

**Computer Science 240**  
**More Digital Logic**  
Assignment for Lab 3

1. Assume you have 3 inputs, S, A1 and A0, and an output Q.

When S = 0, Q = A0

When S = 1, Q = A1

Give the truth table for Q:

S	A1	A0	Q
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Write a function for Q, and simplify to a minimum number of gates:

Draw a circuit which produces Q:

S stands for "Select". Knowing this, describe in English what this circuit does:

2. Assume you have 2 inputs, A1 and A0, and 4 outputs/functions, Q0, Q1, Q2, and Q3

Q0 is only true when A1A0 = 00

Q1 is only true when A1A0 = 01

Q2 is only true when A1A0 = 10

Q3 is only true when A1A0 = 11

Give the truth table:

A1	A0	Q0	Q1	Q2	Q3
0	0				
0	1				
1	0				
1	1				

Write a function for each of Q0, Q1, Q2, and Q3:

Q0 =

Q1 =

Q2 =

Q3 =

Draw a circuit which produces each of the functions from a single set of inputs A1 and A0:

Each input combination of A1A0 represents a decimal number. How is this related to the outputs?

3. Complete the truth table for two functions, Sum and CarryOut, which represent the result when adding two binary digits A and B.

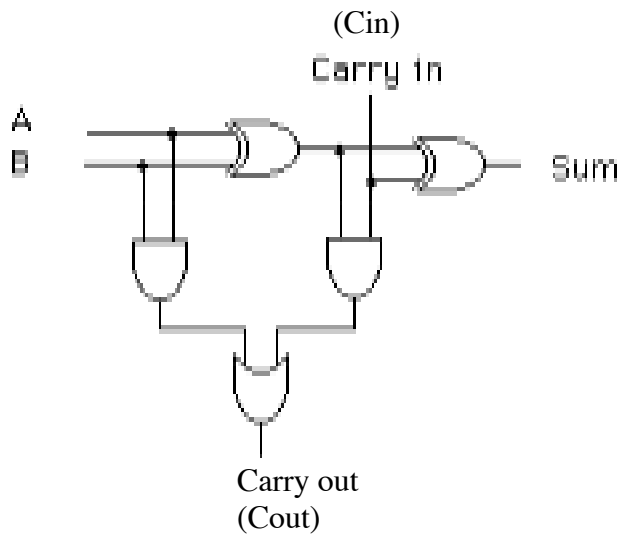
A	B	Sum	CarryOut
0	0		
0	1		
1	0		
1	1		

Draw a circuit which produces Sum and CarryOut from inputs A and B (this circuit is known as a *half adder*). You should use exactly one AND gate and one XOR (exclusive or) gate.

Give the truth table for a *full adder* (which incorporates a carry-in bit to the sum of A and B):

A	B	CarryIn	Sum	CarryOut
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

A circuit for the full adder is:



Circle the two half adders.

Explain what each half adder is doing, in relation to adding the three bits A, B, and Cin:

Explain what the OR gate is doing to produce the Cout.