In [1]:
```
# Tejas Acharya
# EE-541
# Homework 01
# Problem 01
```

In [2]:
```
#Importing Libraries
import random
import matplotlib.pyplot as plt
```

In [3]:
```
#Constants
PROBABILITY_OF_SUCCESS = 0.7
MIN = 0
MAX = 1
```

In [4]:
```
def bernoulli_trial():
    random_num = random.uniform(MIN, MAX) * 100
    trial = 1 if (random_num < (PROBABILITY_OF_SUCCESS * 100)) else 0
    return trial
```

In [5]:
```
def coin_toss(num_flips):
    trials = [bernoulli_trial() for i in range(num_flips)]
    num_heads = sum(trials)

    longest_run = 0
    current_run = 0

    for j in trials:
        if j == 1:
            current_run += 1
        else:
            longest_run = max(current_run, longest_run)
            current_run = 0

    return (num_heads, longest_run)
```

(a)

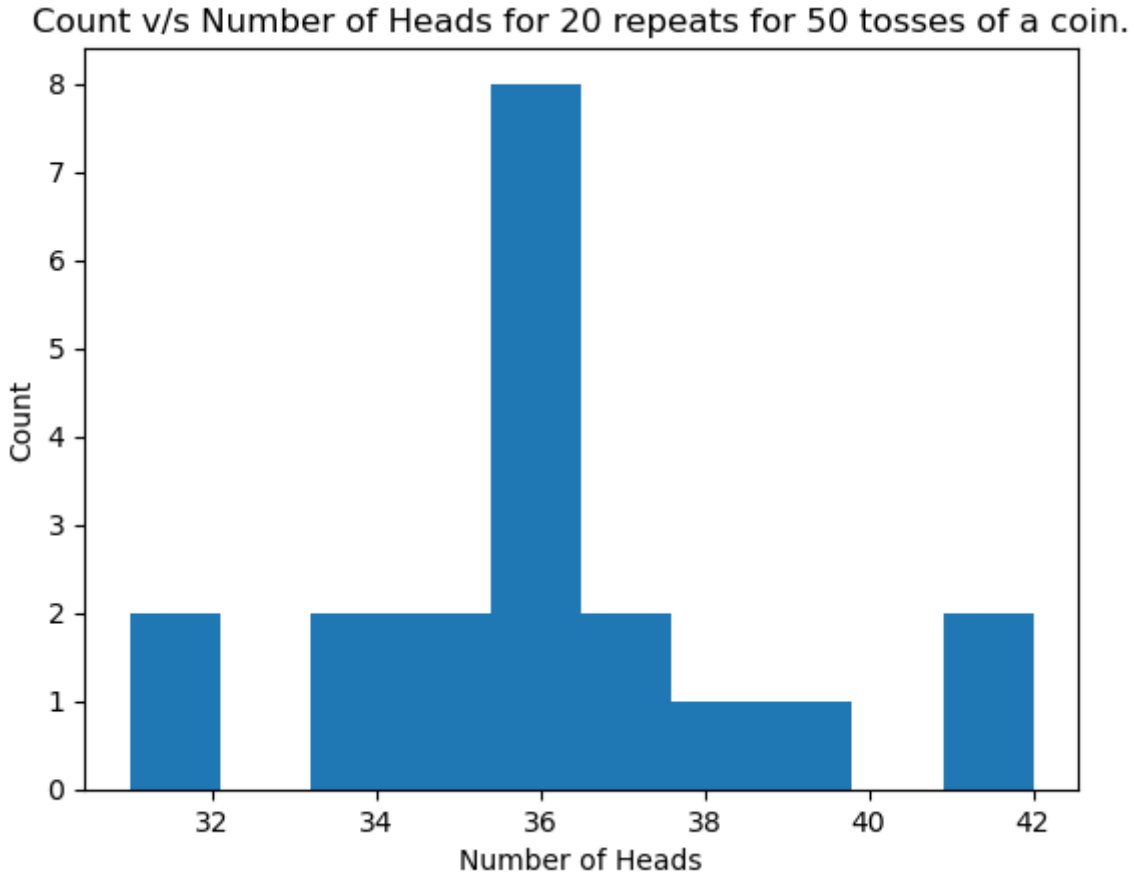
In [6]:
```
num_flips = 50
num_heads, longest_run = coin_toss(num_flips)
print(f'Number of Heads = {num_heads}, Longest Run of Heads = {longest_run}
```

