Dr. Sandro Andreotti

Programming for Data Science

Winter term 2023/2024

Assignment 7
Issued: 2023-10-25

1 The Border Array

Use NumPy to to add a border (filled with 0's) around an existing array. There is a NumPy function you can use which does exactly this (can you find it?). Implement your function once using this NumPy function and once using **only concatenation / stacking.**

Input:

```
[[ 1, 1, 1],
 [ 1, 1, 1],
 [ 1, 1, 1]]
```

Output

```
[[ 0, 0, 0, 0, 0],
 [ 0, 1, 1, 1, 0],
 [ 0, 1, 1, 1, 0],
 [ 0, 1, 1, 1, 0],
 [ 0, 0, 0, 0, 0]]
```

2 The Checkerboard

Use NumPy to to generate a NxN checkerboard matrix (see 4x4 example below) **using slicing.**

```
[[ 0, 1, 0, 1],
 [ 1, 0, 1, 0],
 [ 0, 1, 0, 1],
 [ 1, 0, 1, 0]]
```

3 Array Comparison

- Use NumPy to to test for each element of a 1-D array whether it is also present in a second array. There exists an NumPy function which does exactly this (can you find it?). Implement your function once using this NumPy function and once using only comparison operators and aggregators (e.g. any()). Do not use any loops!
- Adjust your function to return those elements present in both arrays. Again, there exists a single function... find it!

```
Input:
array([ 0, 10, 20, 40, 60])
array([ 0, 40])

Output:
array([ True, False, False,  True, False])
```

4 NumPy Mixed

Solve all these problems without ever performing a loop explicitly! For most of them there exists a matching NumPy Function!

a) Use NumPy toto sort along the *i*-th axis of an array.

b) Use NumPy to to sort the rows of you 2D array according to the i-th column.

c) Use NumPy to to remove single-dimensional entries from a specified shape (e.g. specified shape: (3, 1, 4) → (3, 4)).

d) Use NumPy to to create a 5x5 matrix with row values ranging from 0 to 4.

e) Use NumPy to to calculate the sum of all the multiples of 7 or 11 below 200.

f) Use NumPy to to join a sequence of arrays along a new axis.

g) Use NumPy to to get the row numbers in given array where at least one item is larger than a specified value.

h) Use NumPy to to partition a given array in a specified position and move all the smaller elements values to the left of the partition, and the remaining values to the right, in arbitrary order (based on random choice).

i) Use NumPy to to sort the n smallest elements of a given array (without sorting the complete array!).

j) (optional) Use NumPy to to compute a histogram for a given array using functions `linspace, searchsorted, unique`,