General Instructions

Due Date:
Saturday, February 4 at 11pm (submit via blackboard)

Assignment Summary Instructions:
This assignment has three problems summarized below. You will use MATLAB as tool to solve the problems for the given test cases provided and that it is flexible for any additional test case that might be used to evaluate your code.

- Problem #1: Data Collection
- Problem #2: Unit Production Cost
- Problem #3: Electronic Device Production

Submission Instructions:
You will submit a **.m file – Matlab file (separate sections using %% for each problem)**. Your final script should be in the zipped folder and named as **MA#_USERNAME.m (for example, MA1_dwburles.m).**

Submit your **.m** to blackboard using the Mastery Assignment 2 link. Your final submission should be a .m file named as **MA#_USERNAME.m (for example, MA2_dwburles.m).** The file must be completely submit before 11pm on February 4 for credit. **No late work is accepted and will result in a zero on the assignment**. It is your responsibility to make sure the file is completely submitted prior to the deadline. You are provided 2 upload opportunities in case your first upload is incomplete or a mistake.

Academic Honesty Reminder:

The work you submit for this assignment should be your work alone. You are encouraged to support one another through collaboration in brainstorming approaches to the problem and troubleshooting. **However, all support should be only verbal in nature**. Sharing files and showing other students your file is considered physical and visual help and is considered an academic honesty violation.

Some examples of academic misconduct in ENGI 1331 include but are not limited to the following actions:

1. Picking up and using or discarding another student's written or computer output;
2. Using the computer account of another student;
3. Representing as one's own the work of another on assignments, quizzes, and projects;
4. Giving another student a copy of one's work on an assignment before the due date.
5. Copying work from online resources (Chegg, google forums, etc.)
6. Posting work to online resources where other students can view your work

This assignment will be checked for similarity using a MATLAB code. The similarity code will check each submission for likeness between other student submissions, past student submissions, the solution manual, and online resources and postings. If your submission is flagged for a high level of similarity, it will be review by the ENGI 1331 faculty, and then it will be turned in for an academic honesty violation if deemed appropriate.

NOTE: Since this is an automated system for all sections, if any of your work is not your own, you will be caught. Changing variable names, adding comments, or spacing will not trick the similarity algorithm and will result in a violation.

Problem #1

Background: *Two lab technicians are testing the power and potential that results from various mass being propelled into the air by an air cannon. Each engineering recorded there results in the data file provided for this problem; however, the units were not consistent. In the first data collection session (**Problem1_data1.csv**), a lab technician collected three different measurements and recorded mass in grams in row 1, height in feet in row 2, and time in minutes in row 3. However, in data collection session two (**Problem1_data2.csv**), a different lab technician collected four different measurements and recorded mass in pounds-mass, height in centimeters, and time in hours.*

*The goal of this program is to calculate the potential energy in joules and power in watts for each data session. The program should only consider variables in SI units, so you will need to convert the vector prior to calculating your results. You will create one final matrix that combines the two collection sessions and has the mass in grams in column 1, the potential energy in column 2, and the power in column 3. You will export this matrix to a .csv fill named **Problem1_results.csv** and will use the matrix to produce the formatted output below.*

In addition, to complete the sample output shown below, you will need to also determine:

(a) the number of total observations made in each session combined.
(b) the minimum mass recorded (in grams) and the associated potential energy and power for the combined data set.
(c) the average mass recorded (in grams) and the average potential energy and average power for the combined data set.

(No Algorithm Required)

Coding Requirements:

- Include required documentation and header for the problem.
- The output of your program should look like the sample output displayed below with the same spacing, indentations, and number of significant digits.

Sample Output to Command Window based on data provided:

NOTE: Your code must work for different data that will have a different number of observations.

