ECE 320 - Quiz #4 - Name ______________________

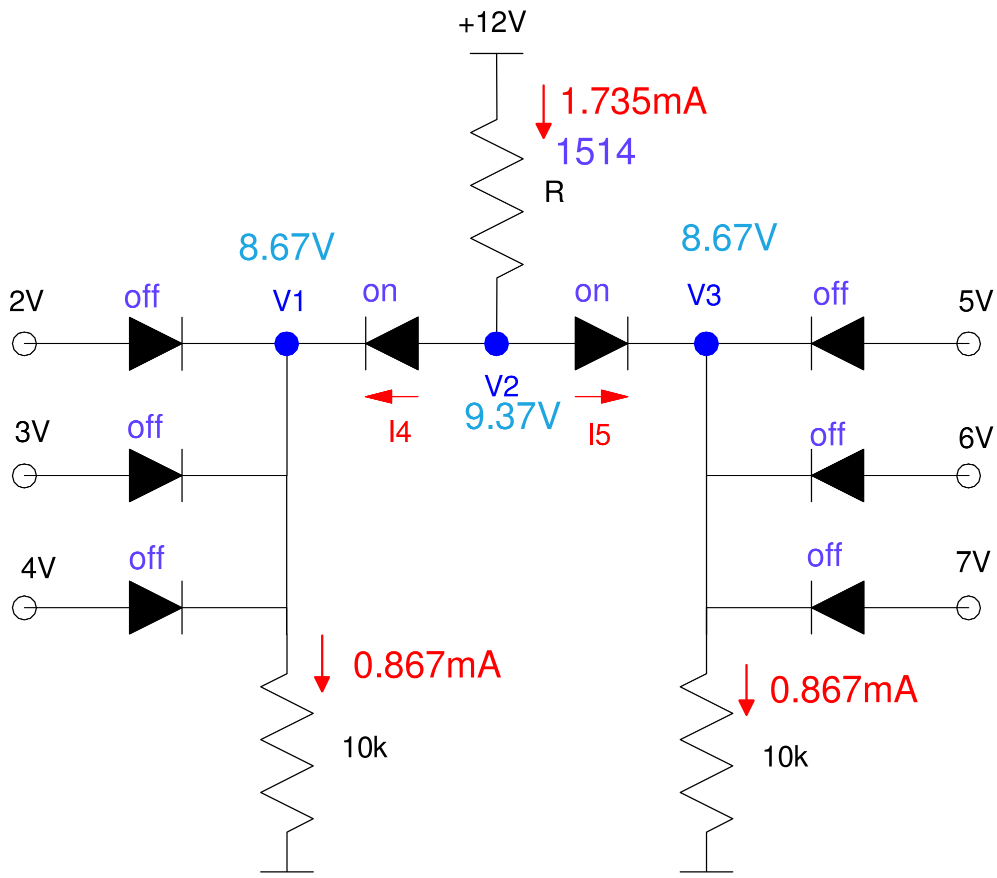
Max/Min, Clipper, Transistors. Spring 2021

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

- Assume ideal silicon diodes (Vf = 0.7V)
- R = 1000 + 100 * Birth Month + Birth Day. May 14th for example gives R = 1514 Ohms

R 1000 + 100*Mo + Day	V1	V2	V3	I4	I5
1514	**8.67V**	**9.37V**	**8.67V**	**0.867mA**	**0.867mA**

note: The 10k resistors are too large: the max functions can't accept the current from R and all three diodes turn off (termed loading)

