

Name: _____

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Chapter 21 QUANTITATIVE DATA ANALYSIS Worksheet

Use this sheet to record your answers to the following Chapter 21 Challenge Problems.

- 21-15.** The photoresistor sold by Patton Robotics (see page 804) is used by a scientist to measure the illuminance, E_v , on a sunny day. The sensor is connected to a voltage divider board (VDB), which is powered with 5V and is connected to an analog pin on the Teensy 3.2. If the sensor's digital reading is 25, determine the illuminance in lux units.
- 21-16.** In the previous problem, a VDB/photoresistor recorded a raw digital value of 25, which you converted to illuminance, E_v , in lux units using the equation on page 804. Later, a new measurement is made with the same sensor and an output value of 50 (twice the original reading) is recorded. Calculate the new illuminance value in lux and compare the two E_v values.
- 21-19.** A DRB5053 Hall-effect sensor (see pages 799-802) is connected to an analog pin of the Teensy 3.2 microcontroller and is powered with 5V. The sensor returns a raw digital value of 400. What is the strength of the magnetic field detected by the sensor? Give your answer in units of mT. What is the polarity of the magnet – north or south? You may want to consult the code and explanation for the “**quantitativeMagField.ino**” sketch, which begin on page **Error! Reference source not found**.807.

- 21-21.** Convert the following 10-bit digital readings from a Teensy 3.2 microcontroller into **analog voltages**. (For assistance answering this question, see *Section 5*, which begins on page 805.)
- a. 0
 - b. 100
 - c. 777
 - d. 1023

- 21-22.** Convert the following input analog voltages as read by a Teensy 3.2 microcontroller into **10-bit digital values**. (For assistance answering this question, see *Section 5*, which begins on page 805.)
- a. 0 V
 - b. 1.0 V
 - c. 2.0 V
 - d. 3.0 V

- 21-26.** As you know, the voltage divider board (VDB) from Patton Robotics has a fixed resistor, R_f , value of $10\text{k}\Omega$. A force sensor of unknown resistance, R_v , is inserted into the VDB's terminal block, and the board is powered with a voltage of 5V. If the sensor's output **voltage** is 1.6V, what is the resistance of the force sensor, R_v ? Give your answer in ohms (Ω). Use the voltage divider equations from *Section 6* on pages 808-812 to answer this question.

Consult the Answer Key to see how well you understood these problems.