ENGR 14100
MATLAB 1 PA

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

Task 1 (of 1)

Learning Objectives: Practice creating and manipulating functions in MATLAB and Python.

Background:

Civil and structural engineers focus on designing structures to be stronger, lighter, and cheaper. To accomplish this, they typically build structures using I-beams. I-beams have several desirable characteristics like high stiffness and low weight, and they are inexpensive to manufacture and use in the building processes. These beams are often subject to compressive and tensile forces along their length. These forces deform the beam in proportion to its Young's Modulus. In order to calculate the deformation per unit length (called strain), engineers must first calculate the stress applied to the material.

To compute engineering stress, the following formula must be applied:

$$\sigma = \frac{P}{A} \qquad \text{(Equation 1)}$$

In Equation 1, σ represents stress (units of force per unit area), P represents the load (units of force), and A represents the cross-sectional area.

Part A:

Your job is to develop an algorithm that will compute the cross sectional area (the area of the "I" shaped end) of any I-beam given its height, width, and thickness (you can assume the thickness of the beam is the same in both its horizontal and vertical segments). A diagram of the I-beam is presented in Figure 1. Construct a flow diagram of your algorithm and save it in a PDF named:

`ML1_PA_Task1a_`*`login`*`.pdf`

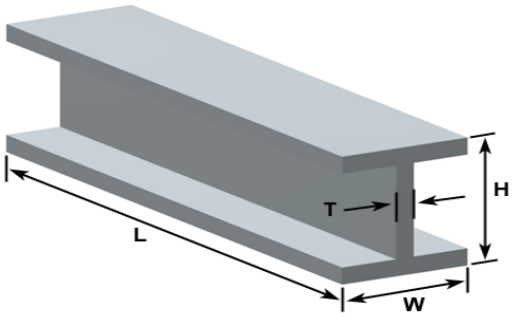

Figure 1: Dimensions of an I-Beam Copyright © 2007 CustomPartNet

Part B:

Based on the flow diagram constructed in Part A, develop a MATLAB function that computes the cross sectional area of any I-beam. The function will take height, width, and thickness as arguments in that order, on one line separated by commas. It will return the values of the inputted arguments in the order they came in, followed by the cross-sectional area. Additionally, all the values have to be outputted in the format below. Your function should include clear and descriptive documentation including the calling syntax, inputs and outputs, as well as any other information relevant to the function.

When run, your script should output the following:

```
Height = X.X ft
Width = X.XX ft
Thickness = X.XXX ft
Cross-sectional area = XX.XX sq. ft
```

Save the function as:

ML1_PA_Task1b_*login*.m

Part C:

Based on the previous flow diagram, develop a Python function, named `getIBeam()`, within a main Python script that computes the cross sectional area of any I-beam. Follow the guidelines described in Part B for inputs and outputs, as well as documentation in the form of comments. Note, the inputs will be separated by spaces rather than by commas. The array being returned by the function should be a tuple. Your Python script should ask the user for inputs in the same order as the arguments of the function (i.e. height, width, and thickness) and should be accepted in one line. Upon obtaining inputs, your script should call the function `getIBeam()` and ask the user for a file name to record the results. You should write the results to the file indicated by the user in the following format:

```
For a beam with a height of X.X ft, width of X.XX ft and a thickness
of X.XXX ft, the cross-sectional area is X.XX sq. ft.
```

Save the script as:

ML1_PA_Task1c_*login*.py

When run, your script should behave like the following:

```
Input height, width and thickness of I-beam (in ft): 2.3 1.4 0.1
... running
Enter file name where you wish to save results: Output.txt
... output written to file Output.txt.
```

Submit the file(s):

ML1_PA_Task1a_*login*.pdf
ML1_PA_Task1b_*login*.m
ML1_PA_Task1c_*login*.py
to the appropriate box on Blackboard by the due date and time specified on the submission box.

Notes: For Task 1B (MATLAB) you ONLY have to submit a MATLAB function.