ENGR 14100
MATLAB 2 PA

Individual Assignment: See the course syllabus for a definition of what this constitutes.

Task 1 (of 2)

Learning Objectives: Practice using matrices and plotting functions in MATLAB.

Background: The company you are interning for has created a new aircraft design, but they need to do some computations in order to verify the design's performance. They need your expertise in aeronautics and MATLAB to construct a program that will compute and plot the drag force, as well as the induced drag component for different aircraft speed (V). Using your notes from AAE 251, you determined that the equations you need to estimate the drag are as follows:

To calculate the coefficient of lift:

$$Cl = L \ / \ (0.5 * \rho * V^2 * S)$$

To calculate induced drag:

$$Di = k1 * Cl^2 * 0.5 * \rho * V^2 * S$$

To calculate the parasitic drag force:

$$D0 = 0.5 * \rho * V^2 * S * Cd0$$

To calculate total drag force:

$$D = D0 + Di$$

You are given the following values:

Aspect Ratio (AR) = 3	Efficiency Factor (e) = 0.9	Density (ρ) = 1.066E^(-3) slugs/ft^3
Parasitic Drag Coefficient (Cd0) = 0.018	Surface Area (S) = 610 ft^2	Lift Generated (L) = 1000 lb
k1 = 0.09896		

Since this is a general aviation aircraft that flies at low speeds, you need only consider speeds from 10 ft/s to 350 ft/s with increments of 5ft/s. The aircraft is flying at constant altitude and level flight. Therefore, since temperature and air pressure are constant, you can assume density and lift are not changing. No values should be taken as input.

In MATLAB, develop a function that will develop a graph of total drag force and induced drag force v. speed. Thus, your graph should contain two distinct plot lines that are readily identifiable.

Save the script as:

`ML2_PA_Task1_login.m`

Task 1 Files:

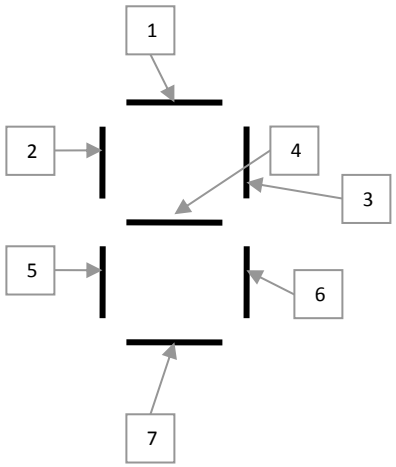
1) `ML2_PA_Task1_login.m`

Make sure you include your INDIVIDUAL HEADER in your file(s) and submit those files to the appropriate turn-in box on Blackboard.

Task 2 (of 2)

Learning Objectives: Create and implement user-defined functions in MATLAB.

Background: A gas station pump is built with 7-cell LCD displays (similar to your alarm clock) to show gallons pumped and dollars spent. In this example, the individual cells of the LCDs have been numbered. Your company has tasked you with redeveloping the programming in the electric control of the display to ensure that the correct numbers are indicated.



Part A: Write a flow chart for an algorithm that accepts as input a single one-digit value, and returns the appropriate output values for the cells of the LCD. The systems operates on a binary system, where 0 indicates that the cell is off and 1 indicates that the cell is on. For example, the display will be blank if all 7 cells are off, i.e. 0 0 0 0 0 0 0, and the number 8 (shown above) would be indicated by having all cells on, i.e. 1 1 1 1 1 1 1. Note, these 0's and 1's are not the binary representations of the one-digit value, but the active cells in the order as indicated above.

You may make your flowchart using any medium, but save the finished result as:

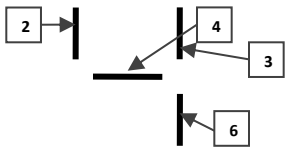
`ML2_PA_Task2_login.pdf`

Part B: Write a MATLAB function called ML2_PA_Task2b_*login.*m (you will not submit a main program calling the function, just the function) that accepts as input a single one-digit value, and returns the appropriate output values for the cells of the LCD, where 0 corresponds to "off" and 1 corresponds to "on."

As an example:

```
>> ML2_PA_Task2b_login(4)
ans =
   0   1   1   1   0   1   0
```

These output values correspond to:



Part C: Modify your function from Part B so that it has the capability to accept any positive number less than 100 and returns the appropriate output values for TWO 7-cell, numeric LCDs. Each digit should have its own corresponding and readily identifiable output.

Save the script as:

ML2_PA_Task2c_*login*.m

Task 2 Files:

1) ML2_PA_Task2_*login*.pdf
2) ML2_PA_Task2b_*login*.m
3) ML2_PA_Task2c_*login*.m

Make sure you include your INDIVIDUAL HEADER in your file(s) and submit those files to the appropriate turn-in box on Blackboard.