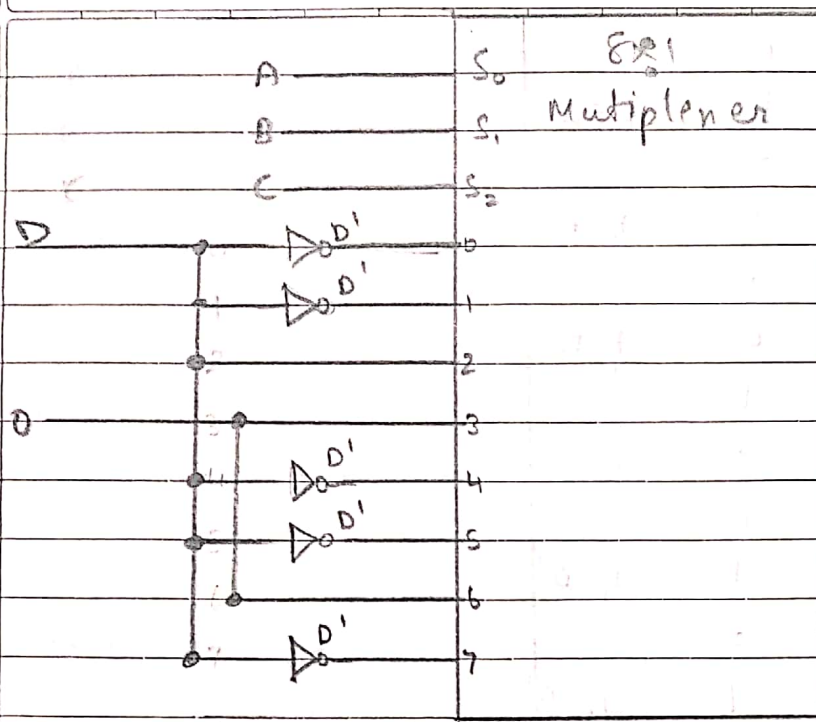| S_0	S_1	S_2	S_3	Output (Y)
0	0	0	0	I_0
0	0	0	1	I_1
0	0	1	0	I_2
0	0	1	1	I_3
0	1	0	0	I_4
0	1	0	1	I_5
0	1	1	0	I_6
0	1	1	1	I_7
1	0	0	0	I_8
1	0	0	1	I_9
1	0	1	0	I_{10}
1	0	1	1	I_{11}
1	1	0	0	I_{12}
1	1	0	1	I_{13}
1	1	1	0	I_{14}
1	1	1	1	I_{15}

Here,

S_0, S_1, S_2, S_3 are selection lines since a 16:1 multiplier requires 4 selection lines.

Using two 8:1 multiplier will use 3 selection lines and 2:1 multiplier will use one selection line.

I_{15}
I_{14}
I_{13}
I_{12}
I_{11}
I_{10}
I_9
I_8

8:1
Mutiplier

S_1
S_2
S_3

2:1
Mutiplier

I_7
I_6
I_5
I_4
I_3
I_2
I_1
I_0

8:1
multiplier

S_0
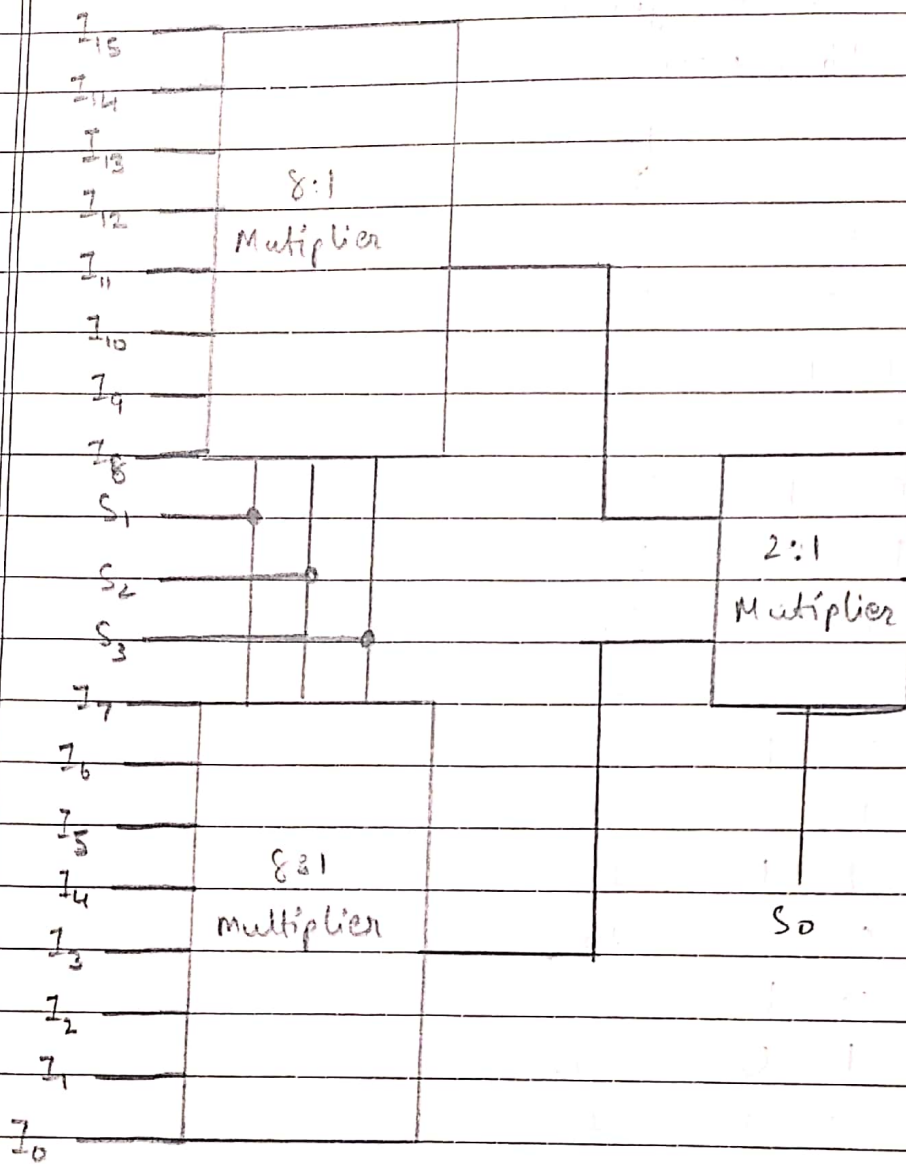
16:1 Mutiplier using two 8:1 multiplier and one 2:1 multiplier.

2.a.

A	B	C	D	F₁	
0	0	0	0	1	$F_1 = D'$
0	0	0	1	0	
0	0	1	0	1	$F_1 = D'$
0	0	1	1	0	
0	1	0	0	0	$F_1 = D$
0	1	0	1	1	
0	1	1	0	0	$F_1 = 0$
0	1	1	1	0	
1	0	0	0	1	$F_1 = D'$
1	0	0	1	0	
1	0	1	0	1	$F_1 = D'$
1	0	1	1	0	
1	1	0	0	0	$F_1 = 0$
1	1	0	1	0	
1	1	1	0	1	$F_1 = D'$
1	1	1	1	0	

A — S_0 8×1
B — S_1 Mutiplexer
C — S_2
D —

D'
D'

0 —

D'
D'

D'

0
1
2
3
4
5
6
7

F_1

3 b $F_2(A, B, C, D) = \pi M (2, 6, 11)$

A	B	C	D	F_2	
0	0	0	0	1	$F_2 = 1$
0	0	0	1	1	
0	0	1	0	0	$F_2 = D$
0	0	1	1	1	
0	1	0	0	1	$F_2 = 1$
0	1	0	1	1	
0	1	1	0	0	$F_2 = D$
0	1	1	1	1	
1	0	0	0	1	$F_2 = 1$
1	0	0	1	1	
1	0	1	0	1	$F_2 = D'$
1	0	1	1	0	
1	1	0	0	1	$F_2 = 1$
1	1	0	1	1	
1	1	1	0	1	$F_2 = 1$
1	1	1	1	1	

A ——— S_0 8:1
B ——— S_1 multiplexer
C ——— S_2

1' ——— 0
D ——— 1
    2
    3
    4
D₀' ——— 5
    6
    7

f_2

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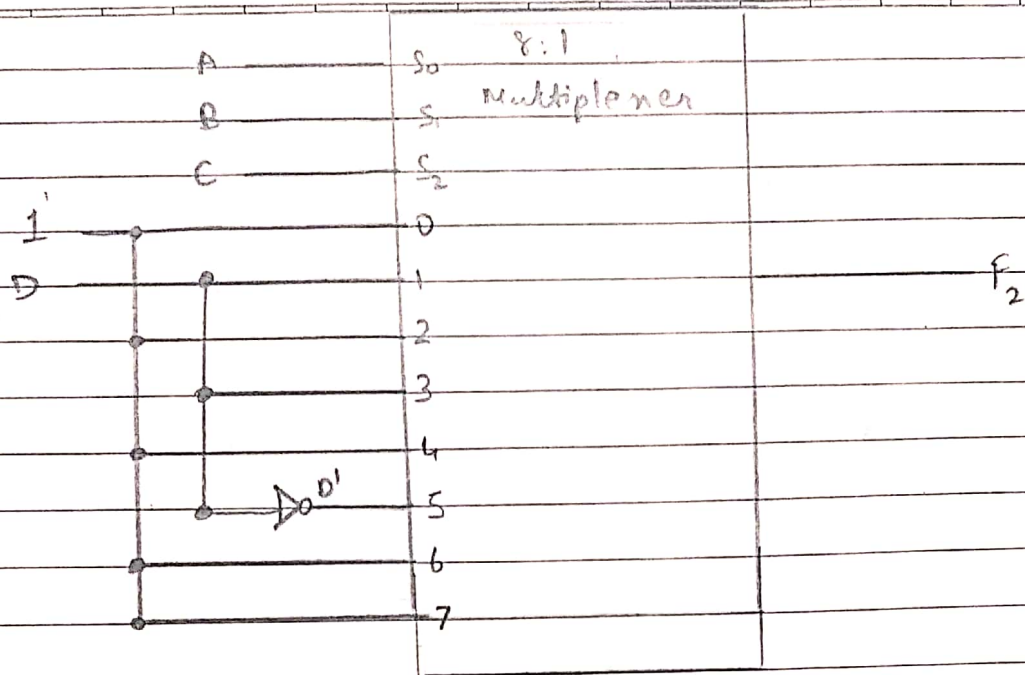
3. Truth table for full adder.

