

CPRE 281 – Solutions to Mock Exam #2

1. (a) i) 10 ii) -13

(b) i) 01010 ii) 11011

(c) i) 10110 ii) 01101

| | | | |
|-----|---------------|---------------|---------------|
| (d) | 010000 | 111110 | 000000 |
| | 01000 | 10001 | 10001 |
| | <u>+01000</u> | <u>+11111</u> | <u>-10000</u> |
| | 10000 | 10000 | 00001 |
| | overflow | | |

2. $-4.625 \times 2^9 = -100.101 \times 2^9 = -1.00101 \times 2^{11}$

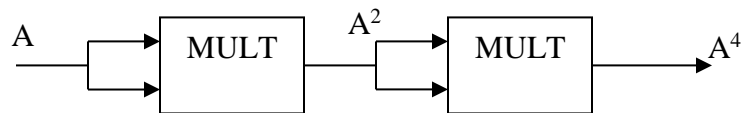
$11 + 127 = 138 = 10001010_2$

IEEE format: 1 10001010 001010000000000000000000

3. (a)

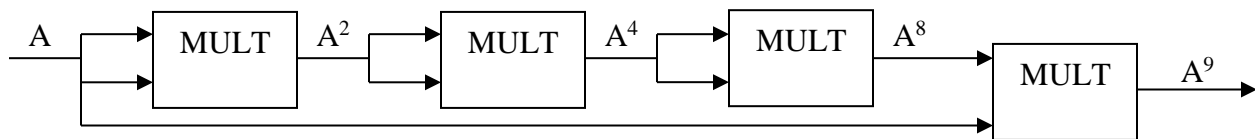


(b)

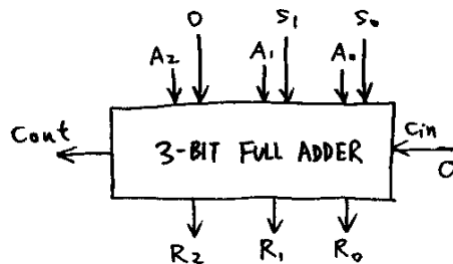


(c) Similar to (b), we can use three MULT blocks in a sequence to compute $8 \cdot A$.

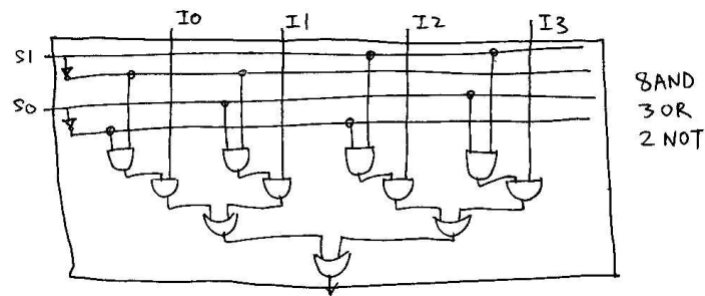
(d)



4.

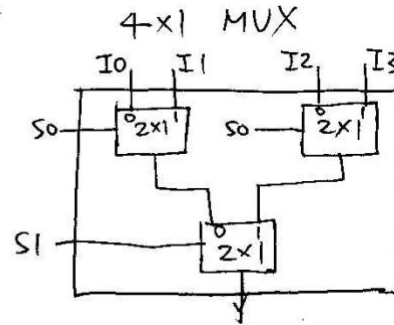
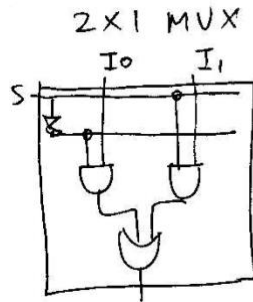


5. (a)



(b) 8 AND, 3 OR, 2 NOT

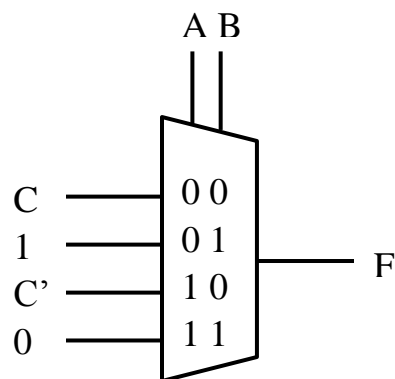
(c)



(d) 6 AND, 3 OR, 3 NOT

(e) The design of (c) uses less gates.

