ECE 320 - Quiz #8 - Name _____

Boolean Logic, DTL, TTL Logic, MOSFETs.

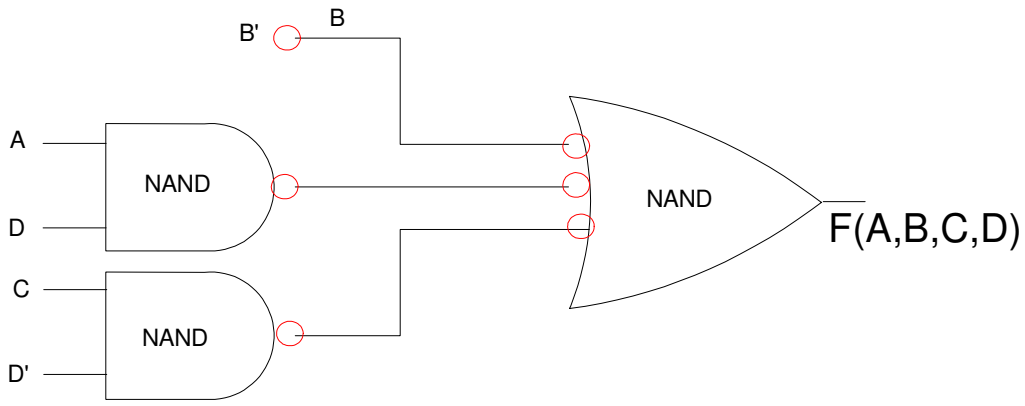
Boolean Logic

1) Design a circuit using NAND gates to implement the following logic

f(A,B,C,D)

AB \ CD	00	01	11	10
00	x	x	x	1
01	0	0	0	x
11	0	1	1	1
10	1	x	x	x

$$f = \overline{B} + AD + C\overline{D}$$



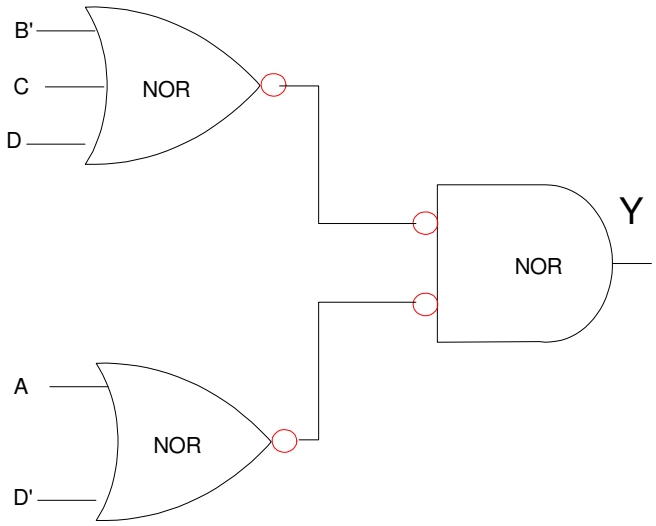
2) Design a circuit using NOR gates to implement the following logic:

Y(A,B,C,D)

