

**Computer Science 240**  
**Basic Digital Circuits and Introduction to Memory**  
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**:

<b>S</b>	<b>A1</b>	<b>A0</b>	<b>Q</b>
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:

<b>A1</b>	<b>A0</b>	<b>Q0</b>	<b>Q1</b>	<b>Q2</b>	<b>Q3</b>
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**:

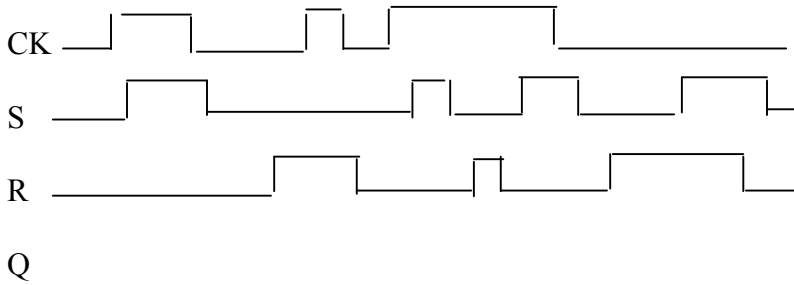
Each input combination of **A1A0** represents a decimal number. How is this related to the outputs?

2. Give the truth table and draw the circuit diagram for the SR latch:

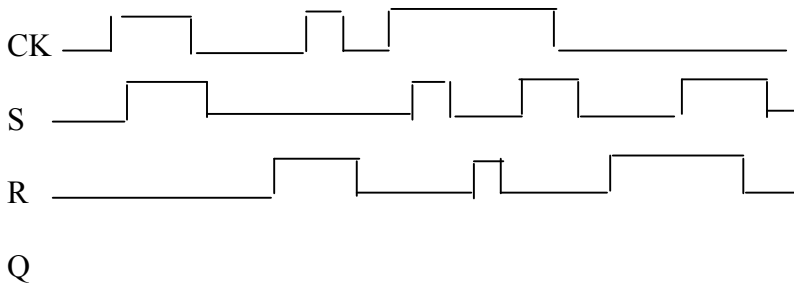
<b>S</b>	<b>R</b>	<b>Q</b>	<b>Q'</b>
0	0		
0	1		
1	0		
1	1		

3. Assume the inputs are  $S=0$  and  $R=0$ . Do you know if the output  $Q$  is 0 or 1? Explain.

4. Assume you have a clocked SR **latch**. Draw  $Q$ , given the following CK, S, and R:



5. Assume you have a clocked SR **flip-flop**, that is activated on the positive edge of the clock. Draw  $Q$  given the same CK, S, and R:



6. Explain why the outputs are different for the latch than for the flip-flop: