

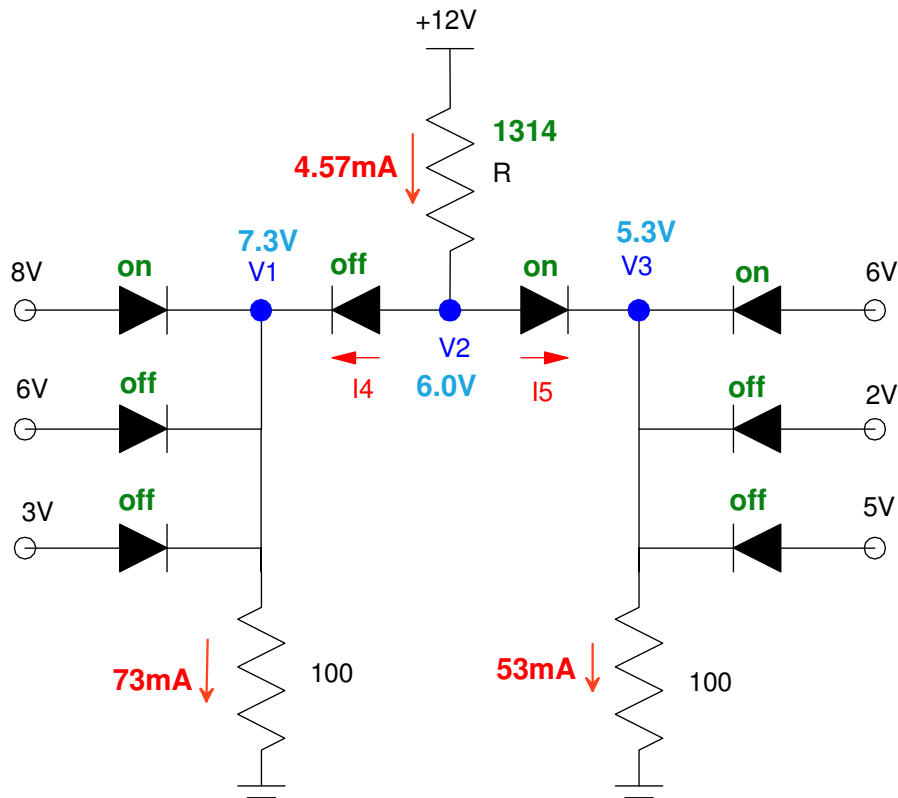
ECE 320 - Quiz #4 - Name _____

Max/Min, Clipper, Transistors. Spring 2023

1) Max/Min: Determine the voltages and currents for the following min/max circuit.

- Assume ideal silicon diodes ($V_f = 0.7V$)
- $R = 800 + 100 * \text{Birth Month} + \text{Birth Day}$. May 14th for example gives $R = 1314 \text{ Ohms}$

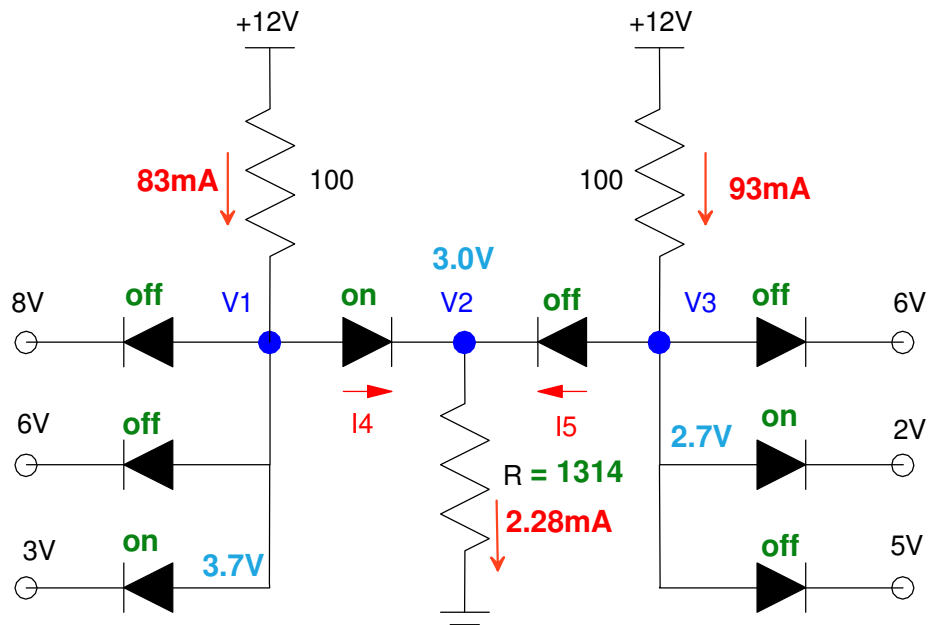
R 800 + 100*Mo + Day	V1	V2	V3	I4	I5
1314	7.3V	6.0V	5.3V	0	4.57mA



