

HOMework 4

DUE Nov 4th 11.55pm 2018

(This HW covers Numpy)

(A single Jupyter Notebook or .PY to be submitted to Wolfware. Do not zip the files before submission. All of the solutions below must use the numpy package)

PART 1 - BASICS

- 1) Create one random integer array, aVec, containing 20 values ranging from 0 to 100. Generate a random float value, b, between 0 and 100. Find the index in aVec whose value is closest to b. Print also the value within aVec through the index.

Example

A = [46, 76, 74, 27, 6, 74, 53, 63, 86, 7, 77, 17, 72, 16, 61, 77, 25, 67, 18, 34]

b = 90.07

Index of A closest to b = 8

A[8] = 86

- 2) Write a Python program to create random vector with values between 0 and 1 of size 15 and replace the maximum value within it by -1.
- 3) Replace all the positions at which non-zeros exist in the given matrix, A to 555. The given 2D array is

A = [1 0 1 0 1 1 1 0 1 0 0

0 1 0 1 1 0 1 0 1 1 1

0 0 0 0 0 0 0 0 1 1 1]

- 4) Write a Python program to check if two randomly generated integer arrays ranging values from 1 to 10, of size 5 elements are equal or not. Report the output as an array, where each element in the first is compared to its corresponding value in the second vector.
- 5) Write a numpy program that creates a null 1D vector with random integer values ranging from 10 to 100 with 20 elements. Further, for each value that is below the mean of all the values in the vector, replace those values with 0.

- 6) Create a matrix of size 5, 5 with 100 on the border and -1 inside. For example, your output should look like:

```
[100 100 100 100 100
 100 -1   -1   -1  100
 100 -1   -1   -1  100
 100 -1   -1   -1  100
 100 100 100 100 100]
```

- 7) Write a numpy sequence of commands to normalize a randomly generated 10 x 10 random matrix, whose values range from 1 to 1000
- 8) Consider an elementary system of three linear equations: $x + 2y + z = 2$, $2x + 6y + z = 7$, $x + y + 4z = 3$, Solve for x, y and z using a python program
- 9) Write a Python program to convert cartesian coordinates to polar coordinates of a random integer 10x3 matrix representing cartesian coordinates 10 rows of x, y and z. The x, y and z range from 0 to 10.
- 10) Given a 1D array, A, negate all elements which are between 2 and 16 (inclusive), in a total of just 2 lines. (First line = define array; 2nd line= statement, 3rd line= print result)

```
a = [9, 10, 7, 1, 8, 9, 10, 14, 20, 11, 2, 1, 0, 23, 6, 8]
```

- 11) Find the cross product of the two vectors, a and transpose of b. i.e $a \times b^T$

```
a = [1, 2, 3] and b = [1, -1, 2]
```

- 12) Find the cross product of the two matrices, A X B

A = [-6 10 -3	B = [1, 2, 3
0 1 0	4, 5, 6
6 -10 5]	1, 2, 4]

- 13) Find the dot product of the two matrices

A = [-6 10 -3	B = [1, 2, 3
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0 1 0	4, 5, 6
6 -10 5]	1, 2, 4]

14) Replace all odd numbers in the given vector with 0 without changing the original vector

a = [3, 1, 2, 4, 9, 29, 11, 15, 32]

15) Find the common items between the vectors a and b

a = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]

b = [7, 2, 4, 6, 2, 1, 9, 10, 15, 20]

16) Randomly generate two objects. The first object is a 1D array, a vector v of 10 integer elements. Randomly generate a second 2D array, B, a matrix of 10 x 5 elements. Subtract the 1d array, v from the 2d array A, such that each item of v subtracts from respective column of A. The resulting matrix must still be of shape 10 x 5. The values in the vector range from (1,100)

17) A cleaning services company compiled the following data related to the annual profit of the firm to its annual Facebook advertising campaign (measured in thousands) as shown in the table below

Advertising Expenditure	12	14	17	21	26	30
Profit	60	70	90	100	100	120

a) Find the best least squares fit to the data in the form of a straight line given by $y = mx + c$ by writing a numpy program.

b) Plot the points and least square fit line using matplotlib.

c) Calculate the profit if the company allocates in its next FB campaign with a \$50,000 campaign. Report the value in \$ currency.