Kent Mark

Cpre 288 – Homework 4

4/8/20

Homework 4

1. The question that I chose to answer was question 1 which focused on being able to: determine the voltage level depending on the gas pressure, determine the digital reading from the ADC after conversion, and find the possible ranges analog input voltage values based on the digital output. For the first part of part a I was told that the psi was 250.0 and I was tasked with finding the voltage level. To find the answer I used the slope intercept formula y = mx + b, where y was the gas pressure, m was the slope, x was the sensor output voltage, and b was the y intercept. After solving for the slope, I got: (500/50) / (2.5 – 0) = 200 psi/V. Making the equation y = 200x + 50, and after solving for x I got: x = (250 – 50) / (200) = 1V. For the second part of the part a I first found the resolution of the ADC by dividing the maximum voltage, 3.3V, by the number of the steps, 212 = 4096, which gave me (3.3V / 4096) = 0.00080566 V/bit. I then divided the input voltage I found in part 1 by the resolution giving me (1V/0.00080566V/bit) = 1241.2 or 0100110110012 in binary. For part b I simply multiplied the resolution by the digital output given which was 225 giving me (0.00080566 \* 225) = 0.18127V. Using the same logic, I then found the lowest voltage that would give me a digital reading of 226 which was (0.00080566 \* 226) = 0.18208V. So, the range of voltages that could give me a digital reading of 225 was 0.1813V <= input voltage < 0.18121V.
2. A key concept from class that applies to question would be the overall concept of the ADC and what it does. In class we learned that the ADC, or analog digital converter, is responsible for converting an analog input signal such as signals that may come from light, temperature, and pressure sensors, into an n-bit digital output signal. We also learned that because most sensors are linear, we can utilize the slope intercept formula to convert their data to analog outputs, digital outputs, and the resolution of the ADC.
3. A resource that I used to help me answer this question was the information that I gleaned from Dr. Rover’s meeting 13 slides which went into to extensive detail about what the ADC did, it’s importance to embedded design, and the different ways we could use the slope intercept formula to find different conversions.
4. My own question:

Given a linear graph representing the Sensor Output Voltage, where MAX psi is 500, MIN psi is 40, Vmin is 0, and Vmax is 3. What is the voltage level at the sensor’s output if the gas pressure is 300 psi?

Using y = mx + b I get: (500 – 40) / (3 – 0) = 153 psi/V

Y = 153x + 40

Solving for x we get: x = (193 – 40)/153 = 1V.