

hw1

September 24, 2020

```
[3]: import math
import matplotlib.pyplot as plt
import random
```

Problem 1.6

(a) Yes, it looks quit uniform to me

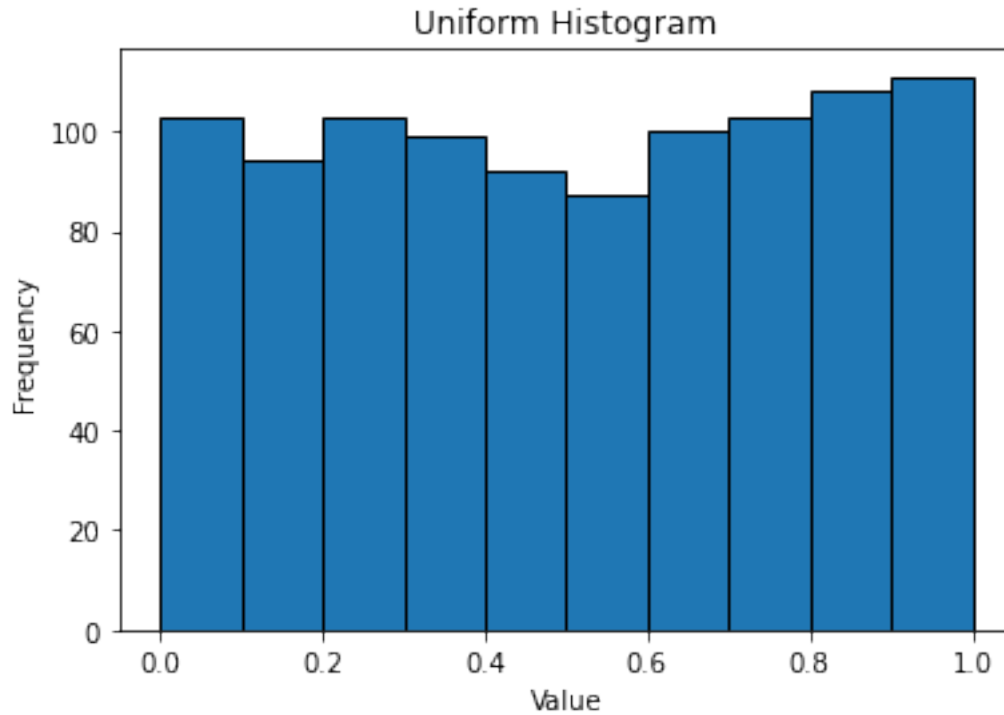
```
[12]: #(a)

N = 1000
histogram_interval = 0.1

sample = []
interval_num = math.floor(1/histogram_interval)
interval_count = [0] * interval_num

for i in range(N):
    temp = random.random()
    sample.append(temp)
    interval_count[math.floor(temp/histogram_interval)] += 1
```

```
[13]: plt.hist(sample, edgecolor = 'black')
plt.title("Uniform Histogram")
plt.xlabel("Value")
plt.ylabel("Frequency")
plt.show()
```

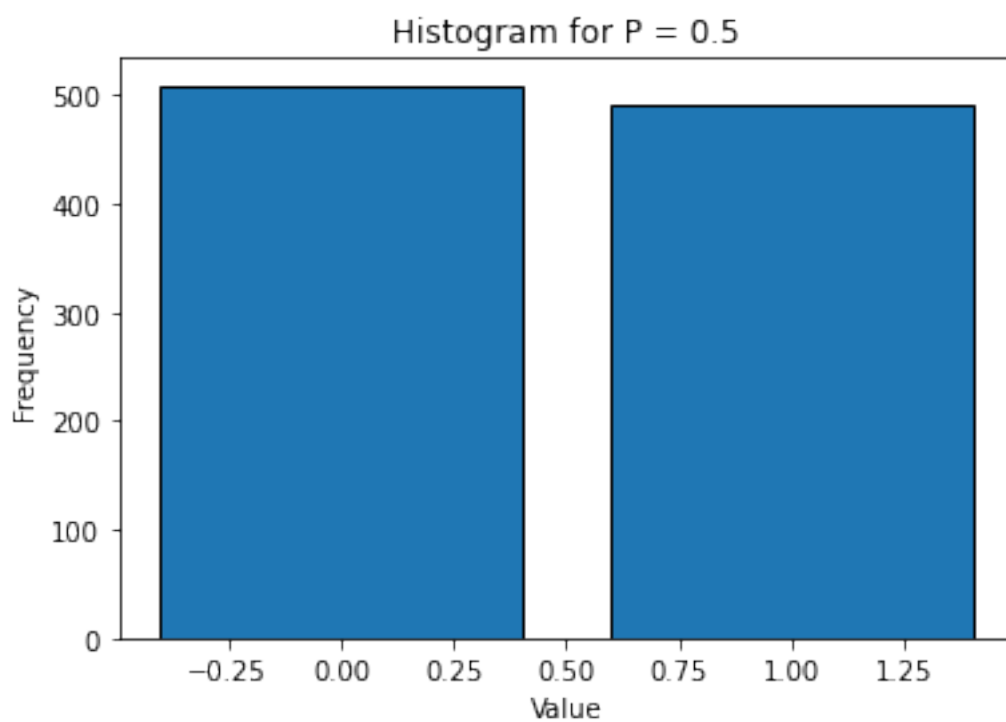
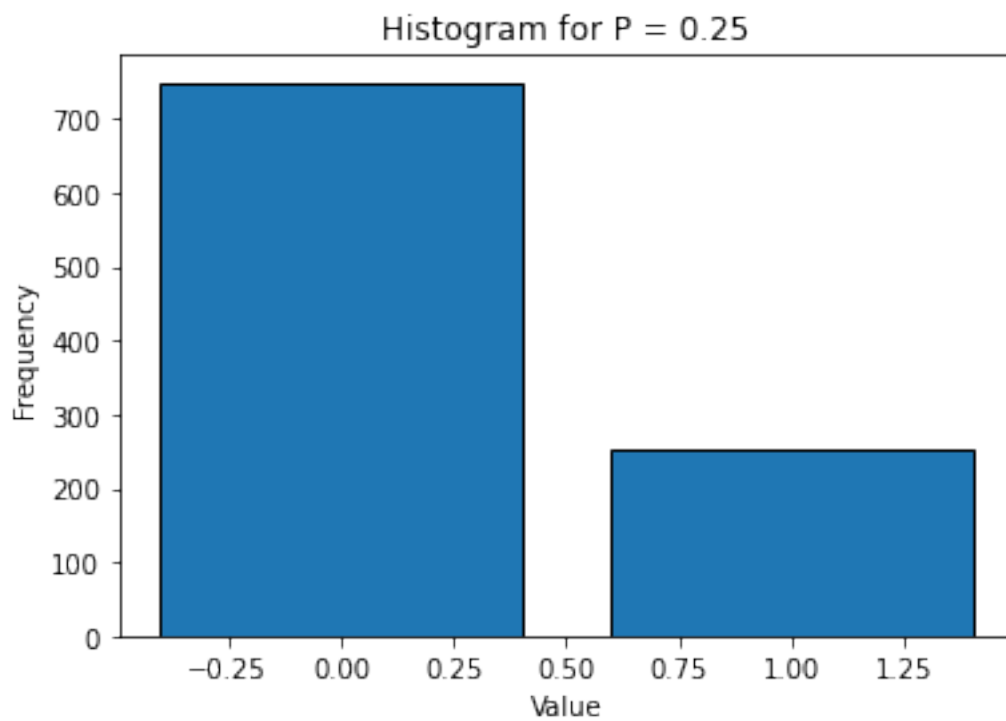


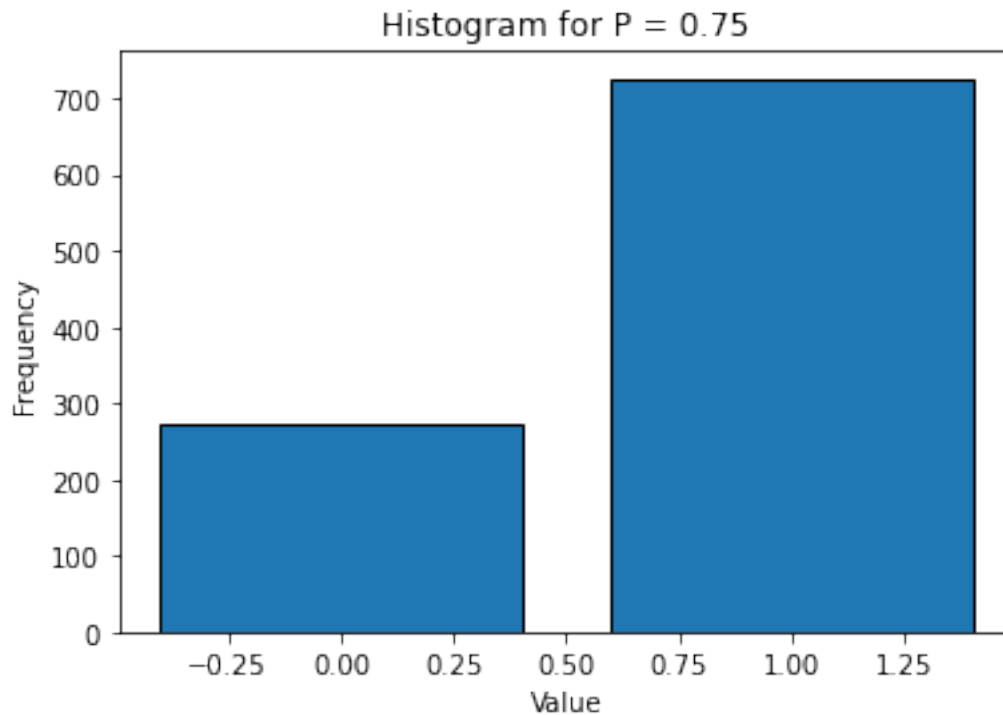
(b) I think it would be a bernoulli distribution where p of the samples would be 1, and $(1-p)$ of them will be 0.