Command Window

```
The total number of combined observations record is 7.

The minimum mass recorded was 10.0 [g].
It had a potential energy of 0.149 [J] and a power of 0.002 [W].

The average mass [g] record is: 161.8
The average potential energy [J] calcualted is: 15.1
The average power [W] record is: 0.3
```

Problem #2

Background: *The following tables show the costs associated with a certain product and the production volume for the four quarters of the business year. You are provided .csv data to load representing the non-shaded areas in the tables below. The tables are provided to help you understand the data you are provided.*

Table 1: Unit Product Cost (Problem2_cost.csv)

	Unit product costs ($ x 10^3)		
Product	Materials	Labor	Transportation
1	7	3	2
2	3	1	3
3	9	4	5
4	2	5	4
5	6	2	1

Table 2: Unit Product Cost (Problem2_volume.csv)

	Quarterly production volume			
Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1	16	14	10	12
2	12	15	11	13
3	8	9	7	11
4	14	13	15	17
5	13	16	12	18

The goal of this program is to determine the following:

1. *The highest costing quarter (combine all 5 products) and the associated Total Material, Labor, Transportation, and overall cost.*
2. *The highest costing product for the year and the associated Material, Labor, Transportation, and Total cost for that product.*

(No Algorithm Required)

Coding Requirements:

- Include required documentation and header for the problem.
- The output of your program should look like the test case displayed below with the same spacing, indentations, and number of significant digits.

Sample Output to Command Window based on data provided:

NOTE: Your code must work for different data that will have a different number of observations.

```
Command Window
Overall Costs: $782.00

Product 4 was the highest costing product for the year.

Material Costs: $118.00
Labor Costs: $295.00
Transportation Costs: $236.00
Overall Costs: $649.00
```

Problem #3

Background: *You are provided .mat file (**Problem3.mat**) that contains data on production of various electronic devices at your company during several years in the matrix **Prod**. Each row of the matrix contains production data for a single year. The first element in each row contains the year, e.g. 2007 or 10012. The remaining elements in each represent the number of a specific part manufactured during that year. For example, the second element might contain the number of 2N3904 transistors produced during each year, whereas the fifth column might contain the number of IC555 timer chips produced. You may assume that corresponding elements in each row contain production numbers for the same type of device.*

*The .mat file also contains a cell array **DeviceID** which contains the part number for each of the electronic devices. NOTE: the first string in **DeviceID** is associated with second column in **Prod**. The number of labels must equal the number of columns in **Prod** minus one.*

*Your program should first load in the data file (**Problem3.mat**). The goal of your program is to determine the following information. NOTE: your code should work no matter the size of the matrix.*

(a.) *Create a row vector that contains the total number of years in the first element and the total number of each item produced during all listed years in the remaining elements. Note that **it** will have the same number of elements as the number of columns in the **data provided.***
(b.) *Create a row vector that contains the total number of years in the first element and the average number of each item produced during all listed years in the remaining elements. Note that **it** will have the same number of elements as the number of columns in the **data provided**.*
(c.) *Create a column vector that contains the total number of all units produced during each year.*
(d.) *Create a column vector that contains the maximum number of any type of device produced during each year in column 1, and another column vector that contains the associated Device ID in column 2.*
(e.) *Determine the overall maximum number of any device produced during any year and record the Device ID and year in which it occurs.*
(f.) *Determine the number years and number of devices*
(g.) *Assume your company makes a profit at a user-defined rate on each device produced, regardless of type, determine the total profit made during all listed years. Your result should be in dollars.*
(h.) *Combine the results of some of the calculations above into a matrix that contains the NON-SHADED PORTION of the table below. Export this table as a .csv file name **Problem3_sums.csv**. NOTE: The results below are only applicable for the data provided. Different data will be used to test your code so your program should be flexible to different values, number of years, and number of devices. You may need to make some additional calculations to complete the matrix (aka, make it balanced in dimensions).*

Year	'2N3904'	'2N3906'	'2N2222'	'IC555'	'IC741'	Yearly Production
2007	1500000	2000000	500000	600000	9000000	13600000
2010	3000000	5000000	200000	400000	7000000	15600000
2011	6000000	9000000	700000	800000	6000000	22500000
2012	800000	10000000	600000	13000000	4000000	28400000
2013	5000000	9000000	2000000	21000000	3000000	40000000
Total Production	16300000	35000000	4000000	35800000	29000000	120100000

(Problem Requirements and sample output on next page)

(No Algorithm Required)

Coding Requirements:

- Include required documentation and header for the problem.
- The output of your program should look like the test case displayed below with the same spacing, indentations, and number of significant digits.

Sample Output to Command Window based on data provided:

NOTE: Your code must work for different data that will have a different number of observations.

Command Window

```
How much profit is made per device produced in cents:  >> 5

There were 5 types of devices produced for data given from 2007 to 2013.

The overall maximum production occurred in 2013 with the IC555 device.
The total production was 21000000.
```