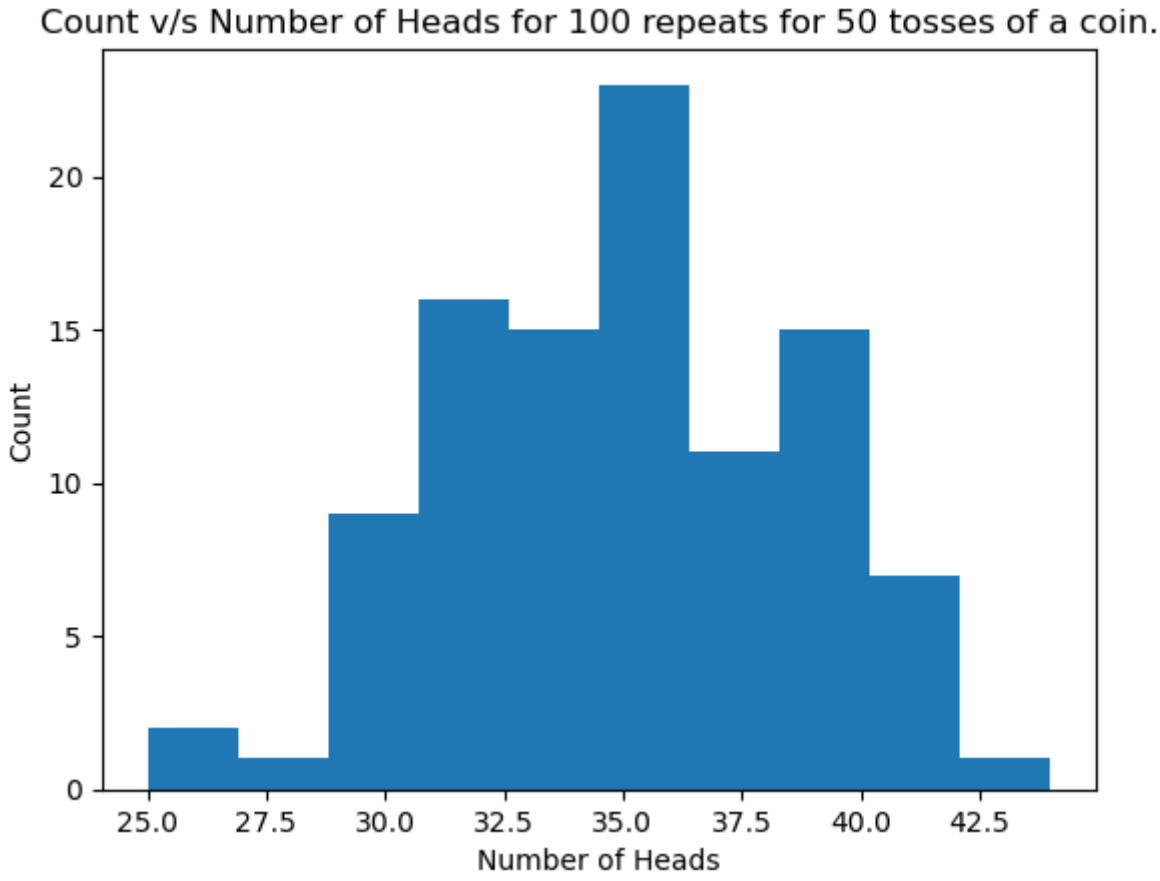
```
Number of Heads = 28, Longest Run of Heads = 6 for 50 tosses of a coin.
```