AB \ CD	00	01	11	10
00	x	x	x	1
01	0	0	0	x
11	0	1	1	1
10	1	x	x	x

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

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

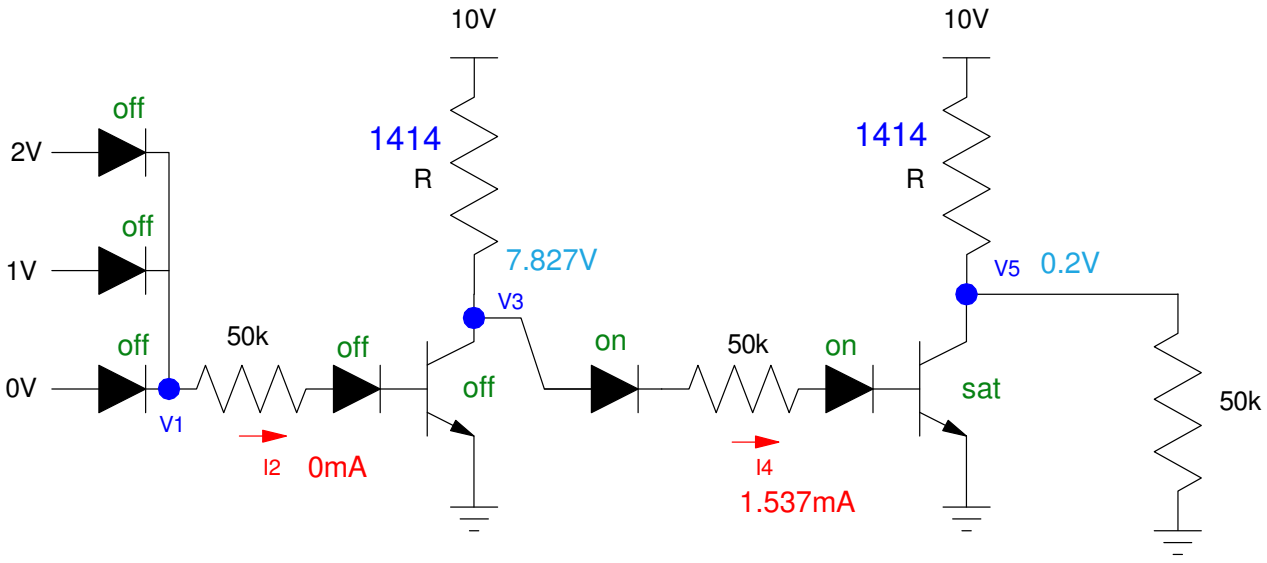


DTL: 10V Logic Logic

3) Determine the voltges and currents for the following DTL gate. Assume

- Ideal 3904 transistors (Vbe = 0.7V, Vce(sat) = 0.2V, gain = 100)
- Ideal silicon diodes (Vf = 0.7V)
- R = 900 + 100(Birth Month) + (Birth Day).

R 900 + 100*mo +day	V1	I2	V3	I4	V5
1414	**1.3..1.4V** floating	**0**	**7.827V**	**1.537mA**	**0.2V**



$$I_4 = \left(\frac{10V - 2.1V}{50k + 1414}\right) = 1.537mA$$

$$V_3 = 10V - 1414 \cdot 1.537mA$$

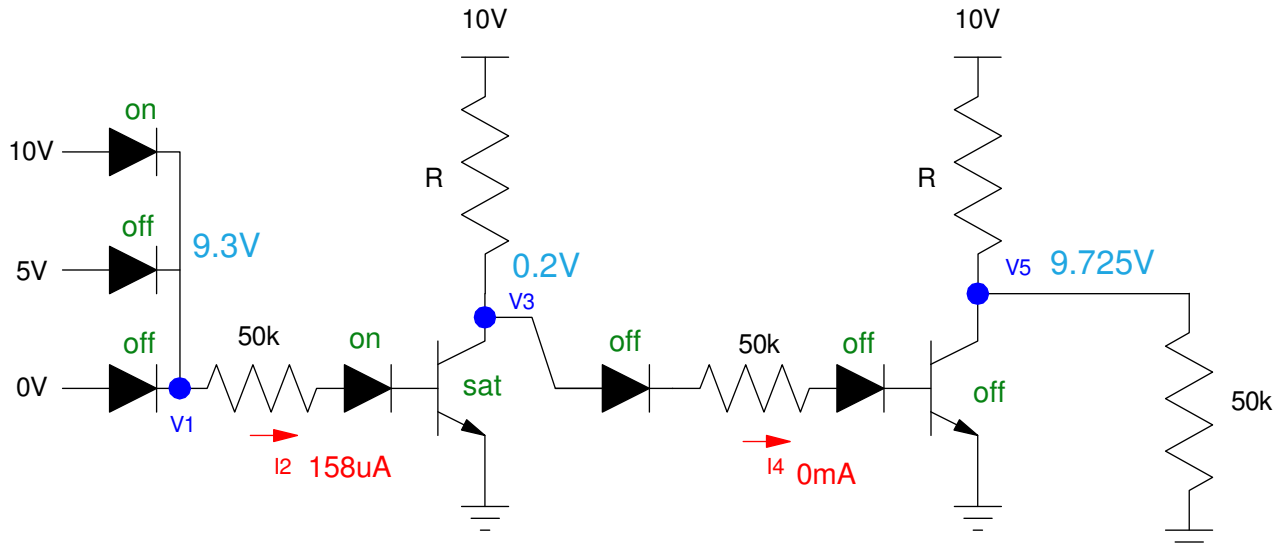
$$V_3 = 7.827V$$

DTL 10V Logic Gate:

4) Determine the voltges and currents for the following DTL gate. Assume

- Ideal 3904 transistors (Vbe = 0.7V, Vce(sat) = 0.2V, gain = 100)
- Ideal silicon diodes (Vf = 0.7V)
- R = 900 + 100(Birth Month) + (Birth Day).

