Computer Science 240
More Digital Logic
Assignment for Lab 4

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 that 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 that 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**:

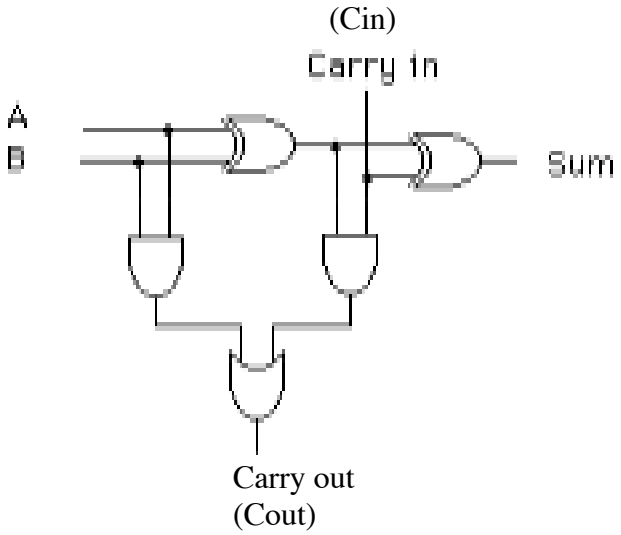
A	**B**	**CarryOut**	**Sum**
0	0		
0	1		
1	0		
1	1		

Draw a circuit which produces **Sum** and **CarryOut** from inputs **A** and **B** (this circuit is know 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**	**CarryOut**	**Sum**
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

4. 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**: