*Read **all** instructions before beginning your work.*

COMP1200-MATLAB – assign05
Due 4:45pm – Friday – February 28, 2020
Submit `assign05.m` via Canvas

NOTE:
Your submitted file(s) MUST be spelled and cased as instructed.

***Before you start writing your program**:*

Read the complete instructions including the **algorithm**. An **algorithm** contains the steps needed to guide you through solving a problem. Use the **algorithm** as comments to a guide you when writing the MATLAB program file solution for the following problem.

Registration for COMP1201 lab is still available. See course listing for available seats. Contact: Clint Lovelace `jcl0014@auburn.edu` to register.

***Problem*:**

Drag Force and Drag Coefficients

The **drag equation** is a practical formula used to calculate the force of drag experienced by an object moving through a fluid. The force on a moving object due to a fluid due to Lord Rayleigh is

$$F_d = \frac{1}{2}\rho v^2 C_d A$$

where

F_d is the force of the drag, air resistance
ρ is the density of the fluid, air density
V is the velocity of the object relative to the fluid, i.e. the air
A is the reference area, frontal area of vehical
C_d is the drag coefficient (a dimensionless constant).

NOTE: use descriptive variables

The reference area A is the area of the projection of the object on a plane perpendicular to the direction of motion (i.e. cross-sectional area). Sometimes different reference areas are given for the same object in which case a drag coefficient corresponding to each of these different areas must be given. Note: v^2 dependence on velocity, meaning that fluid drag increases with the square of velocity.

The drag coefficient of a car at the design conditions of 1 atm at 25°C (ρ = 1.225 kg/m^3) and velocity (v = 90 km/h /3.6 km/h OR 25 m/s) is to be determined experimentally in a large wind tunnel in a full-scale test. The horizontal force (F_d) acting on the car is measured to be 350 N.

For example, typical examples of drag coefficients for automobiles.

Year	Model	C_d
2015	BMW-7	0.24
2016	Toyota-Tacoma	0.39
2017	Tesla-3	0.23
2018	Audi-A6	0.26
2018	Jeep-Wrangler	0.45
2019	Toyota-Corolla	0.28

***Program*: assign05.m**

Read the data file, **`dragCoef05.txt`**, into a matrix. The first column will contain the year and the second column contains the drag coefficient for vehicles. Write a MATLAB script file that select a vehicle from a menu of the vehicle names listing in the above chart and uses the velocity, horizontal force, and air density given above and the drag coefficient read from the data file to compute the frontal area for the vehicle selected by the user and all the vehicles. Display the year and frontal area of the selected vehicle with labels. Display and print title and column header over the numbers of a three column matrix with the year, drag coefficient and frontal area of each vehicle. Note: you will need to add the frontal area as the third column of the original input data matrix. Sort the output table by the frontal area column for output.

***Problem* `CONSTANTS:`** `(with units)`

filename = `'dragCoef05.txt'`

velocity, horizontal force, air density

***Problem Inputs*:** (with units)

drag coefficient

Problem Outputs: (with units)

frontal area

Other variables: (with units)

selected car index

Equation:

See above.

Algorithm: See `green` comments below.

Type the `green` comments as GIVEN in the editor window and use as a guide for typing the MATLAB statements.

Sample output:

Run #1

```
Year of car #2:        2016
Frontal area of car#2: 2.3443

             All Cars
     Year      Drag    Frontal
               Coef    Area(m^2)
   1.0e+03 *
    2.0180    0.0004    0.0020
    2.0160    0.0004    0.0023
    2.0190    0.0003    0.0033
    2.0180    0.0003    0.0035
    2.0150    0.0002    0.0038
    2.0170    0.0002    0.0040

             All Cars
     Year      Drag    Frontal
               Coef    Area(m^2)
    2018       0.45    2.0317
    2016       0.39    2.3443
    2019       0.28    3.2653
    2018       0.26    3.5165
    2015       0.24    3.8095
    2017       0.23    3.9752
```

