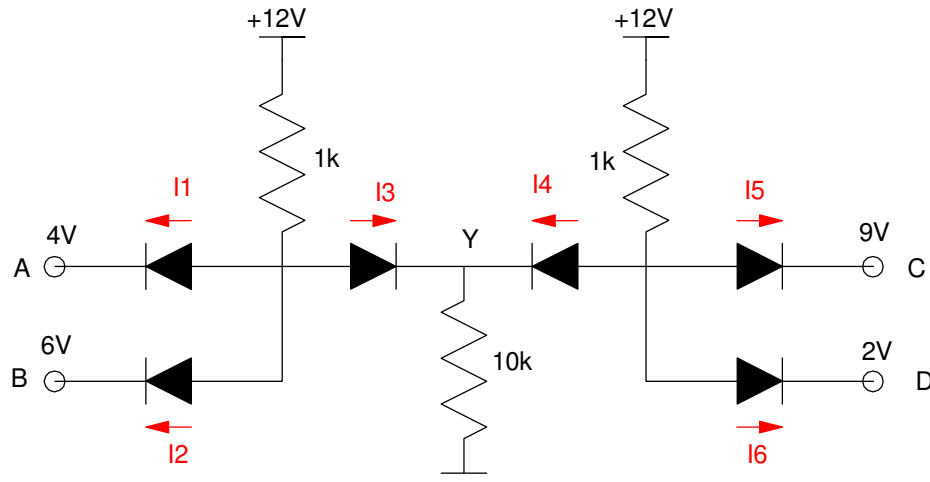# ECE 320 - Homework #4

Max/Min Circuits, Clipper Circuits, Transistor Theory

Max/Min:

1) Determine the voltages and currents for the following max/min circuit. What function does this circuit implement? Y = f(A, B, C, D)

2) Check your results in CircuitLab (or similar program) using 1N4004 diodes

3) Determine the voltages and currents for the following max/min circuit. What function does this circuit implement? Y = f(A, B, C, D)

4) Check your results in CircuitLab (or similar program) using 1N4004 diodes
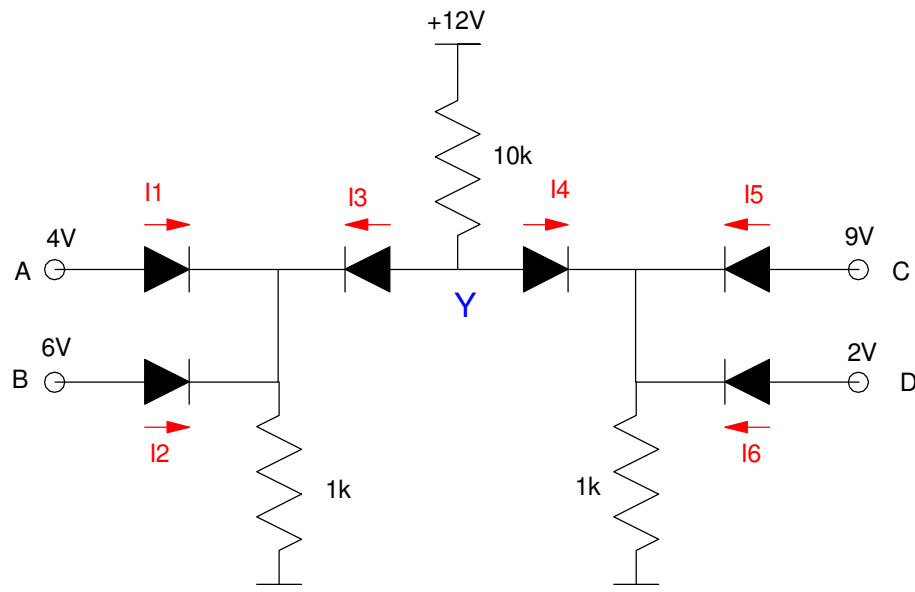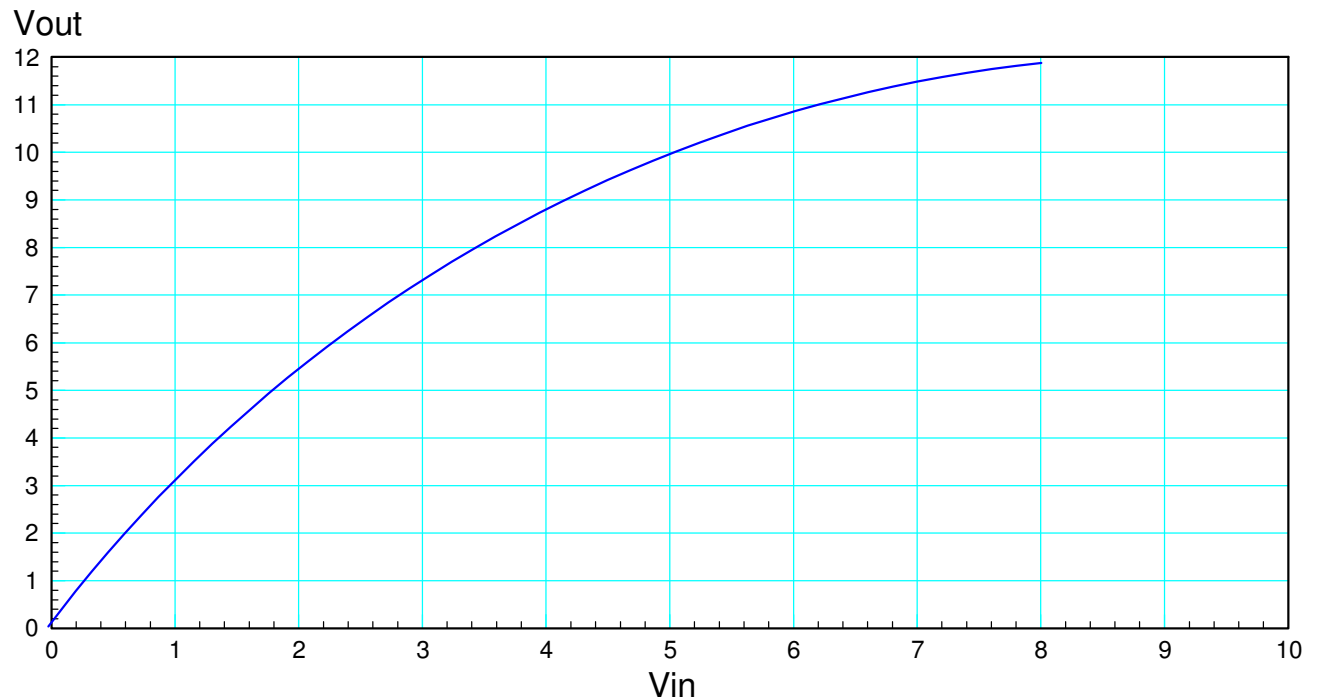
Clipper Circuits:

5) Design a circuit to approximate the following function subject to the following requirements:

- Input: 0 .. 10V, capable of 100mA
- Output: 100k resistor
- Relationship: Graph below, +/- 500mV

6) Check your design in CircuitLab

Problem 3 - 4

7) Design a circuit which meets the following requirements:

- Input: -10 .. +10V, capable of 100mA
- Output: 1k resistor
- Relationship:

$$V_{out} = \begin{cases} +9V & V_{in} > +9V \\ V_{in} & otherwise \\ -5V & V_{in} < -5V \end{cases}$$

Transistors

8) Determine the current gain, β, for the transistor show below. Also label the off, active, and saturated regions.

9) Draw the load-line and determine the Q-point for
   - Vin = 0V
   - Vin = 5V
   - Vin = 10V
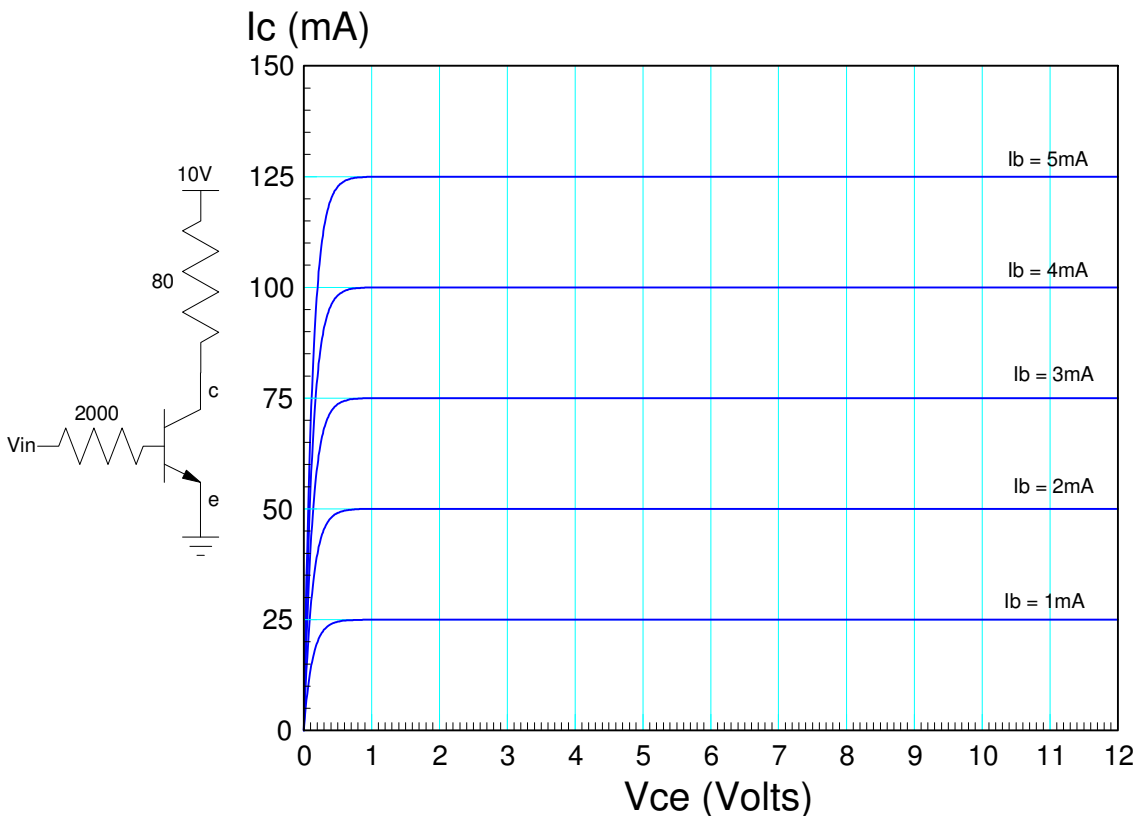
Problem 6 - 7

Lab (over)

Lab: Please include a photo of your circuit to receive credit for problem 10

10) (20pt) Build the following circuit with your electronics kit.

- Measure Vce and Ic for 100 < Rb < infinity.
- Determine the operating point for each conidition and the current gain for your 3904 transistor
- Draw the load line on the graph below and mark each point you measured

Rb	Vb	Vc	Ib	Ic	Current Gain (Ic/Ib)	Region off / act / sat
1k br - bl - re						
10k br - bl - or						
100k br - bl - ye						
1M br - bl - gr						
infinity						