6. (a)



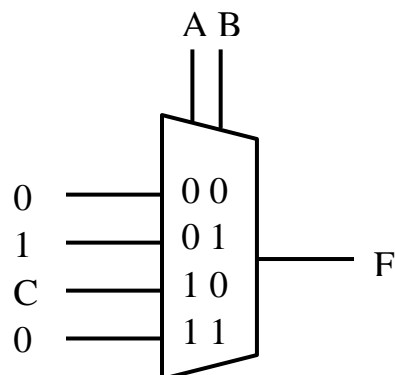
(b) $F(0,0,C) = 0$

$F(0,1,C) = 1$

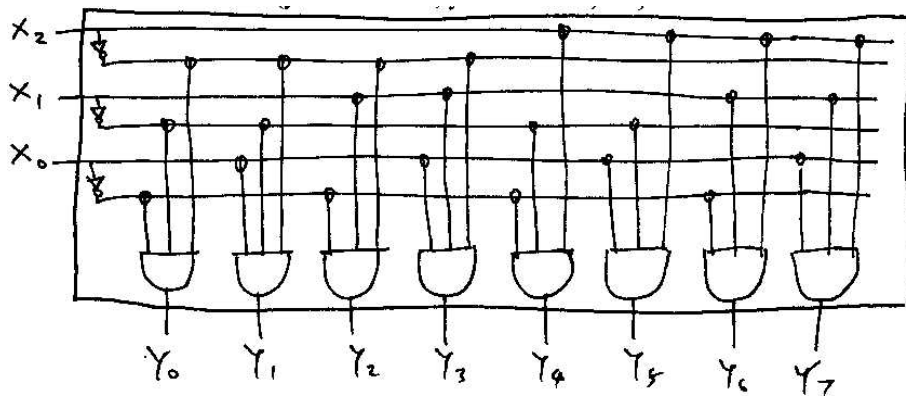
$F(1,0,C) = C$

$F(1,1,C) = 0$

So $F = A'.B'.0 + A'.B.1 + A.B'.C + A.B.0$



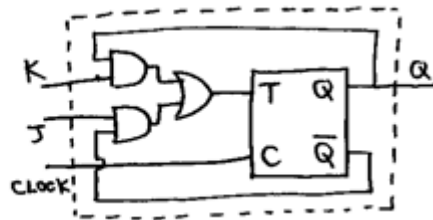
7.



8. (a)

| J | K | Next Q | T |
|---|---|-----------|---|
| 0 | 0 | Q | 0 |
| 0 | 1 | 0 | Q |
| 1 | 0 | 1 | Q |
| 1 | 1 | Q | 1 |

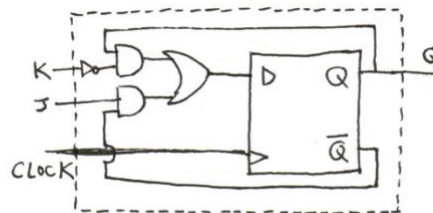
$$S_0 \quad T = KQ + J\bar{Q}$$



(b)

| J | K | Next Q | D |
|---|---|-----------|---|
| 0 | 0 | Q | Q |
| 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | Q | Q |