A	B	C	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

A

```
         ┌──────────────┐
    ┌────┤ D₀   4:1      │
    │    │      MUX      │────── SUM
 ▷ A'│ ──┤ D₁            │
 ▷ A'│ ──┤ D₂            │
    │    │ D₃            │
    │    └──────────────┘
    │         │  │
    C ────────┘  │
    B ───────────┘

    0
         ┌──────────────┐
    ┌────┤ D₀   4:1      │
 ▷ A'│ ──┤ D₁   MUX      │────── CARRY
 ▷ A'│ ──┤ D₂            │
    │    │ D₃            │
    1    └──────────────┘
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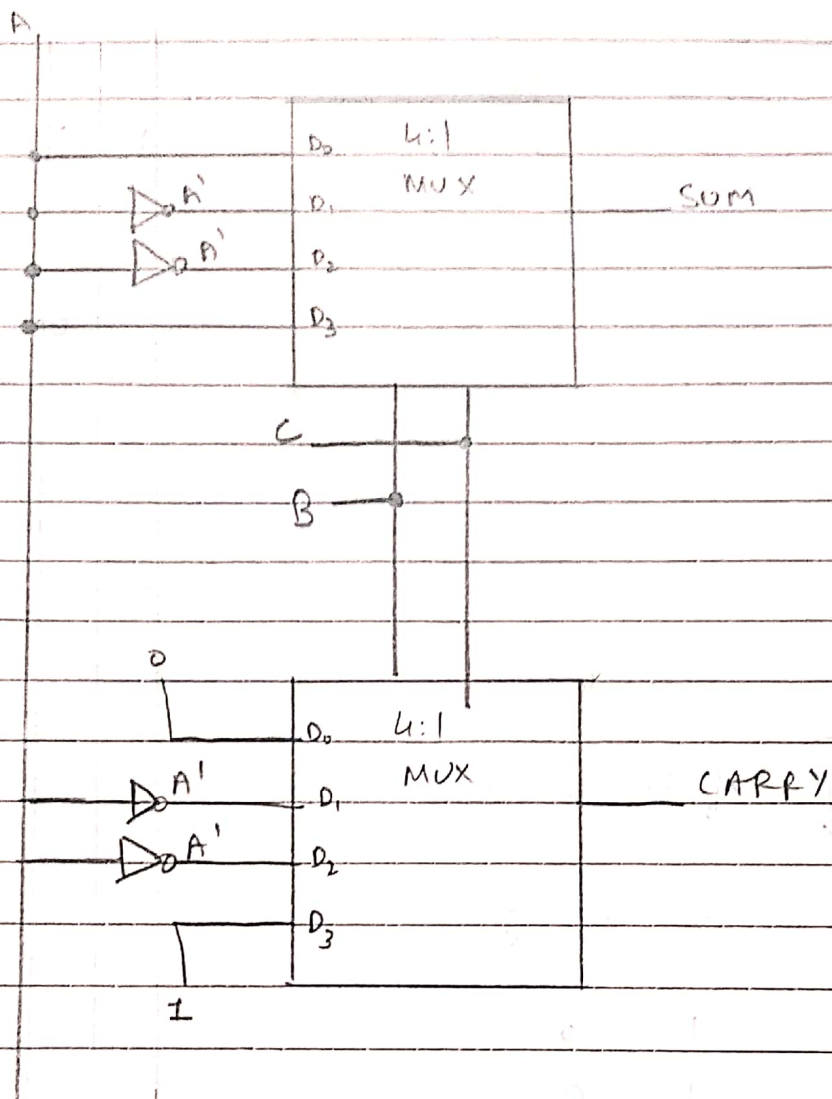
4.

a	b	c	F(output)	
0	0	0	I₀	F = d
0	0	1	I₁	F = 0
0	1	0	I₂	F = 0
0	1	1	I₃	F = 1
1	0	0	I₄	F = d
1	0	1	I₅	F = 1
1	1	0	I₆	F = d'
1	1	1	I₇	F = 0