- Homework is due at the beginning of class

- Start early and get help if you need it

- Show all work neatly and clearly; redraw and/or rewrite problem if needed as work turned in should stand alone

- Identify your answers (with units) using a box or circle

- Staple multiple pages together

Following the development and design of the 4-bit digital-to-analog converter (DAC) in class, perform the following for a 3-bit DAC.

1. Draw a 3-bit (3-input), two op-amp, summer circuit that will operate as the DAC. Use a binary, 3-bit input $(a_2 \; a_1 \; a_0)_2$ and analog output v_o.

2. Analyze the circuit to solve for the output v_o in terms of a_2, a_1, a_0 and resistors.

3. Assume your binary/digital signal will be based on 3.3V logic (logical $0 \leftrightarrow 0$V, logical $1 \leftrightarrow 3.3$V), and that you want your output voltage v_o to range between 0V and 6V.

   (a) Find the constraint on the values of the resistors.

   (b) Draw the input/output (I/O) table showing all combinations of the 3-bit input $(a_2 \; a_1 \; a_0)_2$ along will corresponding output v_o of the DAC.

   (c) Find the resolution of the DAC.

   (d) What is the minimum number of bits needed to achieve a resolution less than 0.1V?