(c) Yes, they match the distribution of my answer.

```
[15]: #(c)

P = [1/4,1/2,3/4]
for p in P:
    temp = []
    for i in range(N):
        if sample[i] <= p:
            temp.append(1)
        else:
            temp.append(0)
    plt.bar([0,1],[N-sum(temp),sum(temp)],edgecolor = 'black')
    plt.title("Histogram for P = "+str(p))
    plt.xlabel("Value")
    plt.ylabel("Frequency")
    plt.show()
```





(d) It would be a Binomial distribution, where the sum will be centered at lower number if p is smaller, and centered at higher number if p is higher.

(e) Yes, they match the distribution of my answer.

```
[16]: #(e)

batch_size = 10

batch_num = math.ceil(N/batch_size)

sum_distribution = []

P = [1/4, 1/2, 3/4]
for p in P:
    sum_distribution = []
    temp = []
    for i in range(N):
        if sample[i] <= p:
            temp.append(1)
        else:
            temp.append(0)
```

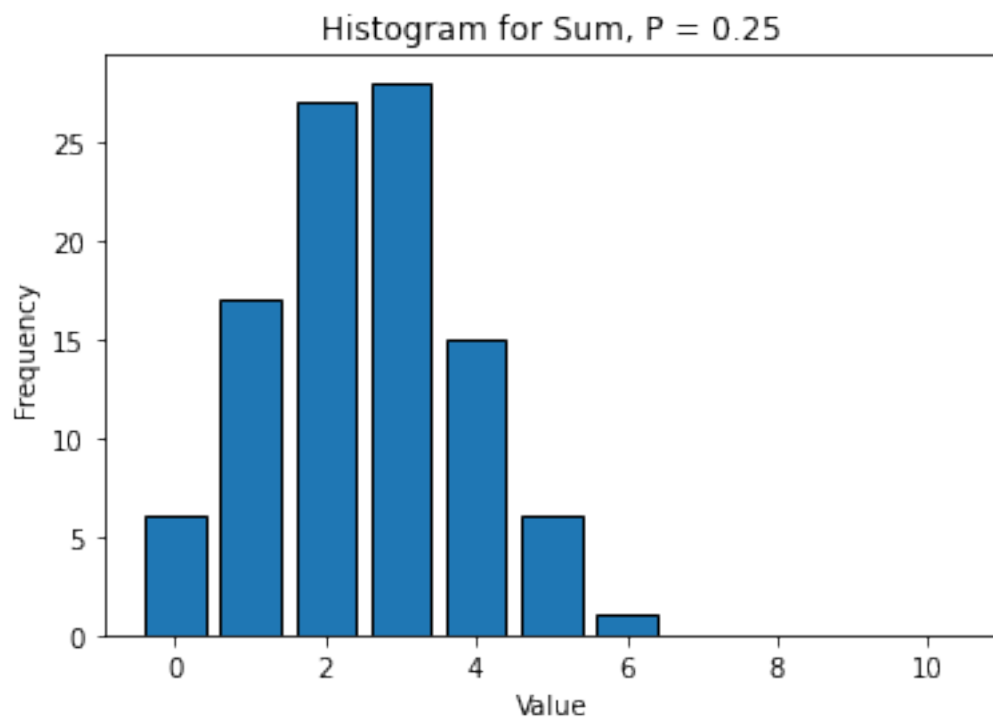
```

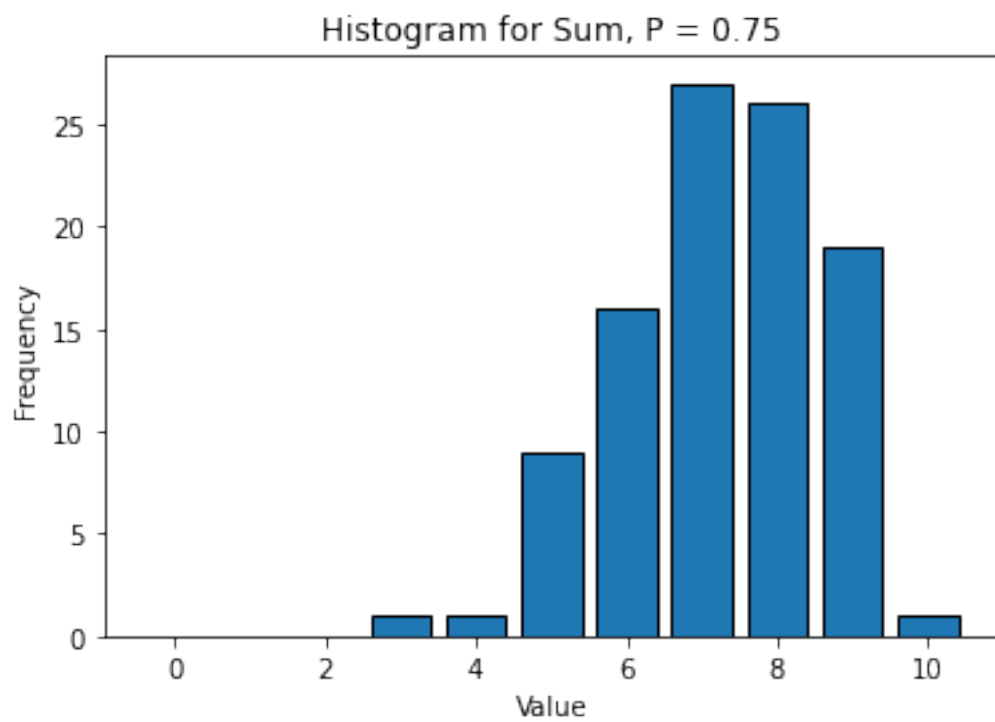
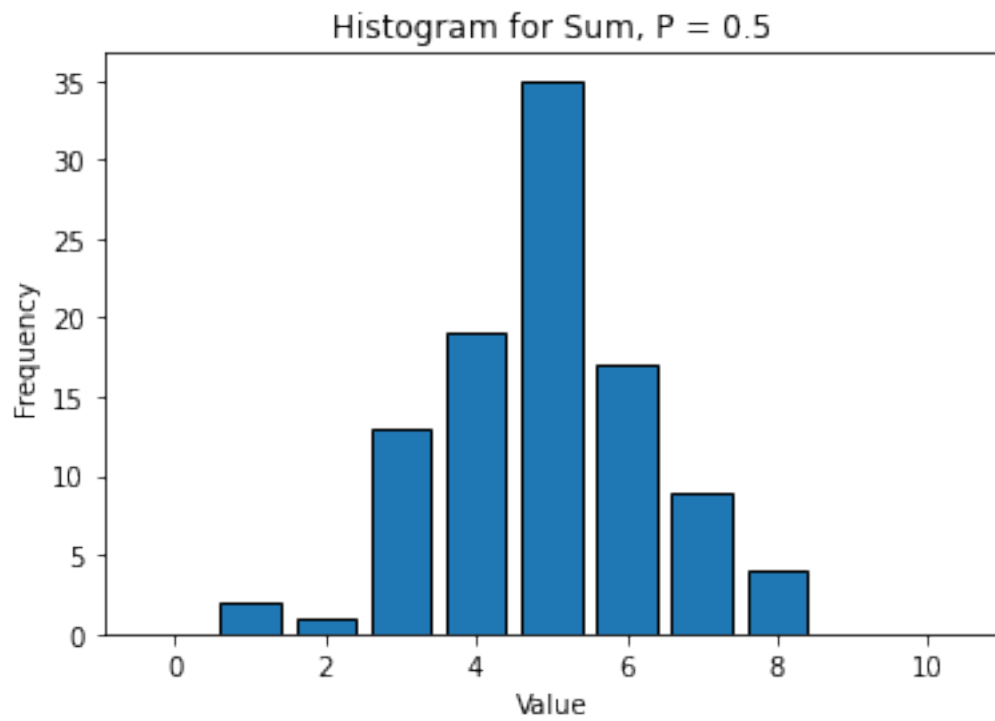
for k in range(batch_num):
    batch = temp[batch_size*k:batch_size*(k+1)]
    sum_distribution.append(sum(batch))

#x_axis= [0,1,2,3,4,5,6,7,8,9,10]
x_axis= list(range(0,batch_size+1))
bar_dist = [0]*(batch_size+1)
#bar_dist = [0]*11
for i in sum_distribution:
    bar_dist[i] += 1

plt.bar(x_axis,bar_dist,edgecolor = 'black')
plt.title("Histogram for Sum, P = "+str(p))
plt.xlabel("Value")
plt.ylabel("Frequency")
plt.show()
plt.clf()

```





<Figure size 432x288 with 0 Axes>