ECE 320 - Homework #9

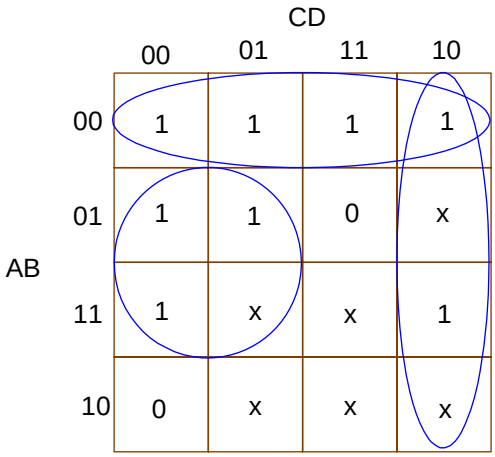
Boolean Logic, DTL Logic, TTL Logic. Due Monday March 20th, 2017

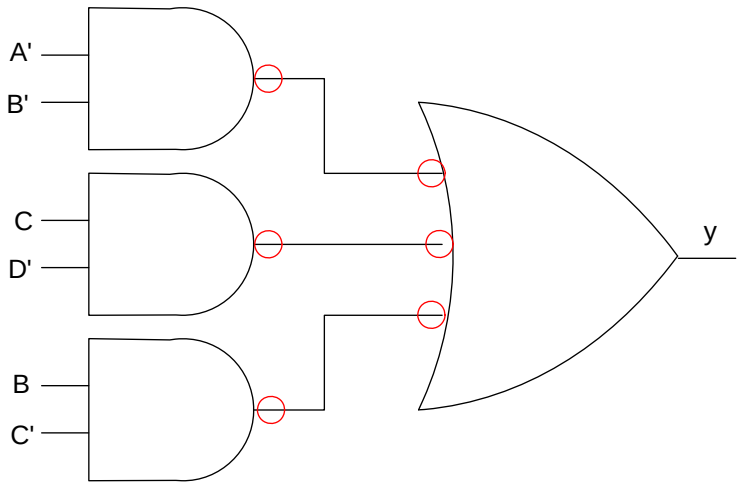
1) Determine a circuit using NAND gates (circle the ones) for implementing y(t)

For NAND gates, circle the ones (several ways to do this). This results in

$$y = \overline{A}\overline{B} + B\overline{C} + C\overline{D}$$

Using AND and OR gates

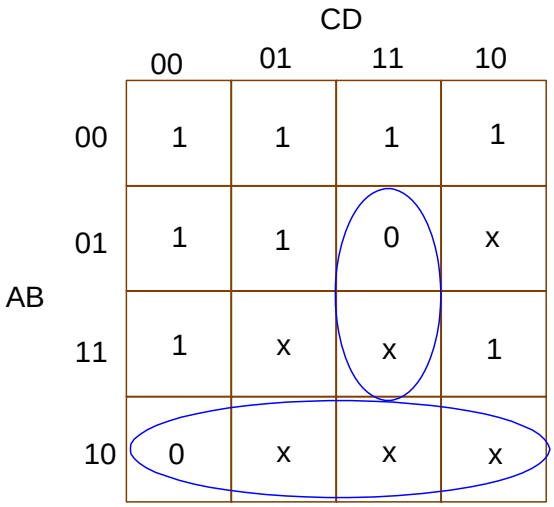


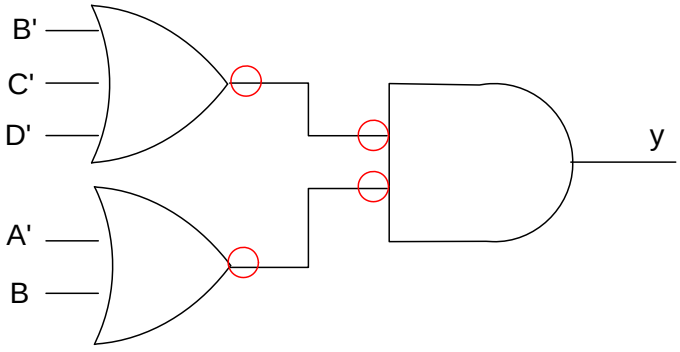


2) Determine a circuit using NOR gates (circle the zeros) for implementing y(t). There are several solutions:

$$\overline{y} = BCD + A\overline{B}$$

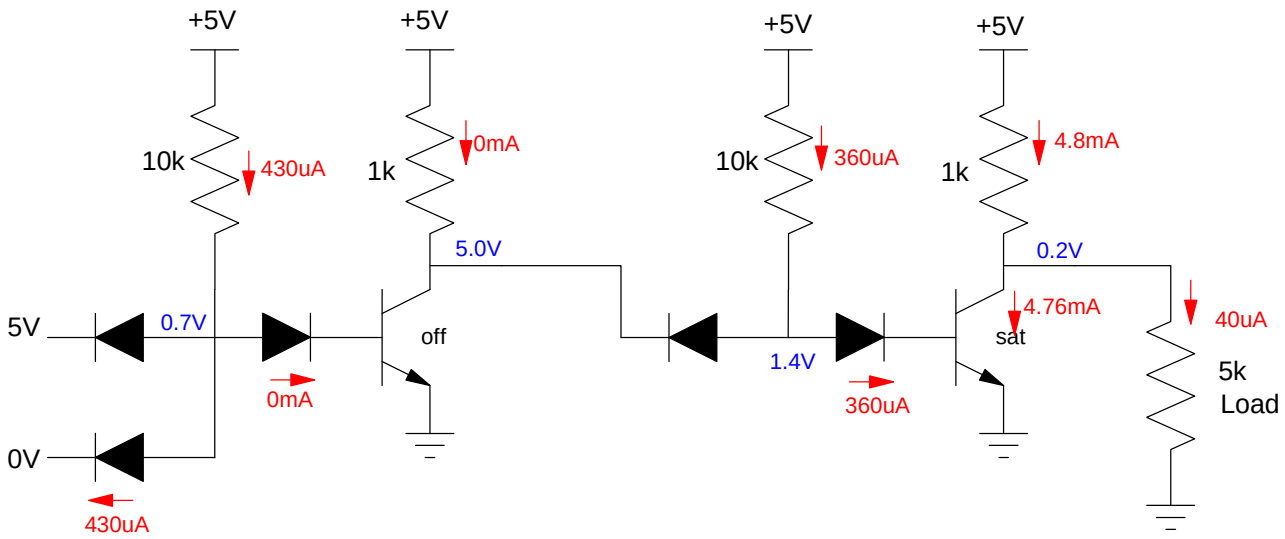
$$y = \left(\overline{B} + \overline{C} + \overline{D}\right)\left(\overline{A} + B\right)$$





3) Determine the voltages and currents for the following DTL circuit. Assume each transistor has

- $\beta = 100$
- $V_{ce(sat)} = 0.2V$
- $V_{be} = 0.7V$



Check:

T1: It takes 1.4V to tuen on this transistor (you only have 0.7V). This makes Ib = 0. The transistor is off.

T2:

Ib = 360uA

Ic = 4.8mA

$$\beta I_b = 36mA > 4.8mA = I_c$$

The transistor is saturated.

Problem 4-8) (part of term project) Design a logic circuit using NAND or NOR gates

4) Requirements. Specify the

- Inputs
- Outputs
- How they relate

5) Analysis. Give calculations for resistors, voltages, and currents for a circuit to meet your requirements using DTL or TTL NAND or NOR gates.

6) Simulation. Check your analysis in simulation. (note: this will probably take several DC runs to verify your circuit works when on and off)

7) Lab: Build and test your circuit in lab.