Homework 1

September 10, 2023

1 Problems

1. In lecture1 (see pages 14 & 15), we printed "My name is Alice and I am 30.". We used two variables name and age. Now, write a function `q1` so that it uses the `input` function to prompt user to input any name and age, and then it will print the greeting and return the name and age as a tuple. For example, below is an example of the execution trace of this function.

```
In [1]: q1()
please input your name: George
please input your age: 35
My name is George and I am 35.
Out[1]: ('George', 35)
```

2. Define a function `q2` that creates a dictionary `info` with the keys - 'name', 'age', and 'fruit'. Store the name and age obtained by calling `q1` under keys 'name' and 'age', respectively. Use `input` function to prompt user to input a list of fruits as a string and then parse the string into a list of strings (by calling the `split` method on the string) and store it in a variable called `fruit_list`. Now, store the `fruit_list` under the key 'fruit'. Finally, print each key and their values in the console using a for loop. For example, below is an example of the execution trace of this function.

```
In [2]: q2()
please input your name: George
please input your age: 35
My name is George and I am 35.

please input your favorite fruit: Apple Banana Peach

name: George
age: 35
fruit: ['Apple', 'Banana', 'Peach']
```

3. Consider the following code snippet -

```
import numpy as np
np.random.seed(1)

a = np.random.randint(0, 10, size=5) # Create 5 random integers
b = np.random.randint(0, 10, size=5) # Create 5 random intergers
```

Your task is to implement a function `q3` that prints `a` and `b`, and the numbers -

(a) that are common in both a and b

(b) that are in a, in b, or both in a and b

Here is an example run of the function.

```
In [3]: q3()
a = [5 8 9 5 0]
b = [0 1 7 6 9]
a intersect b = {0, 9}
a union b = {0, 1, 5, 6, 7, 8, 9}
```

4. Define a recursive function `q4` that returns the last row of a Pascal's Triangle. For example, `q4(0) = [1]`, `q4(1) = [1, 1]`, `q4(2) = [1, 2, 1]` and `q4(3) = [1, 3, 3, 1]`. The nth row has $n+1$ elements. Given the nth row r, we can compute the $n+1$th row r' with the equations:

```
r'(0) = 1
r'(i) = r(i-1) + r(i)  0 < i <= n
r'(n+1) = 1
```

`q4(n)` should call `q4(n-1)` and use the result to find the next row. `q4` should also print out the rows during the computation. Below is the example output of the function.

```
In [4]: q4(5)
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
Out[4]: [1, 5, 10, 10, 5, 1]
```