

Python Lab 6 Exercises

Numpy

Question 1. The libraries *random* and *numpy* are both able to generate pseudo-random numbers in Python. Compare the functions `random.randint()` and `numpy.random.randint()` giving their main differences.

Question 2. Consider the following Python code.

```
import numpy as np
# Prime numbers under 50
A = np.array([2,3,5,7,11,13,17,19,23,29,31,37,41,43,47])
```

Write additional Python code to do each of the following tasks (one line of code each).

- (a) Extract the second-to-last element of A.
- (b) Slice the first 5 elements from A.
- (c) Find how many unique values are in A.
- (d) Find the mean and standard deviation of values in A.
- (e) Create a numpy array the same dimensions as A but with every element 0.
- (f) Select from A the numbers that have right-most-digit of 3.

Question 3. Consider the following Python code.

```
import numpy as np
B = np.array([42, np.nan, 23])
```

- (a) What is the value `np.nan` often used to record in a dataset?

- (b) Write additional Python code to find the maximum value in `B` (excluding any `np.nan`).

Question 4. Write Python code using only `np.arange()` to create the two numpy arrays shown below.

```
array([ 1,  4,  7, 10])
array([10,  7,  4,  1])
```

Question 5. Consider the Python code given below. Briefly explain what `np.diff()` does and compare `len(A)` with `len(B)`.

```
A = np.array([2,3,5,7,11,13,17,19,23,29])
B = np.diff(A)
```

Question 6. The daily count of people receiving the first dose of a COVID-19 vaccine in the UK is recorded in the numpy array below. The first entry (145076) comes from Monday 11 January 2021 and the last entry (185900) comes from Sunday 28 February 2021.

```
vac = np.array([145076, 207661, 278943, 316694, 341317, 296131, 190107,
                204076, 343163, 363508, 409855, 478248, 491970, 220249,
                279757, 311060, 312378, 414419, 487756, 598389, 319038,
                350348, 374756, 469016, 480560, 494163, 549808, 278988,
                352480, 411812, 450810, 503116, 544603, 505362, 237962,
                275956, 364865, 482110, 452454, 371906, 334679, 141719,
                192341, 326692, 448962, 485720, 504493, 407503, 185900])
```

The Python code below draws a line plot, with every Monday daily count shown as a red dot.

```
plt.figure()
plt.plot(vac, 'b-')
index = np.arange(0, len(vac), 7)
plt.plot(index, vac[index], 'r.', markersize=12)
plt.show()
```

Now consider the Python code given below.

- (a) Describe the overall goal (or result) of the Python code below.
- (b) Explain what each of these five lines of Python code (individually) does to contribute towards this goal.

```
D = np.diff(vac)
M = np.diff(np.sign(D))
index = 1 + np.nonzero(M<0)[0]
plt.plot(index,vac[index],'g.',markersize=12)
G = np.diff(index)
```

Note that the data comes from: <https://coronavirus.data.gov.uk/details/vaccinations>