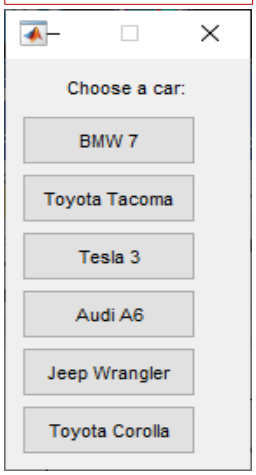
Run #2

```
Year of car #5:        2018
Frontal area of car#5: 2.0317

             All Cars
     Year      Drag    Frontal
               Coef    Area(m^2)
   1.0e+03 *
    2.0180    0.0004    0.0020
    2.0160    0.0004    0.0023
    2.0190    0.0003    0.0033
    2.0180    0.0003    0.0035
    2.0150    0.0002    0.0038
    2.0170    0.0002    0.0040

             All Cars
     Year      Drag    Frontal
               Coef    Area(m^2)
    2018       0.45    2.0317
    2016       0.39    2.3443
    2019       0.28    3.2653
    2018       0.26    3.5165
    2015       0.24    3.8095
    2017       0.23    3.9752
```

Using `disp()`

Print table again using `fprintf()` Spacing may vary from above.

Use `menu()` to select a vehicle. Use the results as an index to data in matrix.



Instructions for all assignment scripts:

- ☐ See Standards for Documentation of MATLAB Programs on the Canvas Resources page.
- ☐ Insert comments at the top and throughout each file.
  - o Include the follow comments at the beginning of this (and ALL) files.
    - % submitter's name, **GROUP # or "none"**
    - % other group members' names or **"none"**
    - % **program file name**, ex. assign02a.m
    - % due date of the assignment
    - % **statement about collaboration REQUIRED.**
    - % a short narrative about what the file does
  - o Use the algorithm given as comments throughout your program.
- ☐ Observe the instructor's rule for naming variables.
  - o Use ALL CAPS for constants variable names.
  - o Start other variables with lower case.
  - o Use descriptive variable names.
- ☐ Use Sample Input/Output as a guide.
- ☐ Code clarity:
  - o Indent blocks as needed. **Use Smart Indent.**
  - o Divide your solution program code into sections as noted in the algorithm. Use blank lines as needed to group statements.
  - o Use section comments as well as the algorithm step comments.
  - o Remove statements from previous assignments that do not apply to the current requirements.
- ☐ Use comments to show units.
- ☐ **Use the CONSTANT and variable names, not numbers.**
  Exceptions are incrementers (or counters) and numbers without identity.
- ☐ No extra output, i.e. use semicolons

GRADE OF ZERO for a file if submitter name not part of Canvas group.

(-3pts) No CURRENT GROUP# or "none".
(-3pts) For your own protection, type "none" for other group members if submitting alone.
(-5pts) Five point penalty for not joining your Canvas group.

(-5pts) Zero points for comments if no collaboration statement.

Start your program file by typing the following into your empty editor window.

- Type yours/your group and other required information comments.
- Type the algorithm as given below as comments
  to guide you when writing the MATLAB instructions
  to do the tasks to solve the given problem.
- Below the comment, type the MATLAB statement(s) that
  o what the comment says. This example should help. →

```
% submitter's name, GROUP # or none
% other group members' names or none
% program file name
% due date of the assignment
% statement(s) about collaboration. See syllabus for examples.
% a short narrative about what the file does
```

NO error checking.
Do not use commands and statements beyond what has been taught on class.
Do not use commands and statements in assign01 until they have been discussed in class.

New commands:
`exist()` to determine if file is available.
Only continue if file is available otherwise ONLY print a message.
`load() menu() sortrows() fprintf()`

Continue:
Use functions from previous assignments as needed.
`if...else` to check for file
`format` as shown in output
Use descriptive variables.

```
clc, clear all
format                  <<< use format to produce output as shown
% ***** CONSTANT *****
FILENAME = 'dragCoef05.txt';
                        <<< other constants with units

% does file exist?                                  <<< See readingTextFile2020 example on Canvas

    % file exist continue
    % ***** INPUT *****
    % read year and drag coefficient from file
                                                    <<< See readingTextFile2020 example on Canvas
    % select a car from menu

    % ***** COMPUTE *****
    % compute the frontal area for selecteds and all cars

    % add frontal area as third column of matrix

    % sort matrix by frontal area column ascending order

    % ***** OUTPUT *****
    % display the frontal area of chosen car

    % display table of drag coefficients and frontal areas

    % print table again using fprintf()              <<< See fprintf matrix vector example on Canvas
```

NOTE: Your submitted file(s) MUST be spelled and cased as instructed.

One submission per group. Canvas links members to files and rubric.

A script cannot run from Canvas. It must be downloaded, saved, and "run".

Submit via Canvas:

`assign05.m` MATLAB script file