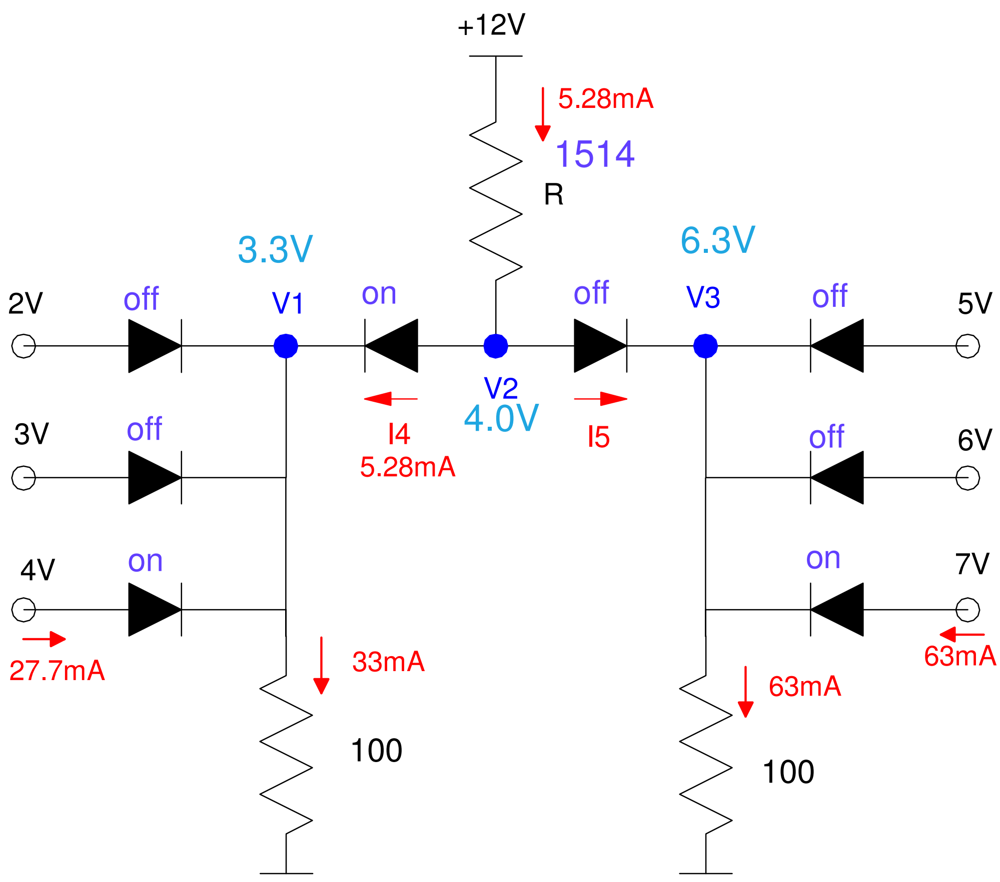


1) Max/Min: Determine the voltages and currnets for the following min/max circuit.

- Assume ideal silicon diodes (Vf = 0.7V)
- R = 1000 + 100 * Birth Month + Birth Day. May 14th for example gives R = 1514 Ohms

note: Changing the circiot so that R doesn't load the circuit and it behaves like a max/min circuit.

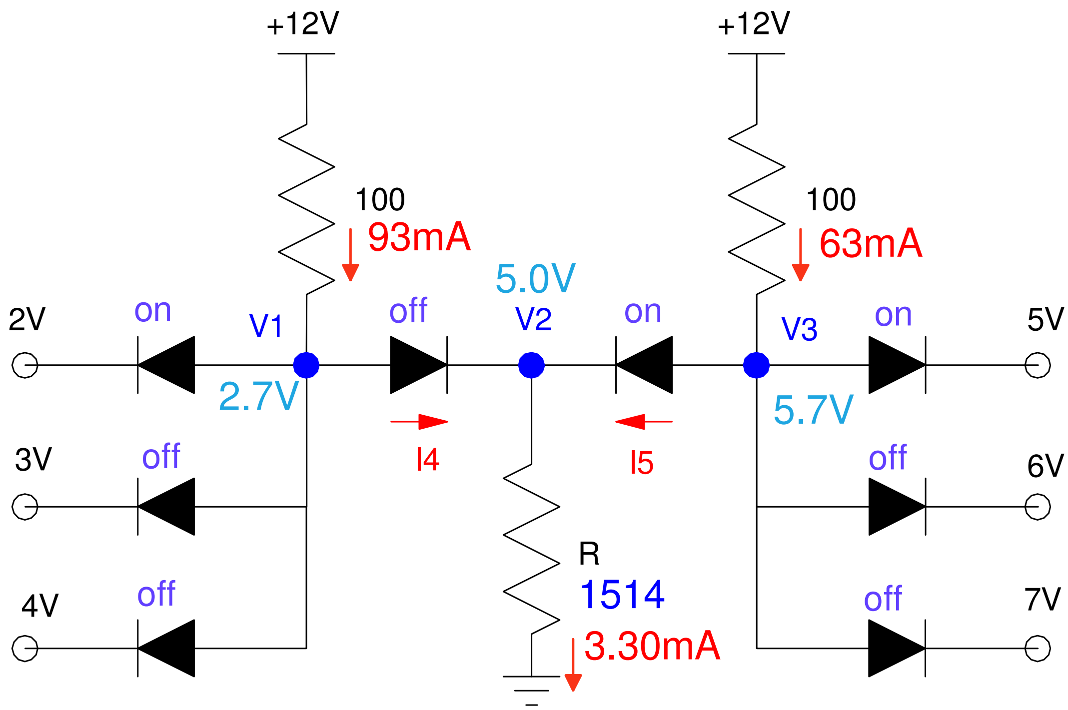
R 1000 + 100*Mo + Day	V1	V2	V3	I4	I5
1514	**3.30V**	**4.00V**	**6.30V**	**5.28mA**	**0**



