MR2020 (Autumn 2021) Midterm Practice/Review

1.   Suppose a bag contains 3 red balls, 2 blue balls, and 1 white ball. You want to estimate how many times you would pick each color ball if you pulled one ball from the bag at a time then immediately put it back and repeated that action 100,000 times. Write a python code that accomplishes this using a for loop. At the end, print the number of each color ball.

2.   What would the following return for the variable A?

```
>> A = 2
for i in range(5):
        A *= 2
```

3.   List each python operator and explain what it does.

4.   Write a Python comparison statement for each of the following English statements. You can assume that numpy was imported as np.

   a. A is not equal to B.

   b. X is greater than or equal to the mean of numpy array B.

c. X is equal to the maximum value in the second <u>row</u> of two-dimensional numpy array B.

d. A is less than B and B is less than C.

e. Either both A is equal to B and A is less than C or just A is greater than C.

5. Write a sample code that attempts to assign the variable A an array of zeros with the same dimensions of B; however, prints "This operation failed" if the variable assignment fails. Assume that numpy is already imported as np.

6. Generate a while loop that creates a random integer from 0 to 10, counts the number of times that the integer is 6, and stops only when the number of times the integer was 6 reaches 1000.

7.   Suppose you have the following arrays of data for temperature (T) and relative humidity (RH) and that numpy is imported as np.

>> T = 30*np.random.random(1000)+5   # degrees C
>> RH = 100*np.random.random(1000)   # %

Write a function that returns 1 if the temperature exceeds 20°C and RH exceeds 80% but returns 0 if that condition is not met.

Then, inside a for-loop that loops through each entry in the arrays T and RH, pass the values of T and RH to the function individually and at the conclusion of the for-loop, print the number of times that the above condition is met.

8. Define a class called Cloud that must initialized with the following attributes (with data type for each attribute in parentheses): base (float), height (float), width (float), raining (boolean). Give the class a method (function) that computes and prints the depth (height minus base) of the cloud.

9. Translate the following Python statements to written English.

    a. (A+B) < 2 and A >= 5

    b. A != B + 1

    c. if B < 5: B += 1

    d. A <= B or A == 0

    e. np.mean(A[:,0]) > B

10. For each separate, not related, problem, respond with what the following **bolded red** lines of code would return (or be evaluated as) in Python.

a. `[j for j in range(5)]`

b.
```
A = np.array([(2,3),(4,5)])
A[0,1]
```

c.
```
def C2F(tempC):
        import numpy as np

        return tempC*1.8 + 32

C2F(30)
```

d.
```
class Temperature:

        def __init__(self, temp, units):
            self.T = temp
            self.units = units

        def TtoC(self):
            if self.units == 'degF':
                return (self.T-32)/1.8

            elif self.units == 'degC':
                return self.T

            elif self.units == 'K':
                return self.T - 273.15

T = Temperature(50,'degF')
T.TtoC()
```

e.
```
weather =
{'temp':[43,45,47],'rain':['True','True','False']}
weather['temp'][2]
```

11. Write UNIX statements that do the following from a UNIX terminal.

    a. List all nonhidden files and directories at the path /home/MR2020/code

    b. Show the path to the current directory.

    c. Change a file called *data.dat* in your current path to a file called *data.txt*.

    d. Delete the file *olddata.nc4*.

    e. Go to your home directory.

    f. Go to the directory /home/MR2020/code.

12. Will the following lines or blocks of code cause an error? If so, why?

a.
```
[j for j in range(100):]
```

b.
```
A = 0
while A > 1:
     A -= 1
```

c.
```
def pythag(a,b):
     import numpy as np
     return np.sqrt(a**2+b**2)

C = pythag(2,3,4)
```

d.
```
def pythag(a,b):
     import numpy as np
     return np.sqrt(x**2+b**2)

C = pythag(2,3)
```

e.
```
people = {'name':['sally','jake'],'age':[42,35]}
```

13.   Suppose a few lists are defined as below.

```
temperature = [30,31,29,27,28]
salinity = [24,25,24,23,24]
wind = [10,8,5,14,4]
```

Using these lists, use one line of code to create a dictionary with variable name *ocean* that uses the following keys (*T*, *S*, and *W*) paired respectively with the lists *temperature*, *salinity*, and *wind* as corresponding values.

14.

    a. Write down the line of code that would recast an array A as a list.

    b. Write down the line of code that would recast a list A as a numpy array.