**CVI620/ DPS920 Worksheet 1- Math Equations**

1- Find x.

2- How many different values can I save if I have 1 bit storage space? 21=2 values (i.e. 0 and 1)

What if there is 1 byte (8 bits) available? 28=256 values (i.e. 0 to 255)

What if there is 3 bytes available? 23\*8=2563 = 16,777,216 values

3- To have an experiment with IoT (internet of things), a company is setting up 1024 light sensors across a farm and wants to store measurements coming from these sensors for 10 hours per day. The estimated storage available for this data is 1.8MB per day. To make it manageable, they sample the measurements every 5 seconds. Assume the measurements from a light sensor are real numbers within the range of 0 to 2.0.

1. How much storage is available for each sensor measurement?

Available storage per day = 1.8 MB = 1.8 \* 1024 \* 1024 \* 8 bits ≈ 15,099,494 bits

1.8 mb of data per day \* 1024 light sensors \* 8 bits \* 1024 sensors

Number of sensor readings per day = 1024 \* 10 \* 3600 / 5 = 7,372,800

1024 sensors \* 10 hours per day \* 3600/5 readings per hour

To stay within the available storage budget, for each sensor, we must use b bits where

b < 15,099,494 / 7,372,800 = 2.05 bits

available storage / number of sensor readings per day

Therefore each sensor measurement needs to be saved in only 2 bits (since we cannot use a fraction of a bit)

1. Given the limited storage, how would you store the sensor measurements?

Since there is only 2 bits available, we only have 22=4 values available (i.e. 00, 01, 10, 11)

We therefore need to quantize the sensor measurements, which are real numbers between 0 and 2.0, into 4 values. For example, for a measurement m, we store bit values s as follows:

If , then s=00

If , then s=01

If , then s=10

If , then s=11