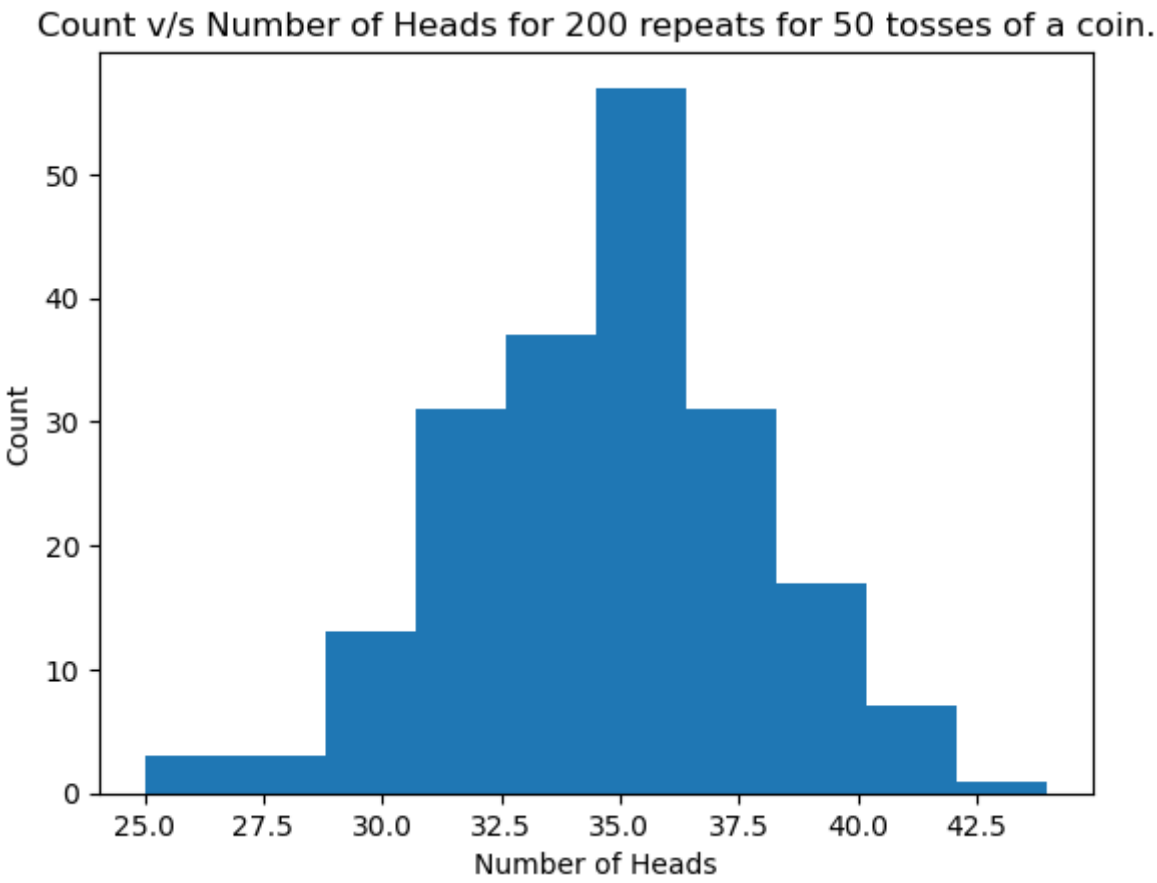
In [7]:
```
repeats = [20, 100, 200, 1000]
num_heads_list = []
```

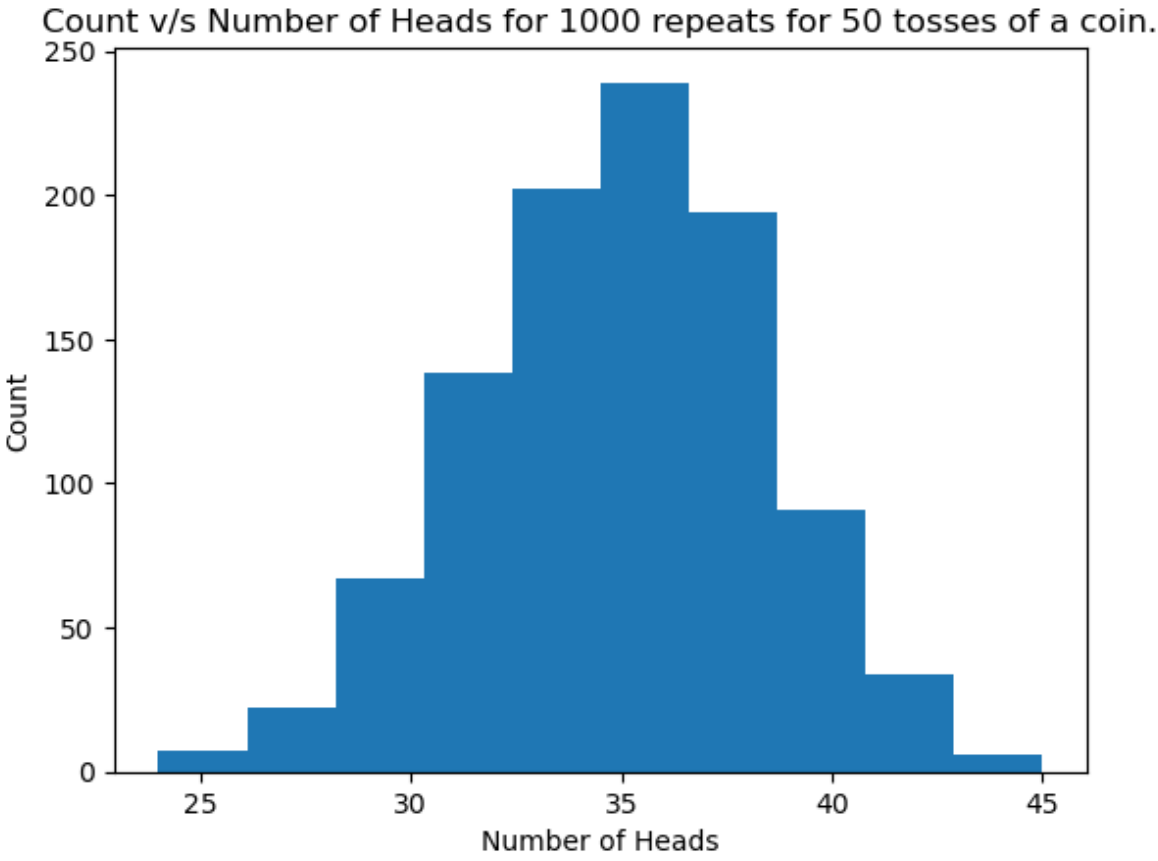
In [8]:
```
for i in repeats:
    num_head_list = []
    for j in range(i):
        head, _ = coin_toss(num_flips)
        num_head_list.append(head)
    num_heads_list.append(num_head_list)

for k in range(len(repeats)):
    plt.figure()
    plt.hist(num_heads_list[k])
    plt.xlabel('Number of Heads')
    plt.ylabel('Count')
```

```
    plt.title(f'Count v/s Number of Heads for {repeats[k]} repeats for {num
    plt.show()
```







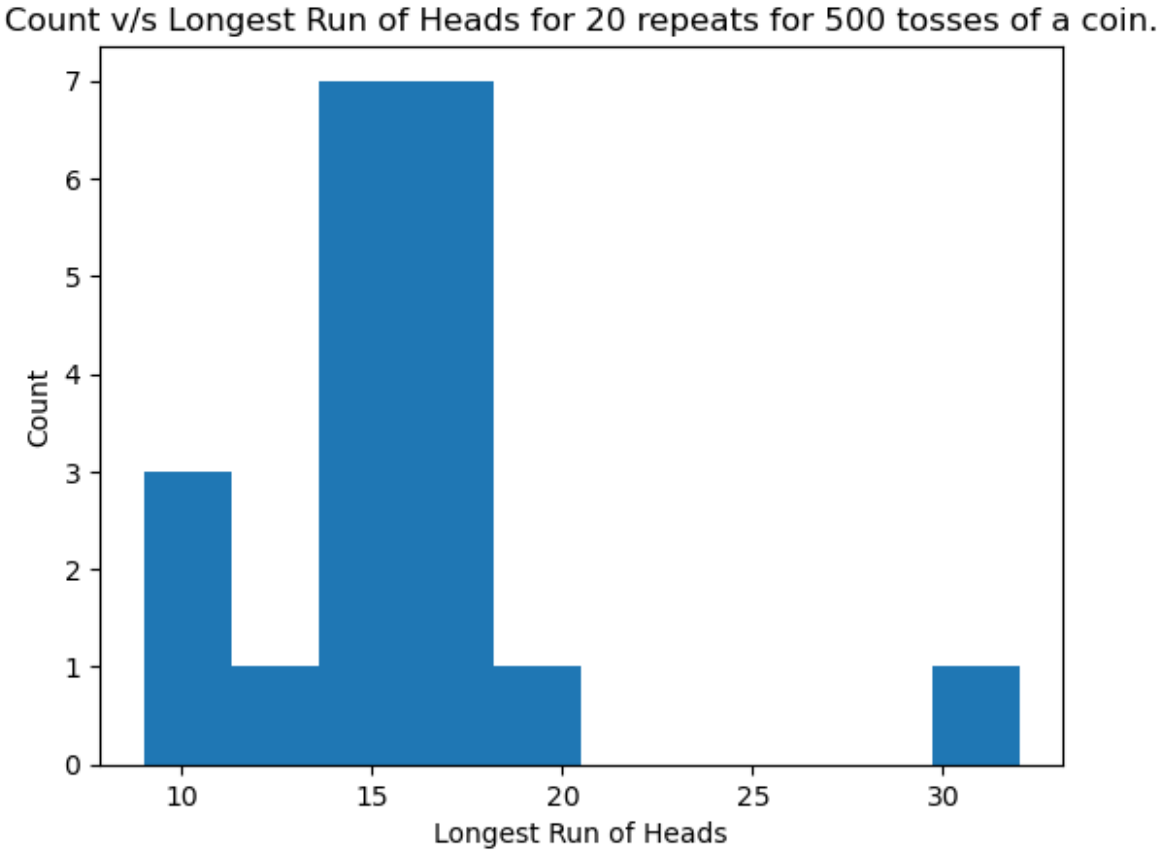


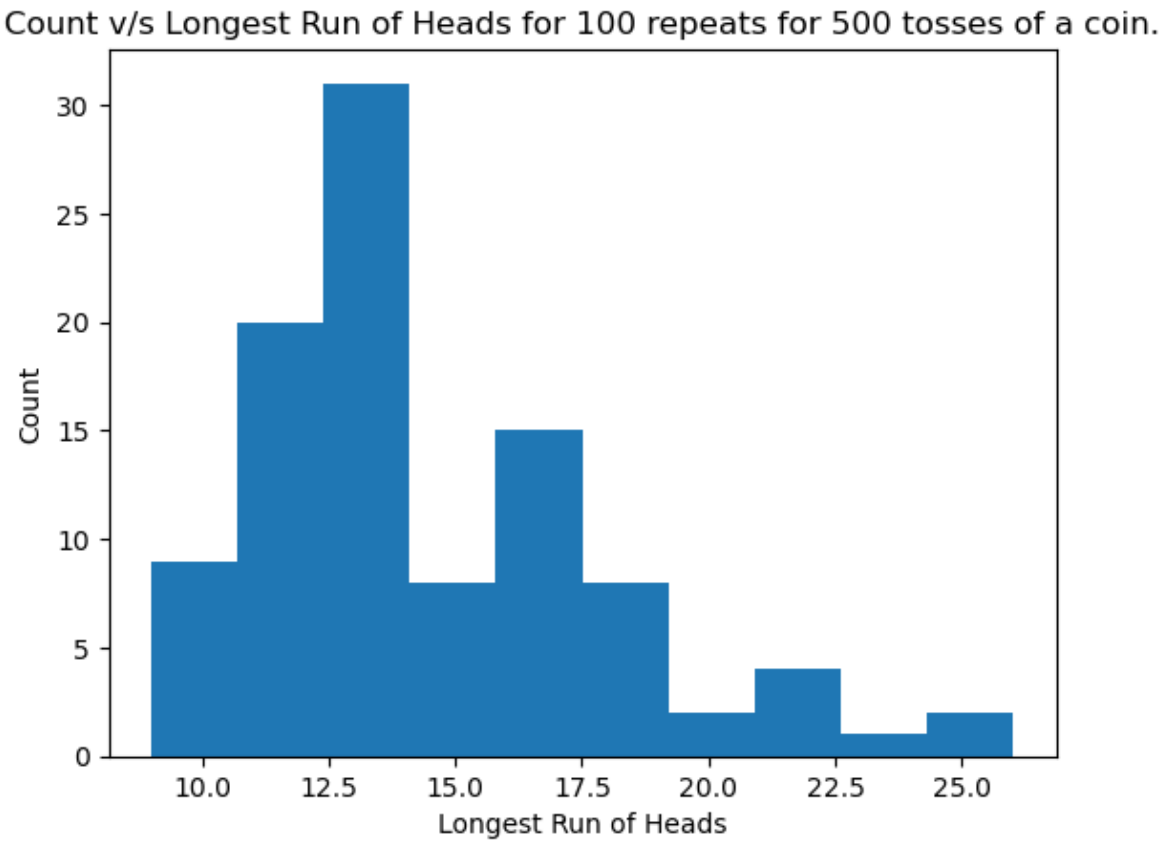
In [9]:
```
print('The x-limit of the Histogram is from 22 to 45.')
```

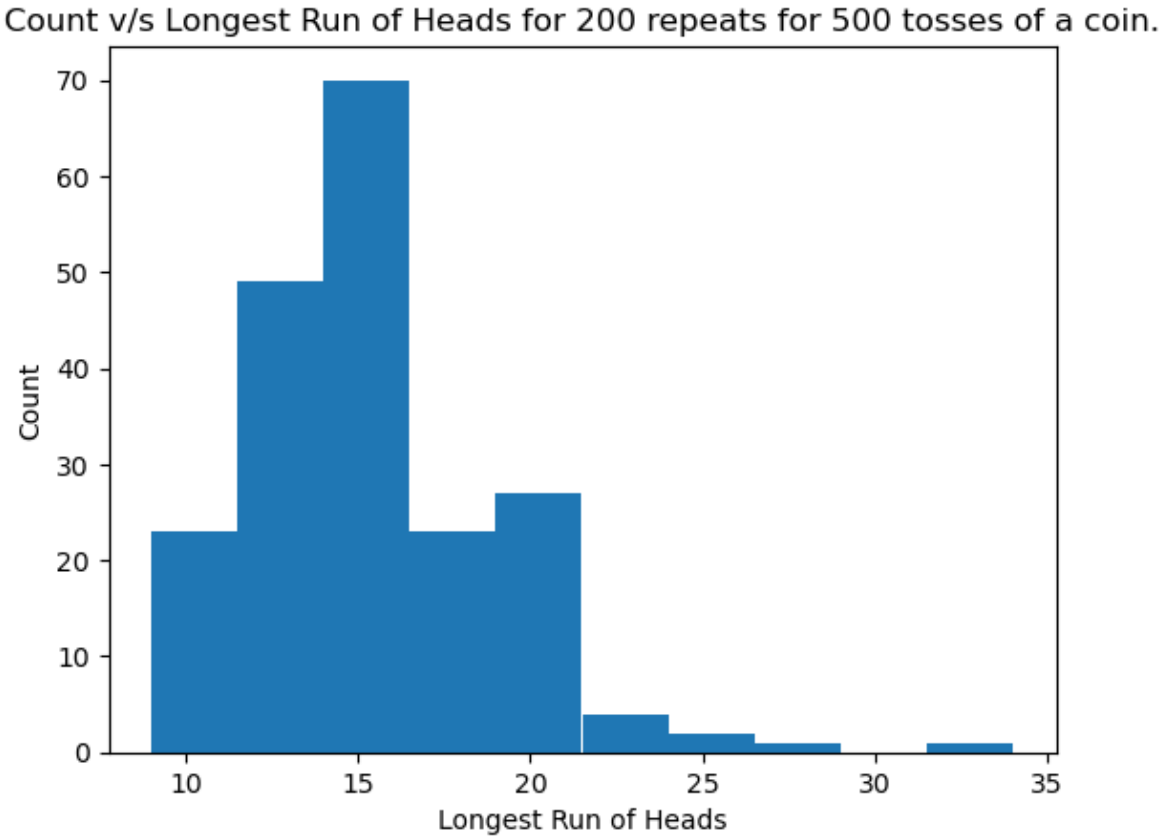
```
The x-limit of the Histogram is from 22 to 45.
```

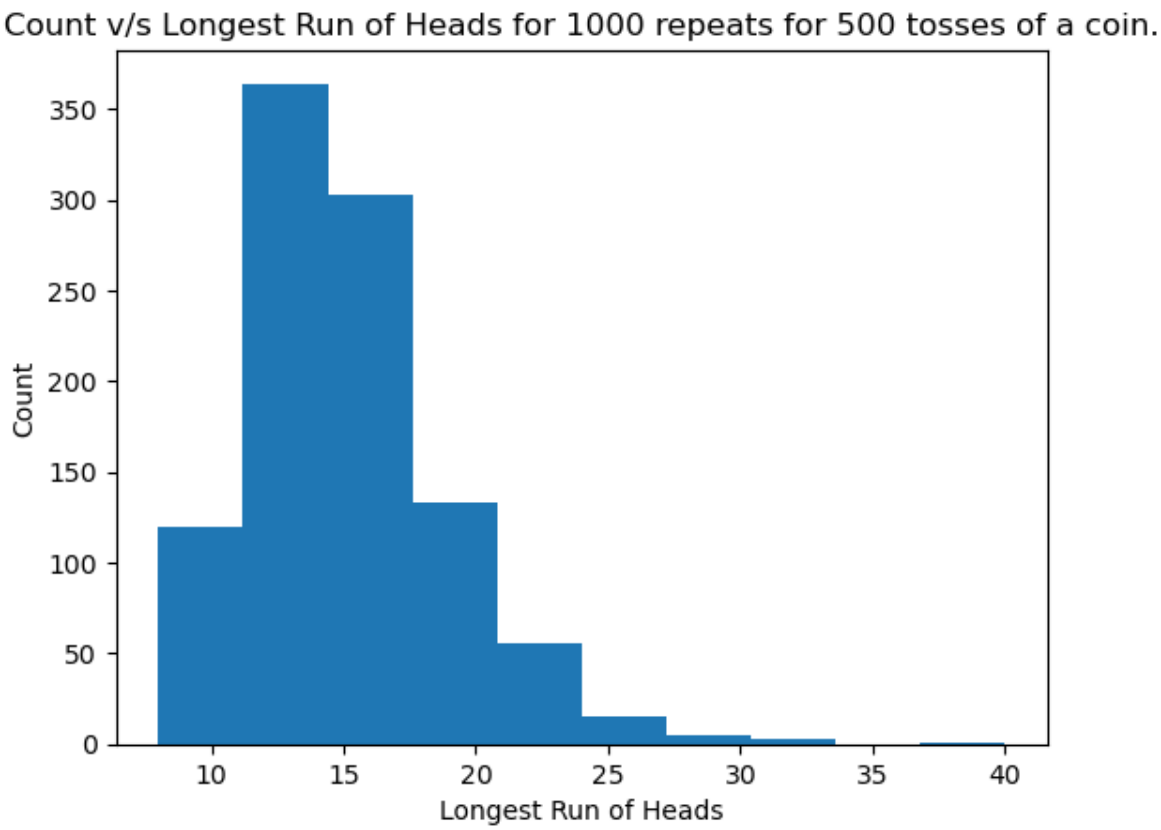
(b)

In [10]:
```
num_flips = 500
heads_run_list = []

for i in repeats:
    heads_run = []
    for j in range(i):
        _, run = coin_toss(num_flips)
        heads_run.append(run)
    heads_run_list.append(heads_run)

for k in range(len(repeats)):
    plt.figure()
    plt.hist(heads_run_list[k])
    plt.xlabel('Longest Run of Heads')
    plt.ylabel('Count')
    plt.title(f'Count v/s Longest Run of Heads for {repeats[k]} repeats for
    plt.show()
```




Count v/s Longest Run of Heads for 100 repeats for 500 tosses of a coin.
Count
Longest Run of Heads
0
5
10
15
20
25
30
10.0
12.5
15.0
17.5
20.0
22.5
25.0


Count v/s Longest Run of Heads for 200 repeats for 500 tosses of a coin.
Count
Longest Run of Heads
0
10
20
30
40
50
60
70
10
15
20
25
30
35


Count v/s Longest Run of Heads for 1000 repeats for 500 tosses of a coin.
Count
0
50
100
150
200
250
300
350
10
15
20
25
30
35
40
Longest Run of Heads