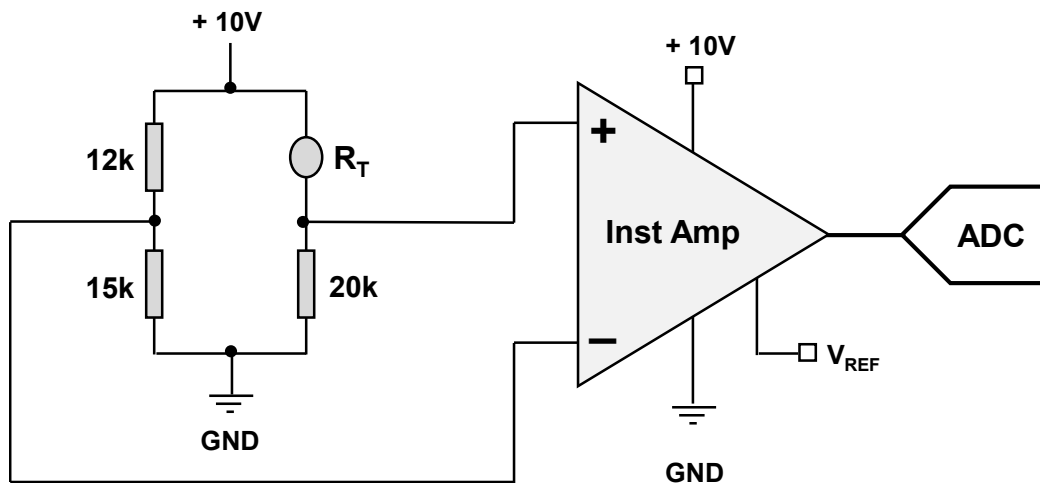


1 problem for 20 pts**Temperature Measurement**

You are asked to design a temperature measurement system that operates from 10 °C to 45 °C with a sensitivity of 0.05 °C. You decide to use a thermistor R_T in a quarter bridge as shown in the figure below. Both the bridge and instrumentation amplifier are powered by +10V and GND. You can assume the amplifier has a max and min output of 9V and 1V, respectively. The reference voltage is $V_{REF} = 5V$. The ADC operates from 0 to 10V with 12 bits. The thermistor properties are the following:

- $T = 10\text{ }^{\circ}\text{C}$: $R_T = 41.8\text{ kohm}$ $\alpha = -4.47\text{ }^{\circ}\text{C}^{-1}$
- $T = 25\text{ }^{\circ}\text{C}$: $R_T = 22.0\text{ kohm}$ $\alpha = -4.10\text{ }^{\circ}\text{C}^{-1}$
- $T = 45\text{ }^{\circ}\text{C}$: $R_T = 10.1\text{ kohm}$ $\alpha = -3.67\text{ }^{\circ}\text{C}^{-1}$



- a) You must choose between an amplifier gain of $A_d = 1, 1.5, 2, 2.5, 3,$ or 3.5 . Which is the best choice? Show all work!
- b) Suppose the measurement system has a noise voltage of $V_N = 1\text{ mV}_{RMS}$. Does the temperature sensitivity at $T = 45\text{ }^{\circ}\text{C}$ satisfy the design requirement? Show all work!

(extra sheet for work)