This assignment includes (3) problems.

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| **Purpose of this assignment** | As discussed in A04, Solar energy is a viable alternative to traditional energy sources such as coal or natural gas in certain situations. This assignment is to provide hands on experience with collecting data relevant to solar energy utilizing the TI Kits. |

**Relevant Course Resources**:

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| Pre-Class Videos | * None yet |
| Course Resources | * Getting Started with Energia and the TI Kits * Block Diagram Basics |
| Lecture Slides | * Class ## Slides * A04 |

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| **Communication Errors between the TI Kits and Your Computer:**   1. Make sure that your TI Kit is plugged in correctly using the provided Micro USB to USB A cable. There should be a green power LED lit up when this occurs. 2. The COM port selected in Energia is not the correct port. While it is generally the highest port number available. This is not always the case. All COM Ports should be tried if there are communication issues. 3. Ensure all drivers have been installed. For instructions on how to install, please see Step 2. 4. Restart Energia IDE 5. Restart your computer (Should not be required, but can help depending on your computer’s settings)   **Submission Instructions:**   1. Re-name your answer sheet as, **ENGR131\_A##\_*yourlogin*.docx**, where *yourlogin* is your *Purdue Career Account* login. 2. Save your files to your **Purdue Career Account** (This is your Purdue storage space. For more information see <https://www.itap.purdue.edu/connections/careeraccount>) 3. Submit your work through the designated **Brightspace Assignment Drop box at** [https:/purdue.brightspace.com/](https://mycourses.purdue.edu/) |

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| **Problem 1** | **Configuring the Light Sensor and a Real Time Readout on the Digital Display** |
| **Goal** | This problem tests your ability to obtain a real time readout on the four-digit digital display from the Grove Light Sensor. To do this, you will need to complete the following:   1. Open the Sketchbook/LaunchPad\_Grove\_Kit/Grove\_Modules/Light\_sensor file in Energia.      1. Before compiling and uploading the sketch, first you need to add to the board.    1. Connect the Grove Starter Kit Light Sensor to J6 of the Boosterpack using the four-prong connector cable      * 1. Connect the Grove Starter Kit Four Digit Digital Display to J14 of the Booster Pack using the four-prong connector cable.      * 1. Connect the Boosterpack underneath the TI Kit board.      1. Compile and upload the Light\_sensor sketch to your TI Kit.    1. **HINT:** If this works, there should be a changing red number should be illuminated on your Grove Starter Kit Four Digit Digital Display.   Then answer the following questions:   1. Draw (by hand or via a computer) a block diagram of your set up on your answer document. 2. Take a picture of your TI Kit and booster back with the illuminated Grove Starter Kit Four Digit Digital Display visible and submit this in the answer document. |
| **Solution: Block Diagram** |  |
| **Solution: Picture** |  |
| **Reference: CODE** | /\*  Grove Light Sensor  A simple program that display the value of light from the Grove Light Sensor  on the Grove 4-Digit Display, this example is very similar to the Grove Rotary Angle Sensor example    The circuit:  \* 4-Digit Display attached to Pin 38 and 39 (J14 plug on Grove Base BoosterPack)  \* Light Sensor attached to Pin 24 (J6 plug on Grove Base BoosterPack)    \* Note:    Created by Oliver Wang    This example code is in the public domain.    http://www.seeedstudio.com/depot/Grove-Light-Sensor-p-746.html  \*/  //4-Digit Display library  #include "TM1637.h"  /\* Macro Define \*/  #define CLK 39 /\* 4-Digit Display clock pin \*/  #define DIO 38 /\* 4-Digit Display data pin \*/  #define LIGHT\_SENSOR 24 /\* pin connected to the Light Sensor \*/  /\* Global Variables \*/  TM1637 tm1637(CLK, DIO); /\* 4-Digit Display object \*/  int analog\_value = 0; /\* variable to store the value coming from Light Sensor \*/  int8\_t bits[4] = {0}; /\* array to store the single digits of the value \*/  /\* the setup() method runs once, when the sketch starts \*/  void setup()  {  /\* Initialize 4-Digit Display \*/  tm1637.init();  tm1637.set(BRIGHT\_TYPICAL);  }  /\* the loop() method runs over and over again \*/  void loop()  {  analog\_value = analogRead(LIGHT\_SENSOR); /\* read the value from the sensor \*/    memset(bits, 0, 4); /\* reset array before we use it \*/  for(int i = 3; i >= 0; i--)  {  /\* Convert the value to individual decimal digits for display \*/  bits[i] = analog\_value % 10;  analog\_value = analog\_value / 10;  tm1637.display(i, bits[i]); /\* display value on 4-Digit Display \*/  }  delay(100); //small delay so that the number doesn't change too quickly to read  } |