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

- Assume ideal silicon diodes (Vf = 0.7V)
- R = 1000 + 100 * Birth Month + Birth Day. May 14th for example gives R = 1514 Ohms

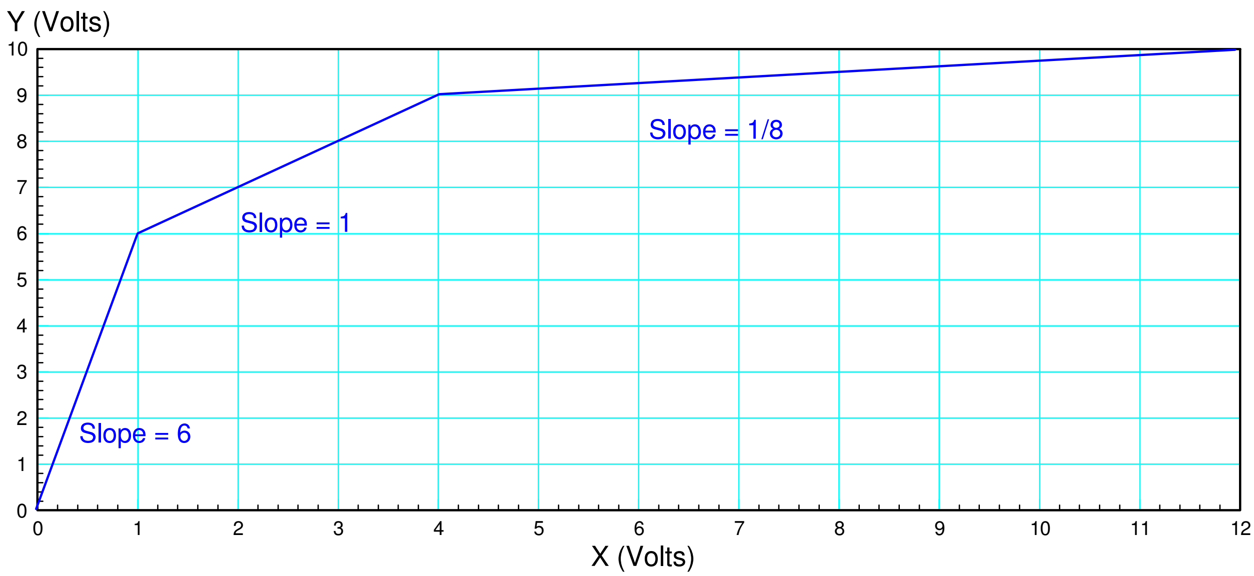
R 1000 + 100*Mo + Day	V1	V2	V3	I4	I5
1514	**2.7V**	**5.0V**	**5.7V**	**0**	**3.3mA**