2) Max/Min: Determine the voltages and currents for the following min/max circuit.

- Assume ideal silicon diodes ($V_f = 0.7V$)
- $R = 800 + 100 * \text{Birth Month} + \text{Birth Day}$.

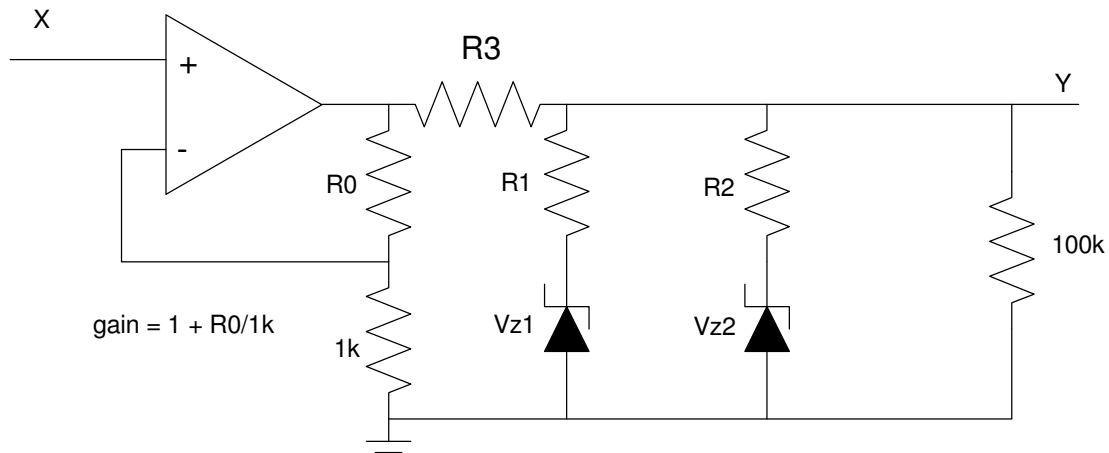
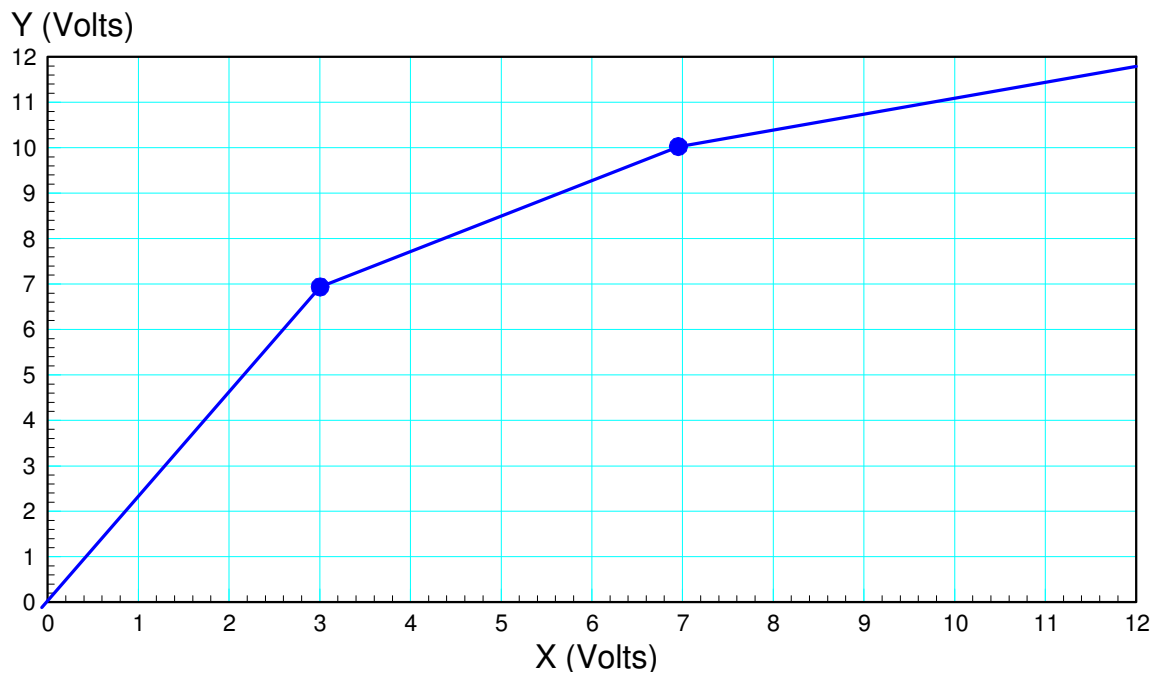
R $800 + 100 * Mo + Day$	V1	V2	V3	I4	I5
1314	3.7V	3.0V	2.7V	2.28mA	0