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| **Problem 2** | **Communication between the TI Kit and Your Computer: Extracting Data from the Serial Port into Excel/CSV** |
| **Goal** | This problem tests your ability to upload a sketch to the TI Kit board demonstrating that the TI kit can communicate with the computer. To do this, you will need to complete the following:   1. Setting up the Grove Starter Kit Light Sensor to transmit data to the serial port.    1. Download the Light\_sensor\_excel folder from [GitHub](https://github.com/paulleywalnuts/ENGR131-TIKITS/tree/9ca7d7ad5660cab2a773decf209c0e6109a867eb) and add it to your /LaunchPad\_Grove\_Kit/Grove\_Modules folder in your Energia folder.    2. Open the Sketchbook/LaunchPad\_Grove\_Kit/Grove\_Modules/Light\_sensor\_excel file in Energia.      * 1. Compile and upload the Light\_sensor\_excel file to your TI Kit as assembled in Problem 1.   2. Open the Serial Monitor located in the Tools Menu to complete question 1.   3. Close the Serial Monitor.  1. Utilize the ArduSpreadsheet to record data from the serial port to an excel sheet.    1. Download the ArduSpreadsheet zip file from Github.    2. Extract the Arudspreadsheet zip file to the Energia/Tools Folder in your documents.      * 1. Open ArduSpreadsheet located in the Tools Menu to complete question 2.        * 1. Close the ArduSpreadsheet.   Then answer the following questions:   1. Take and upload a screenshot of the Serial Monitor window when 25 data points have been taken. 2. Using the ArduSpreadsheet plug-in, record 1 minute of data for your Grove Starter Kit Light Sensor in the Classroom. Save this data and upload it with your answer document. |
| **Solution: Serial Monitor Plot** |  |
| **Reference: CODE** | /\*  Grove Light Sensor  A simple program that display the value of light from the Grove Light Sensor  on the Grove 4-Digit Display, this example is very similar to the Grove Rotary Angle Sensor example    The circuit:  \* 4-Digit Display attached to Pin 38 and 39 (J14 plug on Grove Base BoosterPack)  \* Light Sensor attached to Pin 24 (J6 plug on Grove Base BoosterPack)    \* Note:    Created by Oliver Wang    This example code is in the public domain.    http://www.seeedstudio.com/depot/Grove-Light-Sensor-p-746.html  \*/  //4-Digit Display library  #include "TM1637.h"  /\* Macro Define \*/  #define CLK 39 /\* 4-Digit Display clock pin \*/  #define DIO 38 /\* 4-Digit Display data pin \*/  #define LIGHT\_SENSOR 24 /\* pin connected to the Light Sensor \*/  /\* Global Variables \*/  TM1637 tm1637(CLK, DIO); /\* 4-Digit Display object \*/  int analog\_value = 0; /\* variable to store the value coming from Light Sensor \*/  int8\_t bits[4] = {0}; /\* array to store the single digits of the value \*/  int rowNumber=0; /\* Initializing the row number, seconds in which the excel file records the data  /\* the setup() method runs once, when the sketch starts \*/  void setup()  {  /\* Initialize 4-Digit Display \*/  tm1637.init();  tm1637.set(BRIGHT\_TYPICAL);  Serial.begin(9600);  }  /\* the loop() method runs over and over again \*/  void loop()  {  analog\_value = analogRead(LIGHT\_SENSOR); /\* read the value from the sensor \*/  Serial.print(++rowNumber);  Serial.print('\t');  Serial.println(analog\_value);    memset(bits, 0, 4); /\* reset array before we use it \*/  for(int i = 3; i >= 0; i--)  {  /\* Convert the value to individual decimal digits for display \*/  bits[i] = analog\_value % 10;  analog\_value = analog\_value / 10;  tm1637.display(i, bits[i]); /\* display value on 4-Digit Display \*/  }  delay(1000); //small delay so that the number doesn't change too quickly to read  } |

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| **Problem 3** | **Real World Data Collection** |
| **Goal** | Now that you understand the basics of the the Grove Starter Kit Light Sensor and how to extract data using it. You will now utilize it to obtain real world solar data. To do this, you will need to complete the following:   1. As in Problem 2, utilize the Grove Starter Kit Light Sensor and the ArduSpreadsheet plug-in. 2. Upload and compile the Light\_sensor\_excel file 3. Open the ArduSpreadsheet plug-in for use in question 1.   Then answer the following questions:   1. Record 10 minutes of continuous data outside using the light sensor and save it as a csv file. |
| **Solution: CSV file** |  |
| **Reference: CODE** | /\*  Grove Light Sensor  A simple program that display the value of light from the Grove Light Sensor  on the Grove 4-Digit Display, this example is very similar to the Grove Rotary Angle Sensor example    The circuit:  \* 4-Digit Display attached to Pin 38 and 39 (J14 plug on Grove Base BoosterPack)  \* Light Sensor attached to Pin 24 (J6 plug on Grove Base BoosterPack)    \* Note:    Created by Oliver Wang    This example code is in the public domain.    http://www.seeedstudio.com/depot/Grove-Light-Sensor-p-746.html  \*/  //4-Digit Display library  #include "TM1637.h"  /\* Macro Define \*/  #define CLK 39 /\* 4-Digit Display clock pin \*/  #define DIO 38 /\* 4-Digit Display data pin \*/  #define LIGHT\_SENSOR 24 /\* pin connected to the Light Sensor \*/  /\* Global Variables \*/  TM1637 tm1637(CLK, DIO); /\* 4-Digit Display object \*/  int analog\_value = 0; /\* variable to store the value coming from Light Sensor \*/  int8\_t bits[4] = {0}; /\* array to store the single digits of the value \*/  int rowNumber=0; /\* Initializing the row number, seconds in which the excel file records the data  /\* the setup() method runs once, when the sketch starts \*/  void setup()  {  /\* Initialize 4-Digit Display \*/  tm1637.init();  tm1637.set(BRIGHT\_TYPICAL);  Serial.begin(9600);  }  /\* the loop() method runs over and over again \*/  void loop()  {  analog\_value = analogRead(LIGHT\_SENSOR); /\* read the value from the sensor \*/  Serial.print(++rowNumber);  Serial.print('\t');  Serial.println(analog\_value);    memset(bits, 0, 4); /\* reset array before we use it \*/  for(int i = 3; i >= 0; i--)  {  /\* Convert the value to individual decimal digits for display \*/  bits[i] = analog\_value % 10;  analog\_value = analog\_value / 10;  tm1637.display(i, bits[i]); /\* display value on 4-Digit Display \*/  }  delay(1000); //small delay so that the number doesn't change too quickly to read  } |