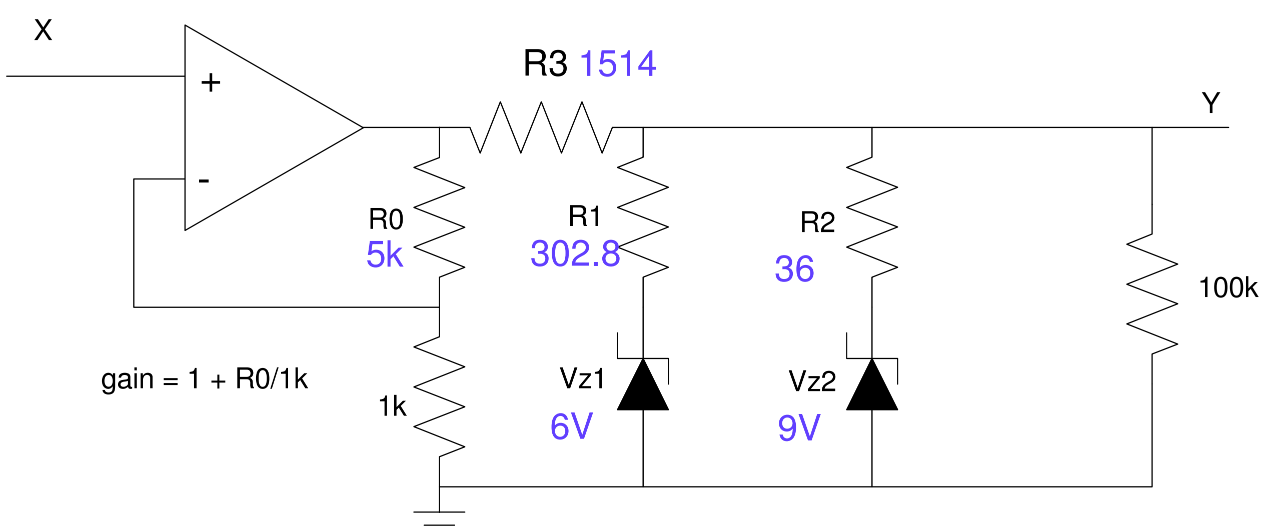


3) Clipper: Determine {R0, R1, R2, Vz1, Vz2} to implement the following function.

- Let R3 be 1000 + 100 * your birth month + your birth day. May 14th would give R = 1514 Ohms.

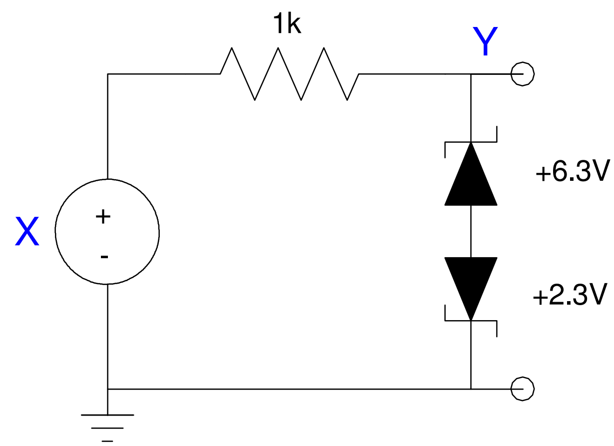
R3 1000 + 100*Mo + Day	R0	Vz1	R1	Vz2	R2
1514	**5k**	**6V**	**302.8** R3/5	**9V**	**36** R3/42