3) Clipper: Determine $\{R_0, R_1, R_2, V_{z1}, V_{z2}\}$ to implement the following function.

- Let R_3 be $1000 + 100 * \text{your birth month} + \text{your birth day}$.

R3 $800 + 100 * \text{Mo} + \text{Day}$	R0	V _{z1}	R1	V _{z2}	R2
1314	1333	7.0V	622.55	10.0V	482.76



$$R_0: 1 + \frac{R_0}{1k} = 2.333$$

$$R_0 = 1333$$

$$R_1: 2.333 \left(\frac{R_1}{R_1 + R_3} \right) = 0.75$$

$$R_1 = 622.5$$

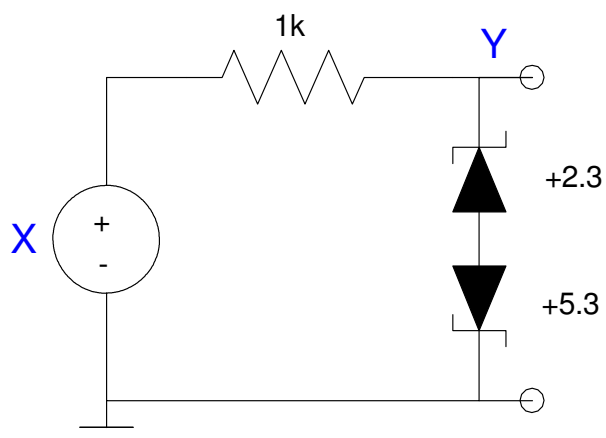
$$R_2: 2.333 \left(\frac{R_{12}}{R_{12} + R_3} \right) = 0.4$$

$$R_{12} = 271.86$$

$$R_2 = 482.76$$

4) Clipper: Design a circuit to clip the voltage at +3V and -6V

$$y = \begin{cases} +3V & x > 3V \\ x & -6V < x < 3V \\ -6V & x < -6V \end{cases}$$