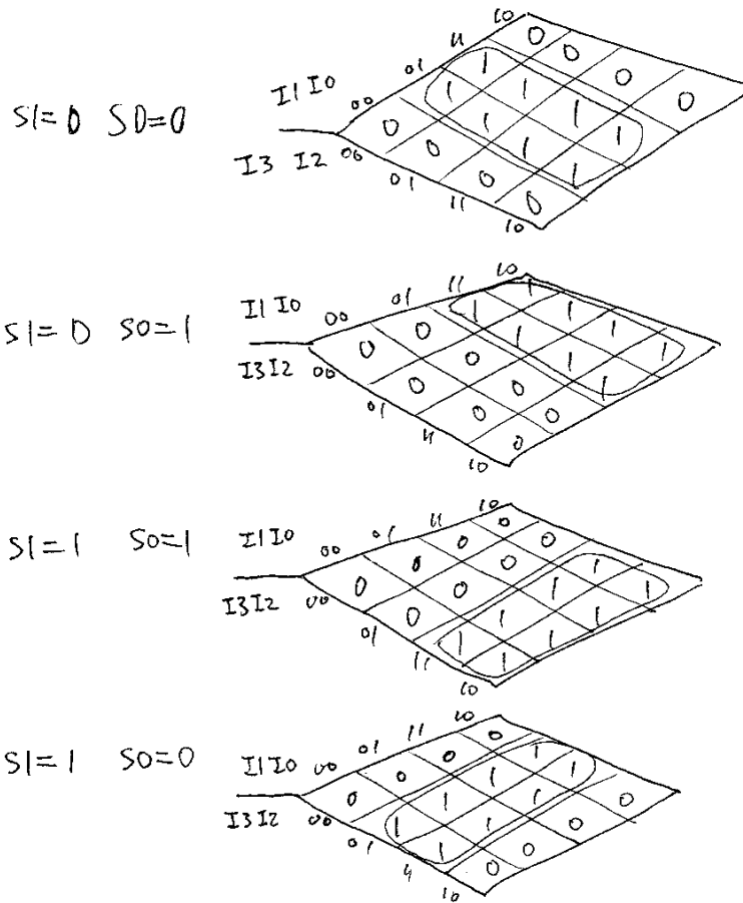
$$S_0 \quad D = \bar{K} \cdot Q + J\bar{Q}$$



Solutions to Extra Exercises

1. (a) 9 bits (b) 9 bits (c) 3 bits
2. (a) 6 trits (b) 6 trits (c) 2 trits
3. (a) 0 to 1023 (b) -511 to 511 (c) -511 to 511 (d) -512 to 511
4. (a) Cannot be represented.
 (b) 110011
 (c) 101100
 (d) 101101
5. (a) You can find the uncompact truth table in Class 21 mini-lecture slide 5.

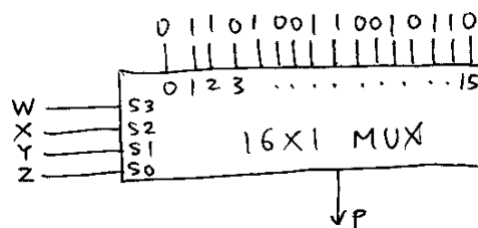
(b)



(c) $F = S_1 S_0 I_3 + S_1 S_0' I_2 + S_1' S_0 I_1 + S_1' S_0' I_0$

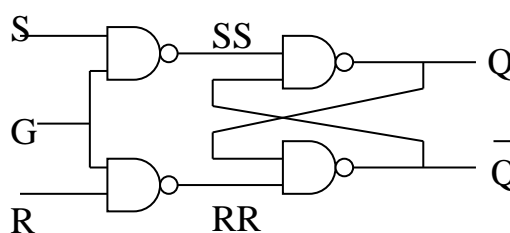
(d) The same expression as (c). The expression is also given in Class 21 mini-lecture slide 6.

6.



7. The design is described in the second-last slide of Class 22 mini-lecture notes. The details are not given.

8.



| G | S | R | SS | RR | Next state |
|---|---|---|----|----|------------|
| 0 | 0 | 0 | 1 | 1 | NC |
| 0 | 0 | 1 | 1 | 1 | NC |
| 0 | 1 | 0 | 1 | 1 | NC |
| 0 | 1 | 1 | 1 | 1 | NC |
| 1 | 0 | 0 | 1 | 1 | NC |
| 1 | 0 | 1 | 1 | 0 | Q=0 |
| 1 | 1 | 0 | 0 | 1 | Q=1 |
| 1 | 1 | 1 | 0 | 0 | U |

9. The design can be found in the second-last slide of Class 28 mini-lecture notes.