4) Clipper: Design a circuit to clip the voltage at +7V and -3V

$$y = \begin{cases} +7V & x > 7 \\ x & -3 < x < 7 \\ -3V & x < -3 \end{cases}$$



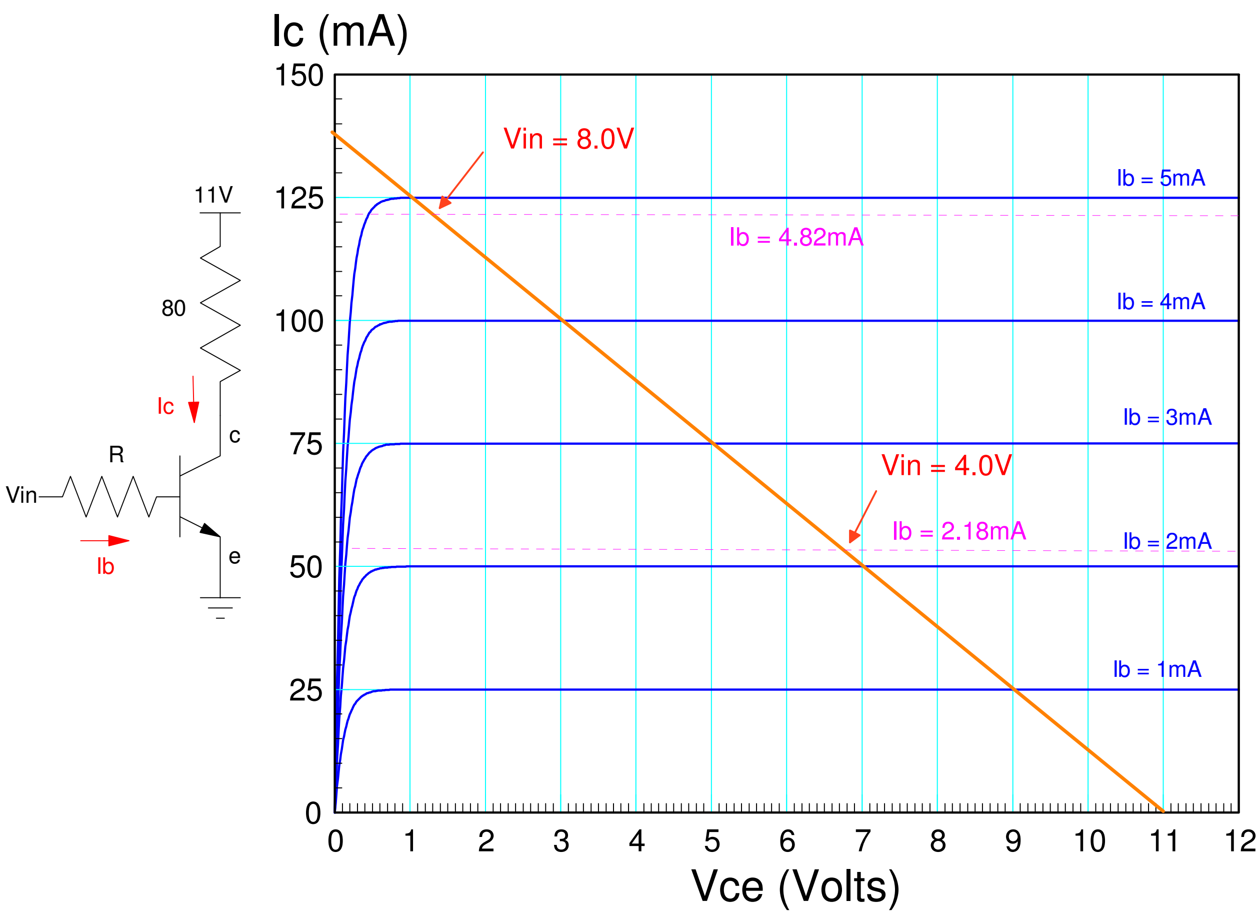
5) The VI characteristics for an NPN transistor are shown below

- Draw the load line for the following circuit
- Show on the load line the operating point (Vce, Ic) when Vin = 4V & 8V.

Assume

- Vbe = 0.7V
- Vce = 0.2V when saturated

R 1000 + 100*Mo + Day	Load Line	Vin = 4.0V	Vin = 8.0V
1514	show on graph	show (Vce, Ic) on graph	show (Vce, Ic) on graph



Vin = 4.0V

$$I_b = \left(\frac{4V - 0.7V}{1514}\right) = 2.18mA$$

Vin = 8.0V

$$I_b = \left(\frac{8V - 0.7V}{1514}\right) = 4.82mA$$

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

R 1000 + 100*Mo + Day	Ib (mA)	Ic (mA)	Current Gain (beta)	Operating Region off / active / saturated
1514	**2.85mA** *varies with R*	**118.8mA**	**41.69** *varies*	**active** *Vce > 0.2V*