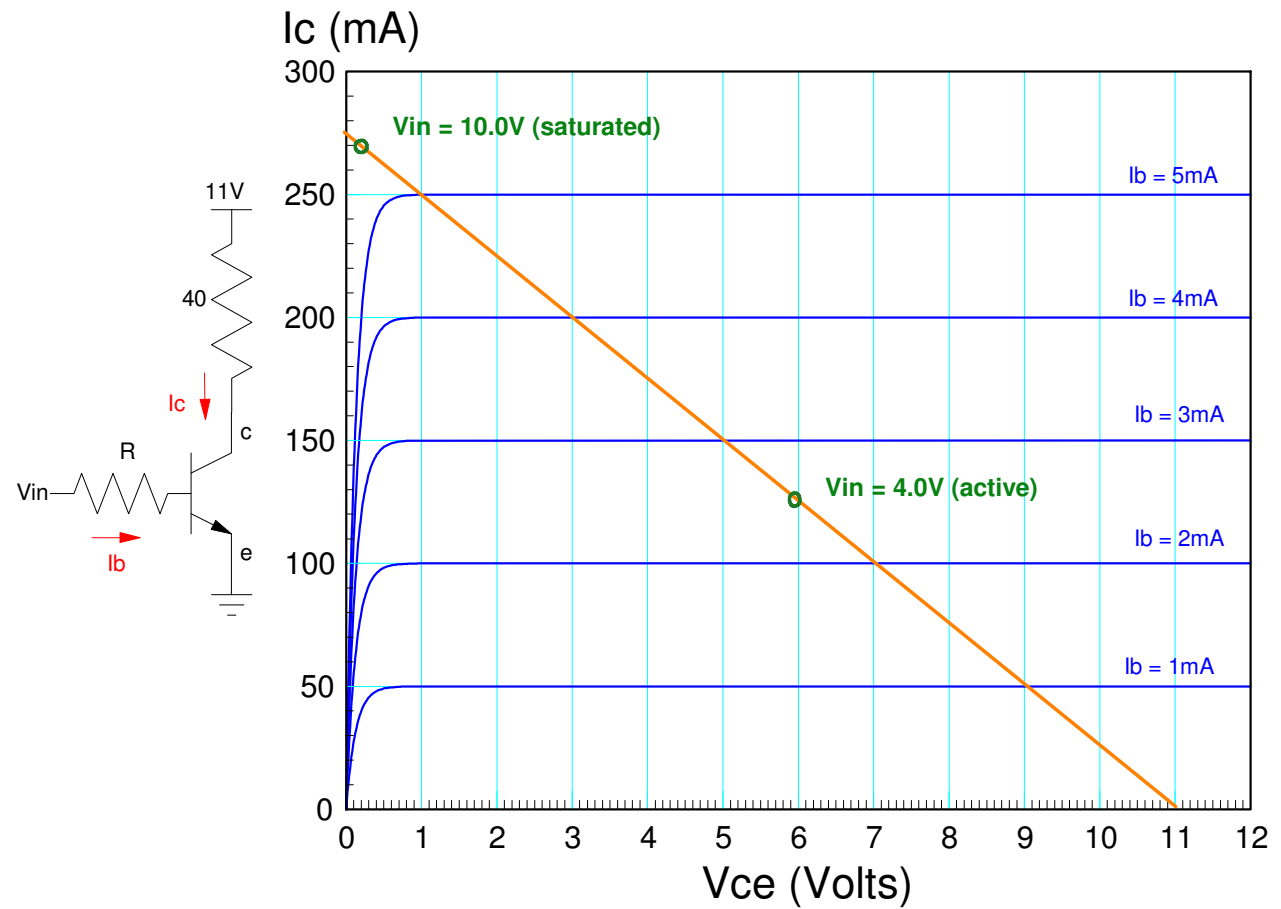
5) The VI characteristics for an NPN transistor are shown below

- Draw the load line for the following circuit
- Show on the load line the operating point (V_{ce} , I_c) when $V_{in} = 4V$ & $10V$.

Assume

- $V_{be} = 0.7V$
- $V_{ce} = 0.2V$ when saturated

R 800 + 100*Mo + Day	Load Line	$V_{in} = 4.0V$	$V_{in} = 10.0V$
1314	x int = 11V y int = 275mA	$I_b = 2.51mA$ $V_{ce} = 5.98V$ $I_c = 125mA$	$I_b = 7.08mA$ $V_{ce} = 0.2V$ $I_c = 270mA$



6) The voltages for the following circuit are measured (shown below). From these measurements, determine the following:

R 800 + 100*Mo + Day	Ib (mA)	Ic (mA)	Current Gain (beta)	Operating Region off / active / saturated
1314	3.195mA	215.5mA	67.45	active

