Lab 6: Part 2

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Lab 6 Part 2 Questions

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1. $R1 + R2 = 2.5k\Omega$

a) From visual inspection, the potentiometer has ~300° of travel. 1/4 turn would be 90°, or 30% of travel. This gives a voltage of $0.3 \cdot 3.3V = \boxed{0.99V}$

b) $0.99\ V \cdot \frac{1\ bin}{0.806\ mV} = 1228.8 = bin\ 1228$

$= \boxed{bin\ 0x4CC}$

c) $0x333 = bin\ 819$

$2^{12}\ bins = 4096\ bins$

$\frac{0.806\ mV}{bin}$

$bin\ 819 = 0.659\ V$

$V_{out} = V_{in} \cdot \frac{R2}{R1+R2}$

$R2 = \frac{V_{out}}{V_{in}}(R1+R2) = \frac{0.659V}{3.3V} \cdot 2.5k\Omega = 0.499k\Omega$

$= 499\ \Omega$

$R1 = 2.5k\Omega - R2 = 2.5k\Omega - 499\ \Omega = 2000.76\ \Omega$

$$\boxed{\begin{array}{l} R2 = 499\ \Omega \\ R1 = 2501\ \Omega \end{array}}$$

2.

a) From section 6.8 of the data sheet, the sensor gain is typically 10 mV/°C for the LM35D.

b) Per section 6.3, the specified operating temperature for the LM35D is: 0°C to 100°C.

c) 25°C

$$\rightarrow 25°C \cdot \frac{10\,mV}{°C} = \boxed{250\,mV}$$

With 3.3V, 1 bin = 0.806 mV

$$\rightarrow \frac{250\,mV}{0.806\,mV} = 310.174 \Rightarrow \text{bin \#} = 310$$

$$= 0b000100110110$$

$$= \boxed{0x136}$$

5067 Question

1. Bin resolution is $\frac{0.806\ mV}{bin}$. Using the nominal slope of $\frac{10\ mV}{°C}$, this converts to a bin resolution of $\frac{0.806\ mV}{bin} \cdot \frac{1°C}{10\ mV} = \boxed{\frac{0.0806\ °C}{bin}}$.

Extra Credit

1. $T_{min} = 0°C$ $T_{max} = 35°C$

$ADC_{min} = 0V$ $ADC_{max} = 3.3V$

$T_{v,min} = 0V$ $T_{v,max} = 350\,mV$

a) $\boxed{V_{off} = 0V}$. The range is already shifted down to 0V as the minimum value.

$$\frac{3.3V}{350\,mV} = \boxed{9.42857 = A}$$

b) $$\frac{35°C}{3.3V} = \frac{10.606°C}{1\ V}$$

$$\rightarrow \frac{10.606°C}{1\ V} \cdot \frac{0.806\ mV}{bin} = \boxed{\frac{0.0085°C}{bin}}$$