R 900 + 100*mo +day	V1	I2	V3	I4	V5
1414	**9.30V**	**158uA**	**0.2V**	**0**	**9.725V**



$$I_2 = \left(\frac{10V - 2.1V}{50k}\right) = 158\mu A$$

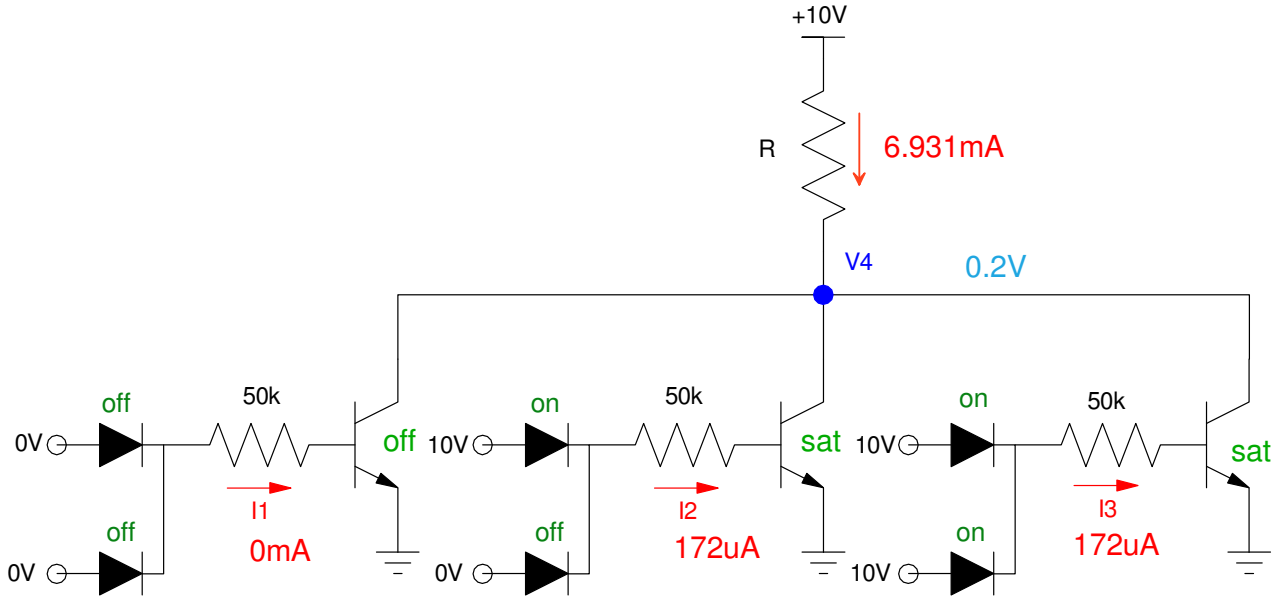
$$V_5 = \left(\frac{50k}{50k + 1414}\right) 10V = 9.725V$$

10V Open Collector Logic

5) Determine the voltages and currents for the following circuit. Assume

- Ideal silicon diodes (Vf = 0.7V)
- Vbe = 0.7V
- β = 100
- R = 900 + 100(Birth Month) + (Birth Day).

R 900 + 100*mo +day	I1	I2	I3	V4
1414	**0**	**172uA**	**172uA**	**0.2V**



TTL Logic

6) Determine the voltges and currents for the following TTL gate. Assume

- Ideal 3904 transistors (Vbe = 0.7V, Vce(sat) = 0.2V, β = 100
- R = 900 + 100(Birth Month) + (Birth Day).

R 900 + 100*mo +day	V1	V2	V3	I4
1414	**0.7V**	**0V .. 0.7V** floating	**9.861V**	**0mA**