# Quiz 4 EECS 270 Spring 2022.

Name: _____Key_____ uname: _____Key_____

**Honor code:**

I have not given or received aid on this quiz, nor have I observed anyone else doing so:

Sign here:_____

This quiz is graded out of 100 points and is worth about 4% of your class grade. You will have *20 minutes* for this quiz. ***Closed everything including calculators!*** To receive partial credit, work must be shown.

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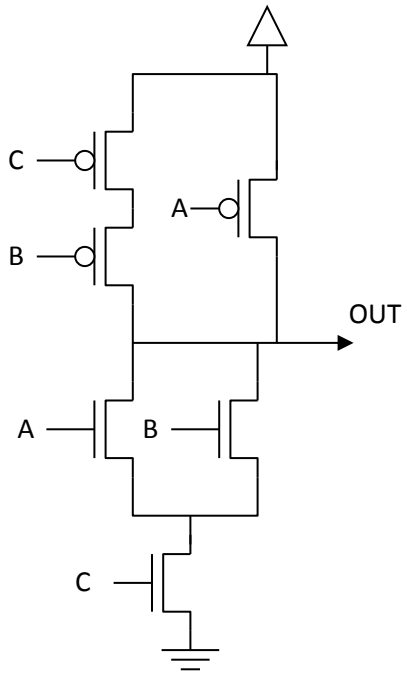
1. Transistor to truth table **[35 points, -6 per wrong or blank entry, minimum 0]**




| A | B | C | OUT | *Top* | *B* |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | -- |
| 0 | 0 | 1 | 1 | 1 | -- |
| 0 | 1 | 0 | 1 | 1 | -- |
| 0 | 1 | 1 | Smoke | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | -- |
| 1 | 0 | 1 | 0 | -- | 0 |
| 1 | 1 | 0 | HiZ | -- | -- |
| 1 | 1 | 1 | 0 | -- | 0 |

Fill in the above truth table with either “1”, “0”, “Hi-Z” or “Smoke” (the last if OUT is connected to both Vcc and Ground).

Stuff in green is work.

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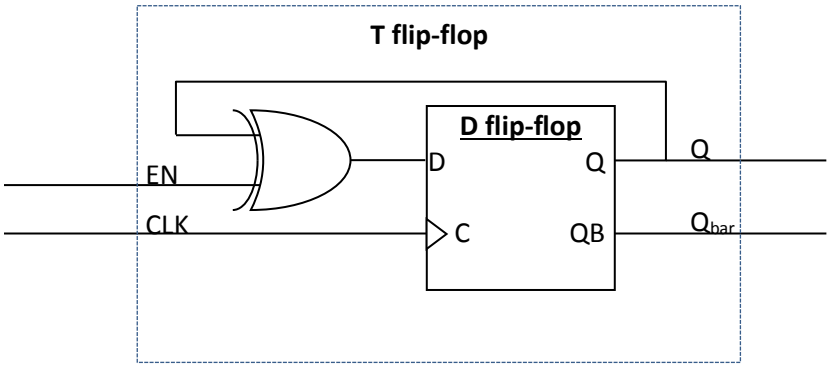
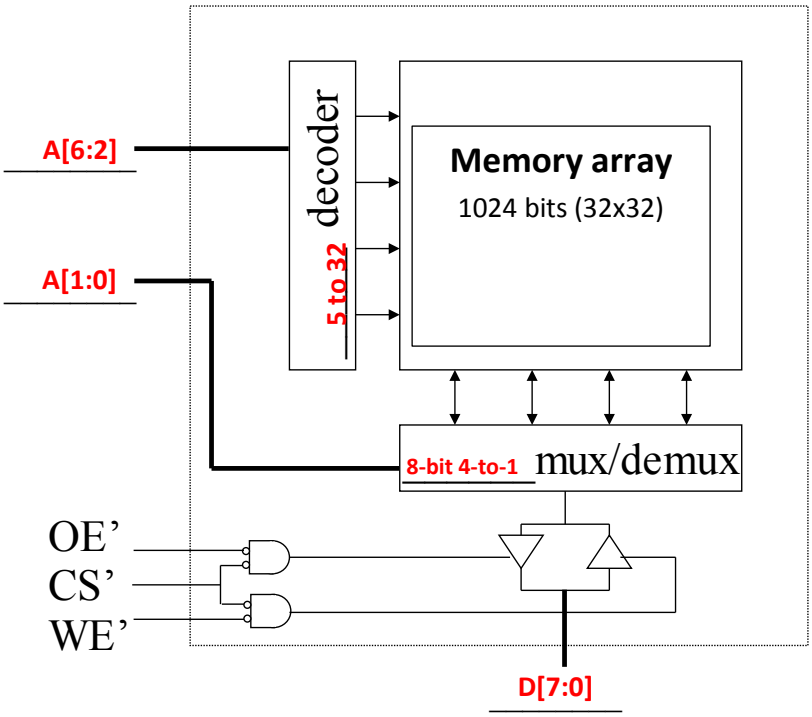
2. Using a single D-flip-flop and no more than three standard gates, design a T-flip-flop. Recall a T flip-flop has two inputs: clock and EN as well as two outputs: Q and $Q_{bar}$. **[35 points]**

**Design steps**: Draw a truth table. Then solve as you would anything else.

| En | Q | nextQ |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |




3. Say we wish to design a memory with that where each location has 8 bits of data using the figure to the right. **[30 points]**
   a. How many addresses would you have? ___**128**_____
   b. There are 5 blanks in the figure. Fill them each in with values that would complete our design. Let address bits be a bus named "A" and the output be a bus named D.




$2^{10}/2^3=2^7=128$ locations (addresses)
You need 5 bits to go in the decoder to select one of the 32 ($2^5$) rows.
You need 2 bits to go into the mux to select among the 4 groups (32/8 or $2^5/2^3$) of a bits.
The Mux must be an 8-bit 4-to-1 mux (4-to-1 is fine).
The output is 8 bits.
In general you want the most significant address bits to go to the decoder. This is because we are likely to be accessing memory locations near each other (spatial locality, covered in 370) and so if the MS bits don't change, we can access memory faster (the data is already coming out of the memory array, so it's just the mux. But for this class, we'll take any of the bits as long as it's the right number.

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