CS 237 Lab 1
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Sources:
http://matplotlib.org/api/pyplot_api.html
https://docs.python.org/2/library/random.html
http://stackoverflow.com/questions/477237/how-do-i-simulate-flip-of-biased-coin-in-python
Late Days Used: 0

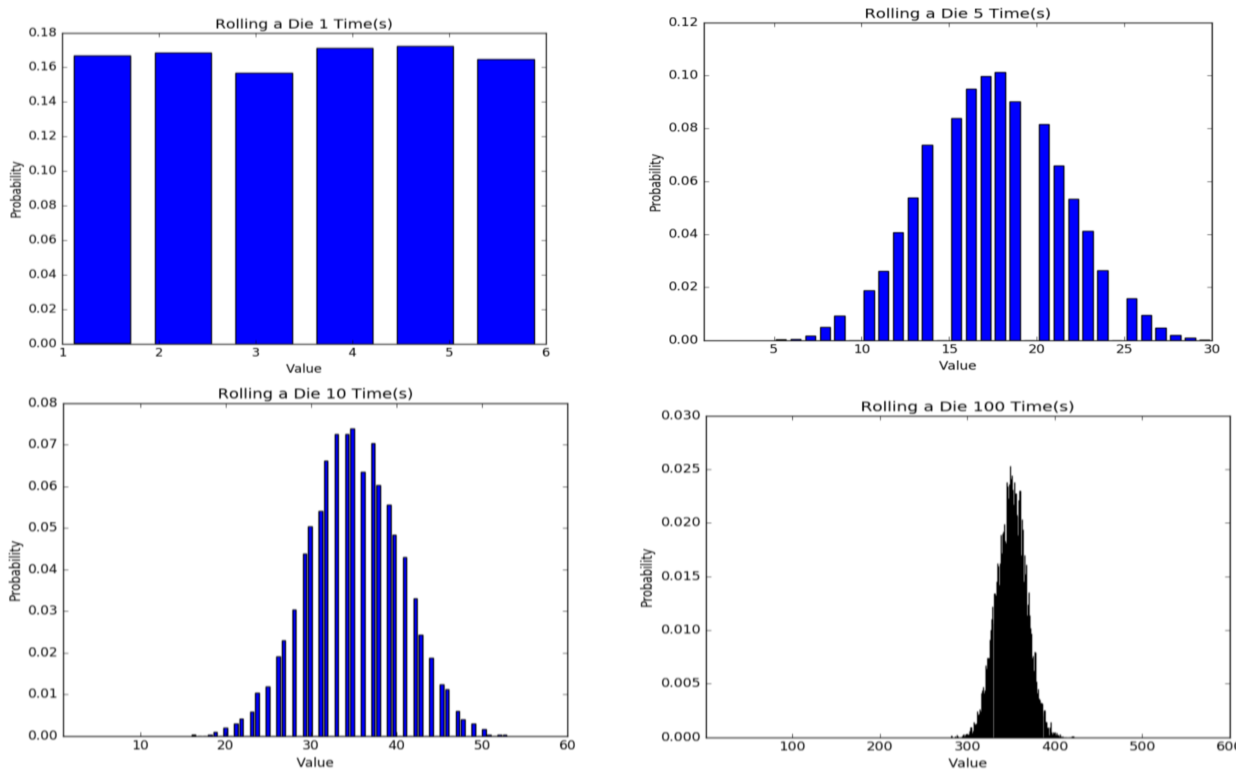
Part 1 – Python

Question 1

```
from matplotlib import pyplot as plt
import numpy as np

#this is the red dotted line
plt.figure(1)
x_coord = [1,2,3,4]
y_coord = [1,2,3,4]
plt.plot(x_coord, y_coord, marker = '', linestyle = ':', color = 'r')
plt.show()

#this is the blue triangle line
plt.figure(2)
x_coord1 = [1,2,3,4]
y_coord1 = [1,2,3,4]
plt.plot(x_coord1, y_coord1, marker = '^', linestyle = '-', color = 'b')
plt.show()
```

Question 2

```
#only my function, not the original

def dieroll(m):
    sum_list = [0 for x in range(10000)]
    for i in range(10000):
        roll_sum = 0
        for j in range(m):
            roll = random.choice(range(1,7))
            roll_sum += roll
        sum_list[i] = roll_sum

    plt.figure(1)
    plt.hist(sum_list, bins = 6*m, rwidth = .7, align = 'mid',\
    weights = np.zeros_like(sum_list) + 1. / len(sum_list))
    plt.xlim(1,6*m)
    plt.title("Rolling a Die " + str(m) + " Time(s)")
    plt.xlabel("Value")
    plt.ylabel("Probability")
    plt.show()
```

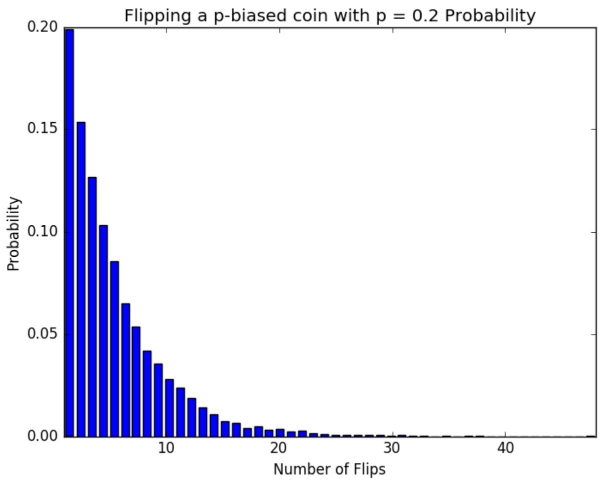


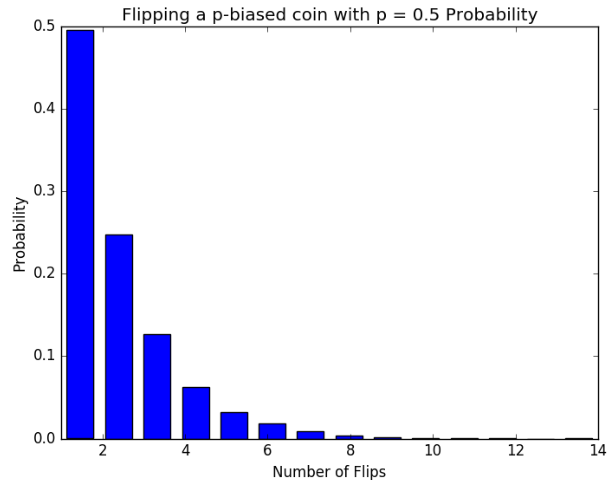
Question 3

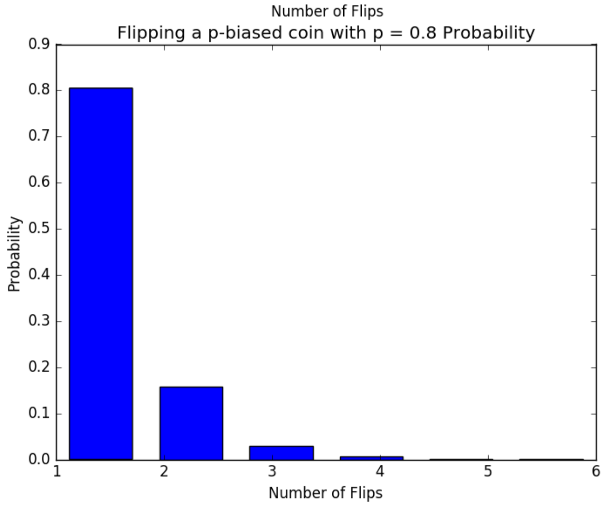
```
import random

#helper function to determine whether point is in circle
def draw_point():
    x = random.uniform(-1.0, 1.0)
    y = random.uniform(-1.0, 1.0)
    if ((x**2) + (y**2)) <= 1.0:
        return True
    else:
        return False


def pi_Estimate(n):
    T = 0.0
    C = 0.0
    for i in range(n):
        if draw_point() == True:
            C += 1
        T += 1
    estimate = 4*(C/T)
    print(C, 'points in the circle out of', T, 'total so pi is estimated to
       be', estimate)
    print estimate

pi_Estimate(100000)
```

Answer: You need 100,000 points to consistently see 3.14 as the value of pi.

Question 4





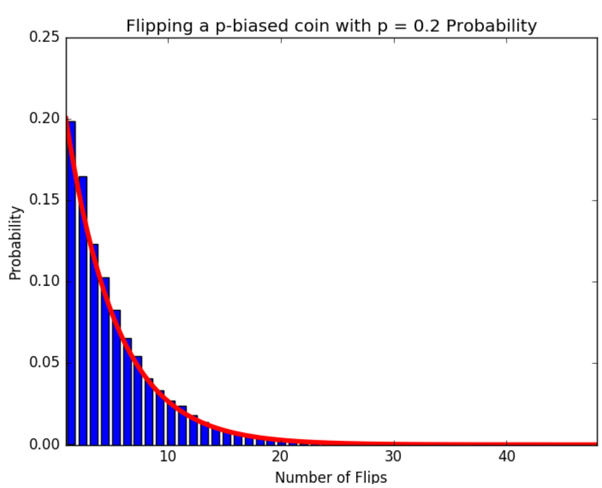


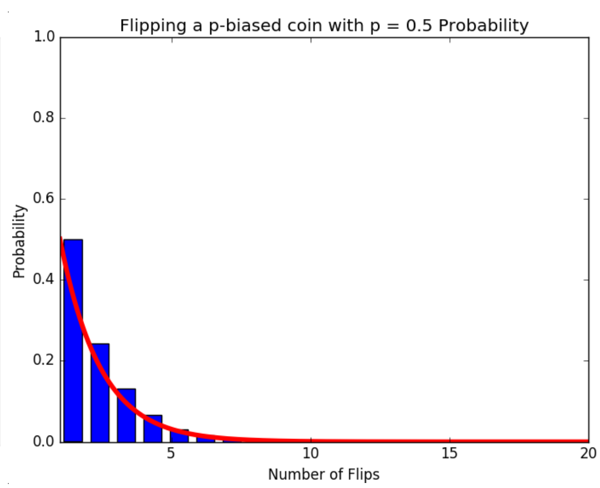
Question 5

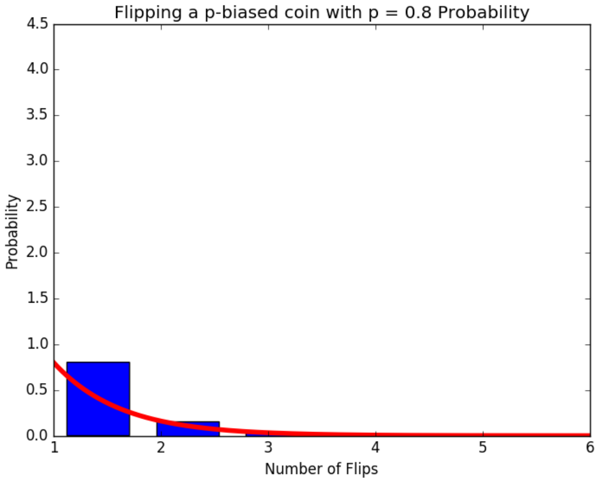
f(k,p) = p((1-p)^(k-1))

Question 6

```
import random
from matplotlib import pyplot as plt
import numpy as np

def expt(p):
    count = 0
    while True:
        choice = random.random()
        if choice < p:
            count+=1
        else:
            count+=1
            break
    return count


def Coin_flip_test(n,p):
    count_list = []
    for x in range(n):
        count_list += [expt(p)]
    return count_list


def plot_cft_pmf(n,p):
    count_list = Coin_flip_test(n,p)
    plt.figure(1)
    plt.hist(count_list, bins = max(count_list), rwidth = .7, align = 'mid',\
     weights = np.zeros_like(count_list) + 1. / len(count_list))
    plt.xlim(1,max(count_list))
    plt.title("Flipping a p-biased coin with p = " + str(p) + " Probability")
    plt.xlabel("Number of Flips")
    plt.ylabel("Probability")
    x = np.linspace(0, max(count_list), 10000)
    y = p*((1-p)**(x-1))
    plt.plot(x, y, linestyle = '-', color = 'r')
    plt.show()
```







Part 2 – R

Question 7

```
> grades <- read.csv('\\Users\\vid82\\OneDrive\\Documents\\CS\\CS237\\grades.
csv')

> View(grades)
   class1 class2 class3
1     3.3    3.3    2.7
2     2.7    3.7    2.3
3     3.7    3.0    4.0
4     2.3    3.7    2.7
5     4.0    2.3    3.7
6     3.3    3.7    3.3
7     3.3    3.3    2.0
8     3.0    3.0    3.3
9     3.0    2.7    2.3
10    3.7    4.0    3.0
11    4.0    3.7    3.3
12    3.3    3.0    2.3
13    2.7    3.3    3.0
14    2.7    3.7    3.3
15    3.7    3.7    3.7
16    4.0    2.3    3.7
17    3.3    2.7    3.0
18    3.3    3.0    2.3
19    3.0    3.0    2.7
20    3.7    3.3    2.7
21    4.0    3.7    4.0
22    3.3    3.7    2.3
23    3.7    4.0    3.0
24    4.0    3.3    2.0
25    3.7    2.7    4.0
26    4.0    2.0    3.3
27    3.0    2.3    3.0
28    2.3    2.7    3.3
29    2.3    3.0    3.7
30    4.0    3.0    2.0
31    2.7    3.7    2.0
32    3.7    3.0    3.7
33    3.3    3.0    2.3
34    4.0    4.0    2.3
35    3.7    3.0    3.7
36    4.0    2.3    3.3
```

```
37    3.3    3.3    2.0
38    3.7    2.7    3.0
39    3.0    3.0    3.3
40    3.7    3.0    3.0
41    3.7    3.0    3.0
42    2.3    3.7    4.0
43    4.0    3.0    2.7
44    4.0    3.3    3.7
45    3.0    3.3    2.7
46    3.0    3.3    3.0
47    4.0    2.3    3.7
48    3.3    2.3    3.3
49    3.0    3.3    4.0
50    3.0    3.7    3.3
51    4.0    4.0    3.7
52    3.7    3.0    3.0
53    3.7    3.3    2.7
54    3.7    3.0    4.0
55    4.0    3.0    2.0
56    2.7    2.3    4.0
57    3.3    3.0    2.0
```

Among the first ten students:

In class 1, 1 person got a 4.0
In class 2, 1 person got a 4.0
In class 3, 1 person got a 4.0

Question 8

```
> summary(grades)
     class1          class2             class3    
 Min.   :2.3   Min.   :2.000   Min.   :2.00  
 1st Qu.:3.0   1st Qu.:3.000   1st Qu.:2.70  
 Median :3.3   Median :3.000   Median :3.00  
 Mean   :3.4   Mean   :3.133   Mean   :3.04  
 3rd Qu.:3.7   3rd Qu.:3.700   3rd Qu.:3.70  
 Max.   :4.0   Max.   :4.000   Max.   :4.00  
```

The statistics provided are the minimum GPA, the first quartile, the median, the mean, the third quartile, and the maximum GPA.

Question 9

```
> sd(grades$class1)
[1] 0.5199588
> sd(grades$class2)
[1] 0.5043855
> sd(grades$class3)
[1] 0.6447202
```

Question 10

```
> boxplot(grades)
```

The line inside the box mean.
The line on top of the box is the upper quartile.
The line on the bottom of the box is the lower quartile.
50% of the of the observations are in the box.

Question 11

```
> table(grades$class1)

2.3 2.7   3 3.3 3.7   4 
  4   5   9  11  14  14 
> table(grades$class2)

  2 2.3 2.7   3 3.3 3.7   4 
  1   7   5  18  11  11   4 
> table(grades$class3)

  2 2.3 2.7   3 3.3 3.7   4 
  7   7   7  10  10   9   7 
> pmf1 <- table(grades$class1)
> pmf2 <- table(grades$class2)
> pmf3 <- table(grades$class3)
> plot(pmf1/57)
> plot(pmf2/57)
> plot(pmf3/57)
```