AMATH 301 – Spring 2022

Homework 1

Due: 11:59pm, January 13, 2022.

**Instructions for submitting:**

* Coding problems are submitted to Gradescope a python script (.py file) or a Jupyter Notebook (.ipynb file) (warning, this may not work as well as a python script). You have **10** attempts (separate submissions to Gradescope) for the coding problems.
* Writeup problems are submitted to Gradescope as a single .pdf file that contains text and plots. Put the problems in order and label each writeup problem. When you submit, **you must indicate which problem is which on Gradescope**. Failure to identify pages on Gradescope will lead to a **5% grading penalty. All code you used for this part of the assignment should be included at the end of your .pdf file. Failure to do so results in a 25% penalty.**

# Coding problems

This section is worth 5 points, with each variable having equal weight.

1. **Parts (a) - (d) of this problem are completed for you to show you how to save variables to make sure that they are checked by the autograder.** Define the following variables in python:
   1. Define *x* = 3*.*1 and save it to the variable A1.
   2. Define *y* = *−*29 and save it to the variable A2.
   3. Define *z* = 9*e* (where *e* is the number such that ln(*e*) = 1) and save it to the variable A3.
   4. Define *w* = *e*4 (where *e* is the number such that ln(*e*) = 1) and save it to the variable A4.
   5. Compute sin(*π*) in python using numpy. Save the result to the variable A5.
2. Create/calculate the array [cos(0)*,* cos(*π/*4)*,* cos(*π/*2)*,* cos(3*π/*4)*,* cos(*π*)] and save the result to the variable A6. **(Hint: I have given you code that creates the array x** = [0*, π/*4*, π/*2*,* 3*π/*4*, π*]**, how can you use this to help you solve this problem?**
3. Use linspace and arange, in the numpy package, to create the vectors **u** and **v** where **u** is the vector with 6 evenly spaced elements beginning with 3 and ending with 4 and where

**v** = (0 0*.*75 1*.*5 2*.*25 3*.*0 3*.*75) *.* (1)

* 1. Save the array **u** to the variable A7.
  2. Save the array **v** to the variable A8.
  3. Save the array **w** = **v** + 2**u** to the variable A9.
  4. Using python commands, create a vector **w** whose entries are the entries of **u**

cubed (i.e., to the third power). Save the result to the variable A10.

* 1. Using python commands, create a vector **x** whose entries are tan(**u**) + *e***v**. Save the result to the variable A11.
  2. Use **indexing** to save the 3rd number in **u** to the variable A12. *Hint: Remem- ber that indexing begins at 0 for python.*

1. Create an array *z* with elements that have spacing 1*/*100 between them and that begins at *−*6 and ends at 3.
   1. Save the array *z* to the variable A13.
   2. Use indexing to create another array that consists of every other entry in *z*. Save that array to the variable A14.
   3. Use indexing to create another array that consists of every *third* entry in *z*. Save that array to the variable A15.
   4. Use indexing to create an array consisting of *the last 5* entries in *z*. Save that array to the variable A16.

# Writeup problems

This section is worth 5 points.

You may want to start a new python script for the writeup portion of the assignment, or you may want to use a Jupyter notebook.

1. The following code will create a straight line. Copy it, save the plot, and add it to your writeup (**NOTE: You may not be able to copy and paste directly. Instead, just recreate this code**).

import numpy as np

import matplotlib.pyplot as plt x = np.arange(-5,5+0.5,0.5)

y = x plt.plot(x,y,color=’black’)

plt.plot(x,y,color=’blue’,marker=’o’)

plt.xlabel(’x’)

plt.ylabel(’y’) plt.show()

Chart, line chart

Description automatically generated

There is a strong positive linear relationship between the x and y variables.

Explain the connection between the blue circles in the plot and the black curve (e.g., how are they related?).

1. Create another figure similar to the previous figure except representing the function

*f* (*x*) = *x*2. Add a title to the figure explaining what is being plotted.

Chart, line chart

Description automatically generated