

Aşağıda yer alan iki adet soruyu analitik olarak ve açıklayıcı bir şekilde çözünüz. İkinci sorudaki devreyi multisimde ( veya alternatif simülasyon programında) kurarak devrenin çalıştığını teyit ediniz.

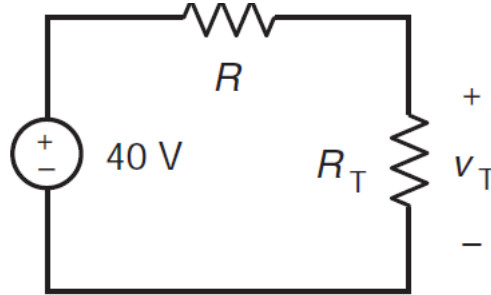
**Q1:** Thermistor is a temperature dependent resistor. The thermistor resistance  $R_T$  is related to the temperature by the equation

$$R_T = R_0 * e^{\beta(\frac{1}{T} - \frac{1}{T_0})}$$

where  $T$  has units of °K and  $R$  is in Ohms.  $R_0$  is resistance at temperature  $T_0$  and the parameter  $\beta$  is in °K. For example, suppose that a particular thermistor has a resistance  $R_0 = 620 \Omega$  at the temperature  $T_0 = 20^\circ\text{C} = 293^\circ\text{K}$  and  $\beta = 3330^\circ\text{K}$ . At  $T = 70^\circ\text{C} = 343^\circ\text{K}$  the resistance of this thermistor will be

$$R_T = 620 * e^{3330(\frac{1}{343} - \frac{1}{293})} = 121.68 \Omega$$

In Figure DP 3-9 this particular thermistor is used in a voltage divider circuit. Specify the value of the resistor  $R$  that will cause the voltage  $v_T$  across the thermistor to be 4 V when the temperature is the last 2 digits of your student number\*\*



Thermistor

**Figure DP 3-9**

\*\* For example if your student number is like 192587**90**, you will do your calculations for 90 °C, if your number is like 192856**32**00, then you can use 32 °C.

**Q2:** The circuit shown in Figure DP 3-11 is designed to help orange growers protect their crops against frost by sounding an alarm when the temperature falls below freezing. It contains a thermistor that has a resistance  $R_0 = 620\ \Omega$  at the temperature  $T_0 = 20^\circ\text{C} = 293^\circ\text{K}$  and  $\beta = 3330^\circ\text{K}$ . (See problem DP 3-9.)

The alarm will sound when the voltage at the  $-$  input of the comparator is less than the voltage at the  $+$  input. Using voltage division twice, we see that the alarm sounds whenever

$$\frac{R_2}{R_T + R_2} < \frac{R_4}{R_3 + R_4}$$

Determine values of  $R_2$ ,  $R_3$ , and  $R_4$  that cause the alarm to sound whenever below a temperature which is the last 2 digits of your student number\*\*

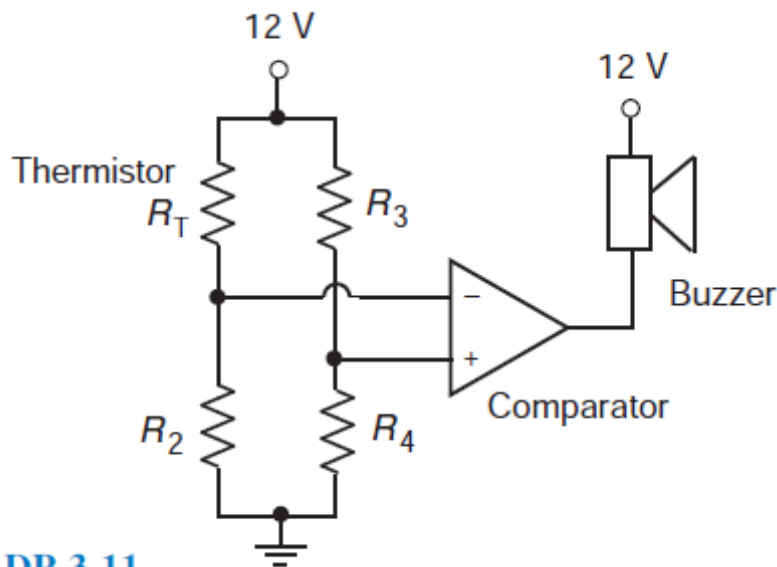


Figure DP 3-11