HW 3.3

Monday, February 10, 2020 10:49 PM

1: a) $R = 10k\Omega \cdot e^{-4300\left(\frac{1}{25} - \frac{1}{25}\right)}$

$R = 10k\Omega$

$\frac{10k\Omega}{20k\Omega} \cdot 3.3V = 1.65V$

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b) $R = 10k\Omega\, e^{-4300\left(\frac{1}{303.15} - \frac{1}{303.15}\right)} = 7863\Omega$

$\frac{10k\Omega}{10k\Omega + 7.863k\Omega} \cdot 3.3V = 1.85V$

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c) $R = 10k\Omega\, e^{-4300\left(\frac{1}{298.15} - \frac{1}{306.15}\right)} = 6860\Omega$

$\frac{10k\Omega}{10k\Omega + 6.860k\Omega} \cdot 3.3V = 1.96V$

2: a) $\frac{1.65V}{3.3V} \cdot 4095 = 2048$

b) $\frac{1.85V}{3.3V} \cdot 4095 = 2296$

c) $\frac{1.96V}{3.3V} \cdot 4095 = 2432$

3: $\frac{x}{3.3V} \cdot 4096 = \frac{2189 \cdot 3.3V}{4095} = 1.763V$ = minimum voltage

$\frac{2189 \cdot 3.3V}{4096} = 1.764V$ = maximum voltage

4:

Temp for minimum Voltage:

$$1.763V = 3.3V \cdot \frac{10k\Omega}{10k\Omega + R}$$

$$\downarrow$$

$$\frac{1.763V\,(10k\Omega + R)}{3.3V} = 10k\Omega$$

$$\downarrow$$

$$0.534\,(10k\Omega + R) = 10k\Omega$$

$$\frac{0.534R}{0.534} = \frac{4.66k\Omega}{0.534}$$

$$\downarrow$$

$$R = 8.727k\Omega$$

$$R = 10k\Omega\, e^{-4300(1/298.15 - 1/t)}$$

$$\frac{\ln\left(\frac{8.727k\Omega}{10k\Omega}\right)}{-4300} = \frac{-4300(1/298.15 - 1/t)}{-4300}$$

$$\downarrow \qquad \downarrow$$

$$3.167 \cdot 10^{-5} - 1/298.15 = 1/298.15 - 1/t - 1/298.15$$

$$-0.00332 = -\frac{1}{t}$$

$$\downarrow$$

$$\frac{1}{0.00332} = t$$

$$\downarrow$$

$$300.992\ \text{Kelvin} = t$$

Temp for max voltage:

$$1.764V = 3.3V \cdot \frac{10k\Omega}{10k\Omega + R}$$

$$\downarrow$$

$$\frac{1.764V\ (10k\Omega + R)}{3.3V} = 10k\Omega$$

$$\downarrow$$

$$0.535\ (10k\Omega + R) = 10k\Omega$$

$$\frac{0.535}{0.535} = \frac{4.65}{0.535}$$

$$\downarrow$$

$$R = 8.692\ k\Omega$$

$$R = 10k\Omega\, e^{-4300(1/298.15 - 1/?)}$$

$$\frac{\ln\left(\frac{8.692\ \Omega}{10k\Omega}\right)}{-4300} = \frac{-4300(1/298.15 - 1/t)}{-4300}$$

$$\downarrow \qquad\qquad \downarrow$$

$$3.260 \cdot 10^{-5} = 1/298.15 - 1/t$$

$$-1/298.15 \quad -1/298.15$$

$$-0.00332 = -\frac{1}{t}$$

$$\downarrow$$

$$\frac{1}{0.00332} = t$$

$$\downarrow$$

300.992 kelvin = t

5. The resolution would go from 4096 to 1024 which is the equivalant to a reduction of 3/4 from 4096.

6. The resolution would remain the same because the comperison of resistance and voltage is proportionate with 3.3V to 5V and any other voltage.