ENG1060: COMPUTING FOR ENGINEERS

PASS 4 – Week 6

2020 OCT NOV

TASK 1

Write an m-file which prints a list of shapes to the command window (see below) and have the user select one of the shapes using the input function. Then, calculate the area of the selected shape after prompting the user for appropriate parameters.
1. Square (side length)
2. Rectangle (width and height lengths)
3. Circle (radius)

Ensure you include an error statement if the user inputs an incorrect shape number. Use fprintf to print a statement to the command window displaying the area of the shape. An example of the command window output is shown below:

```
Shapes:
1. Square
2. Rectangle
3. Circle
--------
Input the shape ID number: 2
Enter the rectangle's width: 4
Enter the rectangle's height: 6
--------
The area of the rectangle is 24.00
```

TASK 2

Stirling's approximation for large factorials is given by

$$n! = \sqrt{2\pi n}\left(\frac{n}{e}\right)^n$$

where *n* is an integer value and *e* represents the Euler number.

A. Write a **function** which calculates the approximated value for the factorial of *n*. Use the error function to terminate the code if the user provides a non-integer value for n.
B. In a separate m-file, prompt the user to enter a value for *n* and use your function from part A to calculate the factorial value.
C. Round the approximated number and check whether the value is divisible by 2, 3 or 7 (in that order).

a. If the rounded number is divisible by any of those numbers, then use fprintf to state that the rounded approximation of n! is divisible by X (where X is either 2, 3, 7).
b. If the rounded number is not divisible by any of the numbers from part (a), then use fprintf to state that the rounded approximation of n! is not divisible by either 2, 3 or 7.

```
E.g. Enter an integer to find its factorial: pi
Error using Stirling (line 7)
Value of n is not an integer
Error in Task_2 (line 9)
n_fact = Stirling(n);
E.g. Enter an integer to find its factorial: 11
```

Rounded approximation of 11! is divisible by 7

TASK 3

The (*x*,*y*) coordinates of a certain object as a function of time are given by

$$x(t) = 5t - 10$$
$$y(t) = 25t^2 - 120t + 144$$

A. Write a **function** that takes in the time *t* as an input and outputs the distance from the origin (0,0).
B. Write an m-file which uses the function written in part A to plot the distance of the object from the origin (0,0)) for the $0 \le t \le 4$ using a resolution of 0.1 seconds. Remember to label your plot.
C. Determine the distance closest to the origin and the corresponding time to the nearest 0.1 second.

TASK 4

The body surface area (BSA) in m^2 of a person (used for determining dosage of medications) can be calculated by the formula (DuBois formula):

$$BSA = 0.007184W^{0.425}H^{0.725}$$

where *W* is the mass in kg and *H* is the height in cm.

Determine the BSA for the following people. Print to a text file named "BSA.txt" using the fopen and fprintf functions. The file should include appropriate headers and should print the person number, mass (kg), height (m) and BSA data.

Person #	Mass (kg)	Height (m)
1	95	1.87
2	45	1.6
3	76	1.72
4	88	1.61
5	51	1.50
6	50	1.61
7	61	1.58
8	105	1.83

In BSA.txt, the printout could be displayed as follows.

```
person #  mass (kg) height (m)  BSA (m^2)
       1      95.00       1.87       2.21
     ...        ...        ...        ...
```

TASK 5

One measure commonly used to measure overweight and obesity is the Body Mass Index (BMI). BMI is a relationship between weight and height as follows:

$$BMI = \frac{W}{H^2}$$

where *W* is the weight in kg and *H* is the height in metres. There are several classifications for the BMI as shown below:

BMI	**Classification**
Less than 18.5	Underweight
18.5 to 25 (inclusive)	Normal
Greater than 25	overweight

Write an m-file that does the following in order:

1. Asks the user to enter their weight in kg and height in metres
2. Calculate the BMI of the person
3. Print a similar statement to the following using the input values via an fprintf() function:
   A **X** metre tall person with weight **X** kg has a BMI of **X** and is classed as **X**.
   Here X represents the appropriate variables.
   E.g. A 1.70 metre tall person with weight 70.00 kg has a BMI of 24.22 and is classed as normal
   Take note of the precision used for the output values.