Problem 1 (25 Points):

a) Find an equation for the gain $V_o/V_{in}$. (10 Points)
b) Assuming a bias current of 1 $\mu$A, find numerical values for $V_1$ and $V_O$ due to bias currents. (10 Points)
c) Add resistors (as many as necessary) to the circuit to eliminate the output due to bias currents. Specify numerical values for the resistors and show where you would place them in the circuit diagram. (5 Points)
Problem 2: (25 Points)

Assume that the OPAMP output has limits of ±15 V.

a) Sketch the transfer curve $V_o$ versus $V_{in}$. (5 Points)
b) Find a numerical value for the upper trigger point. (10 Points)
c) Find a numerical value for the lower trigger point. (10 Points)
The specifications for the OPAMP in the circuit above are:

- $V_{IO}=1 \text{ mV}$
- $I_B = 100 \text{ nA}$
- $A_O= 1 \text{ MHz (Unity gain bandwidth)}$
- $V_{CC} = 15 \text{ V}$
- $V_{EE} = 15 \text{ V}$

a) Find the gain $V_o/V_{IN}$. (5 points)
b) Find $V_o$ due to offset voltages. (5 Points)
c) Find $V_o$ due to bias currents. (5 Points)
d) Find the upper -3 dB Frequency of the circuit. (5 Points)
e) Add resistor(s) to the circuit to eliminate the output due to bias currents. The added elements should not change the gain. (5 Points)
Problem 4: (25 Points)

Assume negative feedback. Assume that all resistors are equal. (This is not a Schmitt Trigger.)

a) Find an equation for the load current. (13 Points)
b) Find an equation for the output voltage $V_o$. (12 Points)