Homework 4

Ch En 263 – Numerical Tools

Due date: 5 May 2020

Instructions

- For the problems in Excel, submit a workbook named "LastName_FirstName_HW4.xlsx" where each worksheet tab is named "Problem_1", "Problem_2", etc.
- For the problems in Python, submit a separate file for each problem named "LastName_FirstName_HW4_ProblemXX.py" where XX is the problem number.
- For your convenience, optional Excel and Python template files are available on the course website.
- If needed, a supplementary handwritten or typed document can be submitted via pdf on Learning Suite with the name "LastName_FirstName_HW4.pdf".
- **Please report how long it took you to complete the assignment (in hours) in the "Notes" section on Learning Suite.**

Problems

1. Do the following in an Excel Workbook. Create a table in Excel that mirrors the table shown below. Enter the independent variable, x, in the first column. In a second column, display the text you would use to evaluate the given Excel function. In a third column, evaluate the function to show the value.

Input value (x)	Output function f(x)
0.5 radians	$\cos(x)$
30 degrees	$\sin(x)$
2	$\tan(\pi/x)$ with π/x in radians
5	$\max(2\sqrt{x}, x^2/2, x^3/3, (x^2+x^3)/5)$
25	$x!$
0.5	x^2 when $x < 1$; $\sin(\pi x/2)$ when $x \geq 1$
4.999	largest integer less than or equal to x

   Hint: A single quote mark (') turns a cell in Excel into a text cell, e.g. '=Cos(A1) will show up as text.

2. (This problem is worth double.) Do the following in a Python file.
   (a) Import the math library using the `import` keyword.
   (b) Find the cosine of $\pi/5$ radians and print it to the console.
   (c) Write a function called `hello` that prints the string "hello world". Call the function to print the string to the console.
   (d) Write a function called `my_func` that takes x as an input and returns $x^2 + x\sin(x)$. Call the function for $x = 2.4$ and print the result to the console.

(e) Define a global variable $R = 2$ m. Write a function called `sphere` that takes no arguments and calculates the volume of a sphere with a radius R. Print the volume of the sphere (and the units) to the console.

Hint: The constant π is a pre-defined variable in the math module: `math.pi`.

3. The data in the table below shows the opening stock price for Google from several days in August and September in 2016. Use Excel functions to calculate the maximum and minimum price, the average price, the standard deviation and the median price.

Date	Price ($)	Date	Price ($)
19-Sep-16	772.42	31-Aug-16	767.01
16-Sep-16	769.75	30-Aug-16	769.33
15-Sep-16	762.89	29-Aug-16	768.74
14-Sep-16	759.61	26-Aug-16	769.00
13-Sep-16	764.48	25-Aug-16	767.00
12-Sep-16	755.13	24-Aug-16	770.58
9-Sep-16	770.10	23-Aug-16	775.48
8-Sep-16	778.59	22-Aug-16	773.27
7-Sep-16	780.00	19-Aug-16	775.00
6-Sep-16	773.45		
2-Sep-16	773.01		
1-Sep-16	769.25		

4. Write a function in a Python program called `ft_to_m` that will convert the input from feet to the output in meters. For example, If I have a variable `x` in units of feet, and I want to convert it to meters and store that value in variable `y`, I would call it using:

```
y = ft_to_m(x).
```

In addition, write these functions: `m_to_ft`, `hr_to_s`, `kg_to_slug`, `K_to_degR`. Use your functions to convert: (a) 5280 ft to m, (b) 5.3 m to ft, (c) 72 hr to s, (d) 41.2 kg to slug, and (e) 300 K to °R.

5. Write a function in a Python program that can evaluate the following formula,

$$y(t) = 5\left[1 - \exp\left(-\frac{(t-\theta)}{\tau}\right)\right]$$

where t is an argument to the function, but θ and τ are global variables defined before the function. Evaluate $y(11.0)$, $y(11.4)$, $y(11.8)$, $y(12.2)$, $y(12.6)$, $y(13.0)$ when $\theta = 2.1$ and $\tau = 4.8$ and print the values to the console. Use the `numpy` module to import the necessary math functions.