Sean Gordon

Homework #7 (Due: Mar. 9)

Total 400 points

Please write down your name on your homework.

Please submit your homework online through Canvas by Friday 10:00pm.

Late homework will be penalized.

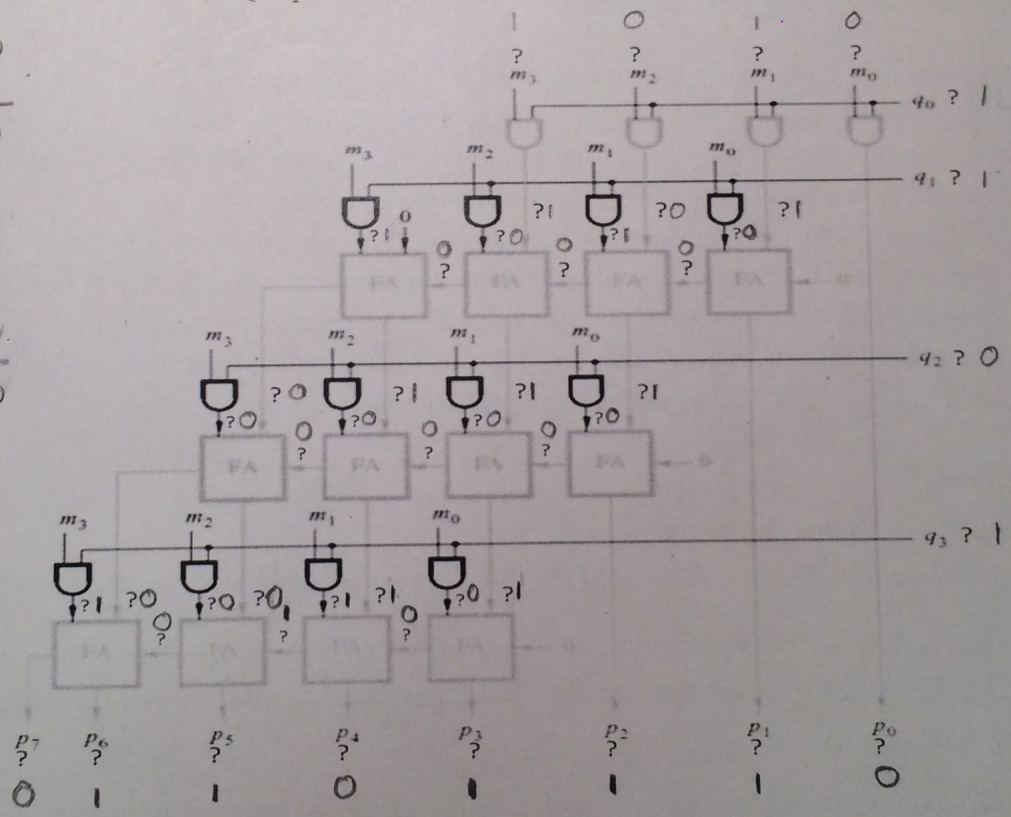
Important: Your submission must be **in .pdf format ONLY!**

Class 18 (80 points)

1. **(80 points)** You are given two unsigned 4-bit numbers M =1010 and Q = 1011.
   a) (50 points) Perform the multiplication M x Q in binary in the same manner as Fig. 3.34 (b). Please keep track of the carry bits whenever addition is performed. The carry bits will be useful in part (b) below.
   b) (30 points) Annotate all 48 wires (each "?") in the 4 x 4 multiplier circuit as shown in Fig. 3.35 with 0 or 1 when M x Q is performed. (Fig. 3.35 is also included below for your convenience.)

a)

```
  1010
× 1011
------
  1010
 1010
 0000
1010
--------
11011110
```



Class 19 (70 points)

1. **(35 points)** Represent the decimal number 15.625 in IEEE 754 single-precision (32 bit) floating-point format. 01000001 01111010 00000000 00000000
2. **(35 points)** What is the decimal value of the following IEEE 754 single-precision floating-point number? 1 10000001 01101000000000000000000 -5.625

Class 21

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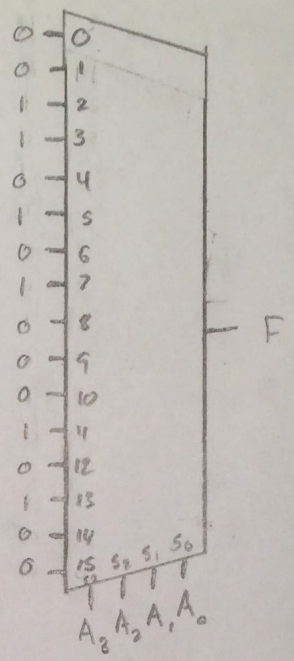
1) $(A \cdot \bar{X}) + (B \cdot X)$

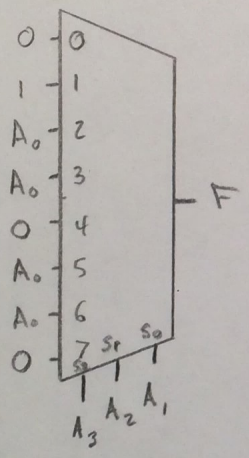
2) a)

A_3	A_2	A_1	A_0	F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

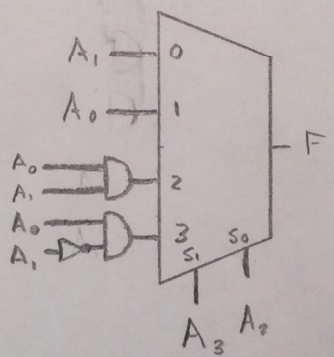
b)



c)



d)

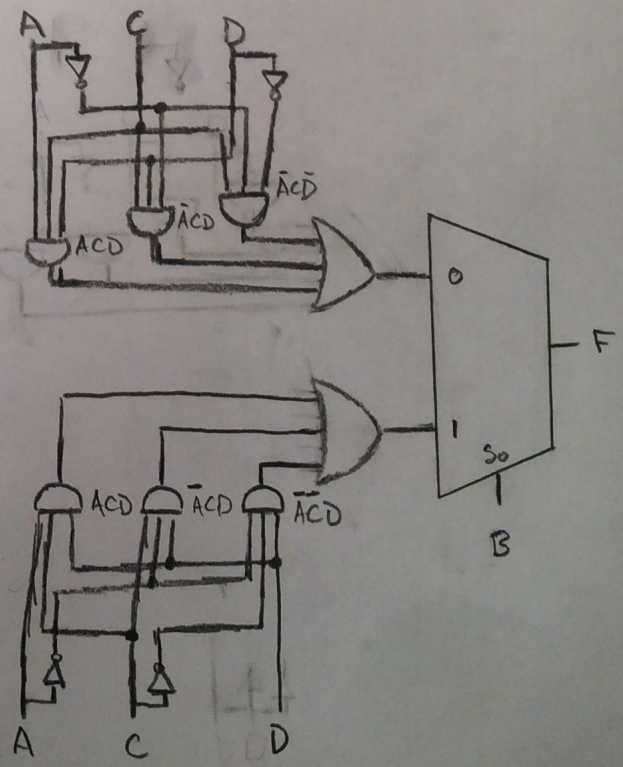


e) $A_3 = A \quad A_2 = B \quad A_1 = C \quad A_0 = D$

$F = \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + \bar{A}BCD + A\bar{B}CD + ABCD$

$\Rightarrow \bar{A}B\bar{C}D + \bar{A}BCD + ABCD + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + A\bar{B}CD$

$\Rightarrow (\bar{A}\bar{C}D + \bar{A}CD + ACD)B + (\bar{A}C\bar{D} + \bar{A}CD + ACD)\bar{B}$



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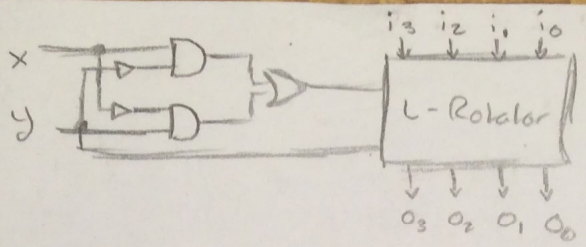
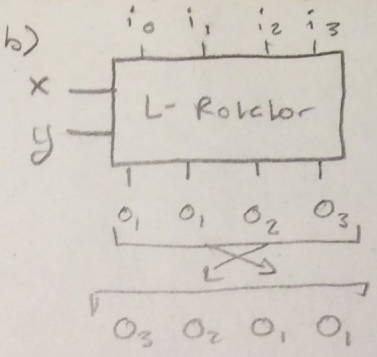
3) a)



b)



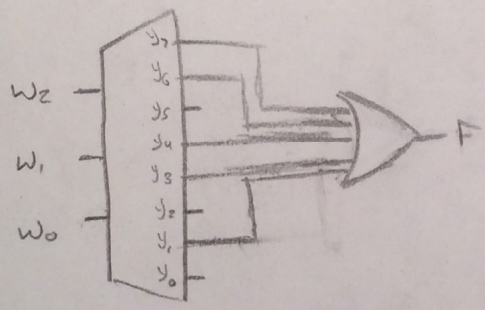
Class 22

1) a) $\bar{w}_2\bar{w}_1w_0 + \bar{w}_2w_1w_0 + w_2\bar{w}_1\bar{w}_0 + w_2w_1\bar{w}_0 + w_2w_1w_0 = \bar{w}_2w_0 + w_2\bar{w}_0 + w_2w_1$

b) $y_7 = w_2w_1w_0$ | $y_6 = w_2w_1\bar{w}_0$ | $y_5 = w_2\bar{w}_1w_0$ | $y_4 = w_2\bar{w}_1\bar{w}_0$

$y_3 = \bar{w}_2w_1w_0$ | $y_2 = \bar{w}_2w_1\bar{w}_0$ | $y_1 = \bar{w}_2\bar{w}_1w_0$ | $y_0 = \bar{w}_2\bar{w}_1\bar{w}_0$

c)



2)

	w_3	w_2	w_1	w_0	y_1	y_2
0	0	0	0	0	d	d
1	0	0	0	1	0	0
2	0	0	1	0	0	1
3	0	0	1	1	0	1
4	0	1	0	0	1	0
5	0	1	0	1	1	0
6	0	1	1	0	1	0
7	0	1	1	1	1	0
8	1	0	0	0	1	1
9	1	0	0	1	1	1
10	1	0	1	0	1	1
11	1	0	1	1	1	1
12	1	1	0	0	1	1
13	1	1	0	1	1	1
14	1	1	1	0	1	1
15	1	1	1	1	1	1