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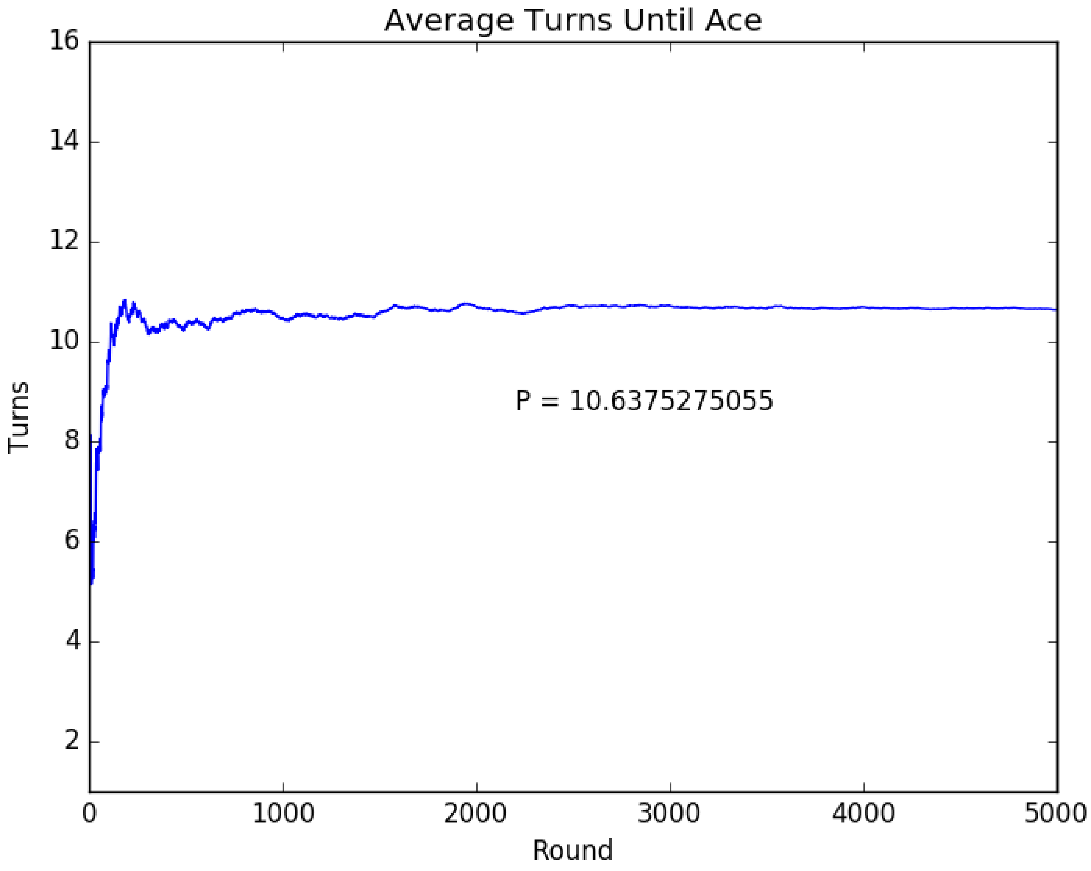
EE 380

Lab 2

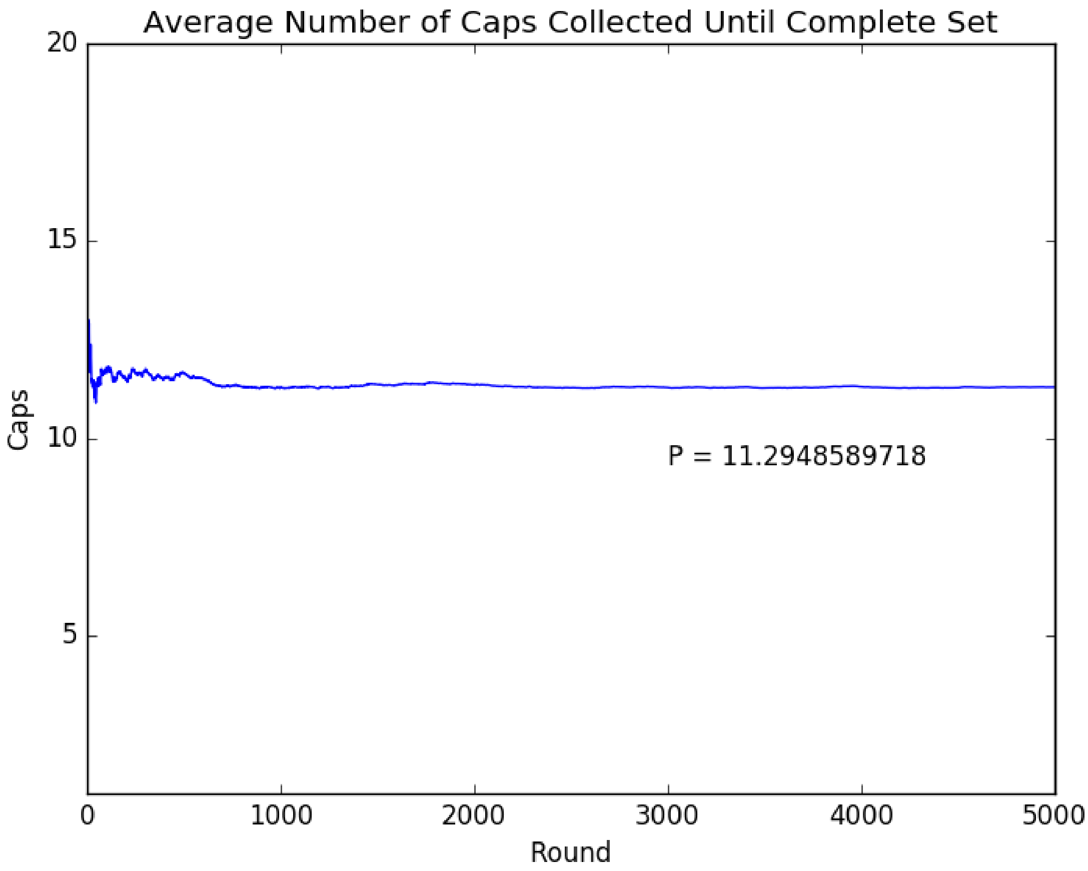
Problem 1:



```
import numpy as np

import matplotlib.pyplot as plt

import math


rounds = 5000


deck = np.arange(1,53)

foundAtArray = np.zeros(rounds)
```

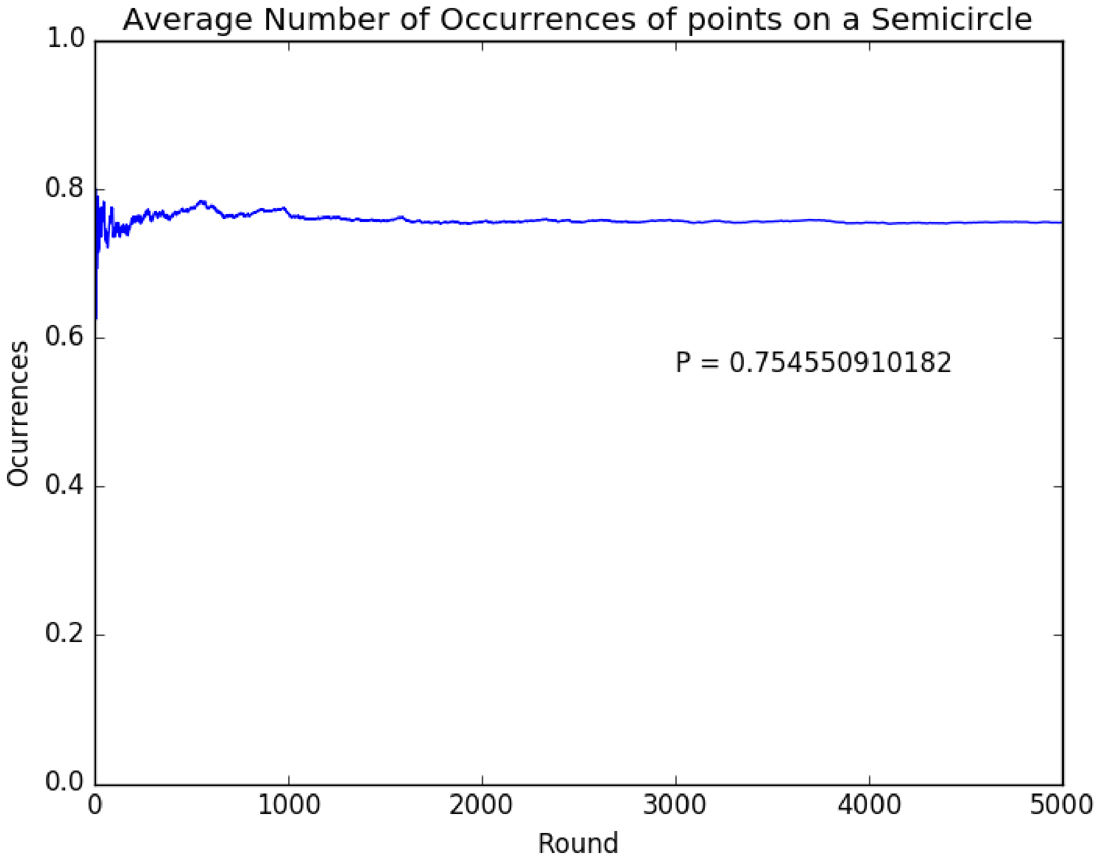
```
foundAt = 0


for i in range(1, rounds):
    deck = np.random.permutation(deck)
    for j in range(52):
        foundAt = foundAt + 1
        if(deck[j] % 13 == 0):
            break
    foundAtArray[i] = foundAt/i


plt.plot(foundAtArray)
plt.title("Average Turns Until Ace")
plt.xlabel("Round")
plt.ylabel("Turns")
plt.axis([1,rounds,1, int(math.ceil(foundAtArray[rounds-1]) + 5)])
plt.annotate("P = " +  str(foundAtArray[rounds -1]), xy = (rounds - 2800, foundAtArray[rounds - 1] -2 ))
plt.show()
```

Problem 2:



```
import numpy as np

import matplotlib.pyplot as plt

import math


rounds = 5000

complete = False

collection = np.zeros(5)

capsCollected = 0

AvgCapsUntilComplete = np.zeros(rounds)

count = 0


for i in range(1,rounds):
    for j in range(5):
        collection[j] = 0
    while(True):
        count = 0
        cap = np.random.randint(0,5)
        capsCollected = capsCollected + 1
        collection[cap] = 1
        for k in range(5):
            count =  count + collection[k]
        if(count == 5):
            break
    AvgCapsUntilComplete[i] = capsCollected / i

plt.plot(AvgCapsUntilComplete)
plt.title("Average Number of Caps Collected Until Complete Set")
plt.xlabel("Round")
plt.ylabel("Caps")
plt.axis([1,rounds,1, 20])


plt.annotate("P = " +  str(AvgCapsUntilComplete[rounds -1]), xy = (rounds - 2000,
AvgCapsUntilComplete[rounds - 1] -2 ))
plt.show()
```

Problem 3:



```
import numpy as np
import matplotlib.pyplot as plt
import math
import numpy as np

rounds = 5000
avg = np.zeros(rounds)
inSemi = 0

p = np.zeros(3)
for i in range(1, rounds):
    for j in range(3):
        p[j] = np.random.random() * 2 * 180


    p = np.sort(p)
    if(p[1] - p[0] == 180):
        inSemi = inSemi + 1
    else:
        if(p[1] - p[0] <= 180):
            delta1 = p[1] -p[0]
            if(p[0] - p[2] + 360 + delta1 <= 180 or p[2]- p[1] + delta1 <= 180):
                inSemi = inSemi + 1
        else:
            inSemi = inSemi + 1
    avg[i] = inSemi / i


plt.plot(avg)
plt.title("Average Number of Occurrences of points on a Semicircle");
plt.xlabel("Round")
plt.ylabel("Ocurrences")
plt.annotate("P = " +  str(avg[rounds -1]), xy = (rounds - 2000, avg[rounds - 1] - .2))
plt.show()
```