

Homework #1 – Tools and Fundamentals

Problem 1(b)

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In [1]: # Imports
import random
import matplotlib.pyplot as plt
```

```
In [2]: # Constants
P_HEAD = 0.7
```

```
In [3]: def is_head():
    return random.uniform(0, 1) < P_HEAD
```

```
In [4]: def get_trials(num_trials):
    return [is_head() for i in range(num_trials)]
```

```
In [5]: def get_longest_run_heads(trials):
    max_run = 0
    curr_run = 1 if trials[0] else 0

    for i in range(1, len(trials)):
        if trials[i]:
            if trials[i] == trials[i - 1]:
                curr_run += 1
            else:
                curr_run = 1
        else:
            max_run = max(max_run, curr_run)
            curr_run = 0
    return max_run
```

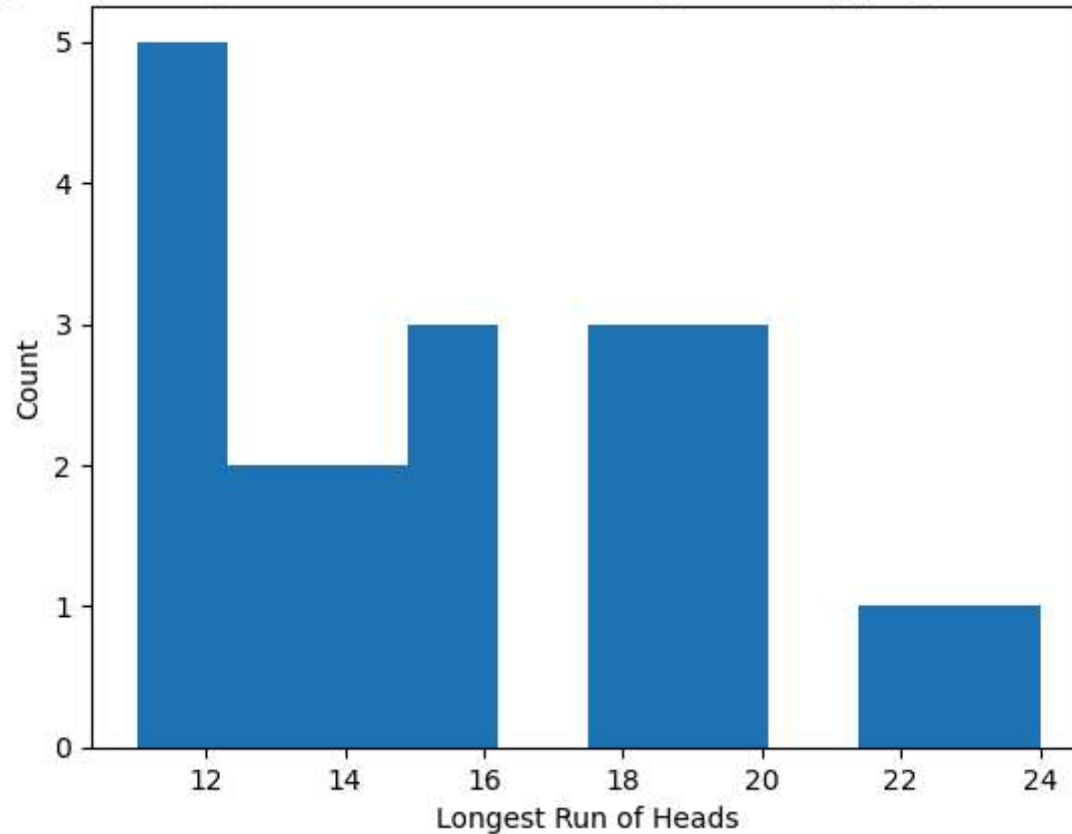
```
In [6]: num_trials = 500
```

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In [7]: num_repeats = 20
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```
longest_heads_run_list = [get_longest_run_heads(get_trials(num_trials)) for i in range(num_repeats)]

plt.figure()
plt.hist(longest_heads_run_list)
plt.xlabel("Longest Run of Heads")
plt.ylabel("Count")
plt.title(f"Histogram of Longest Run of Heads for {num_repeats} repeats of flipping the coin {num_trials} times")
plt.show()
```

Histogram of Longest Run of Heads for 20 repeats of flipping the coin 500 times

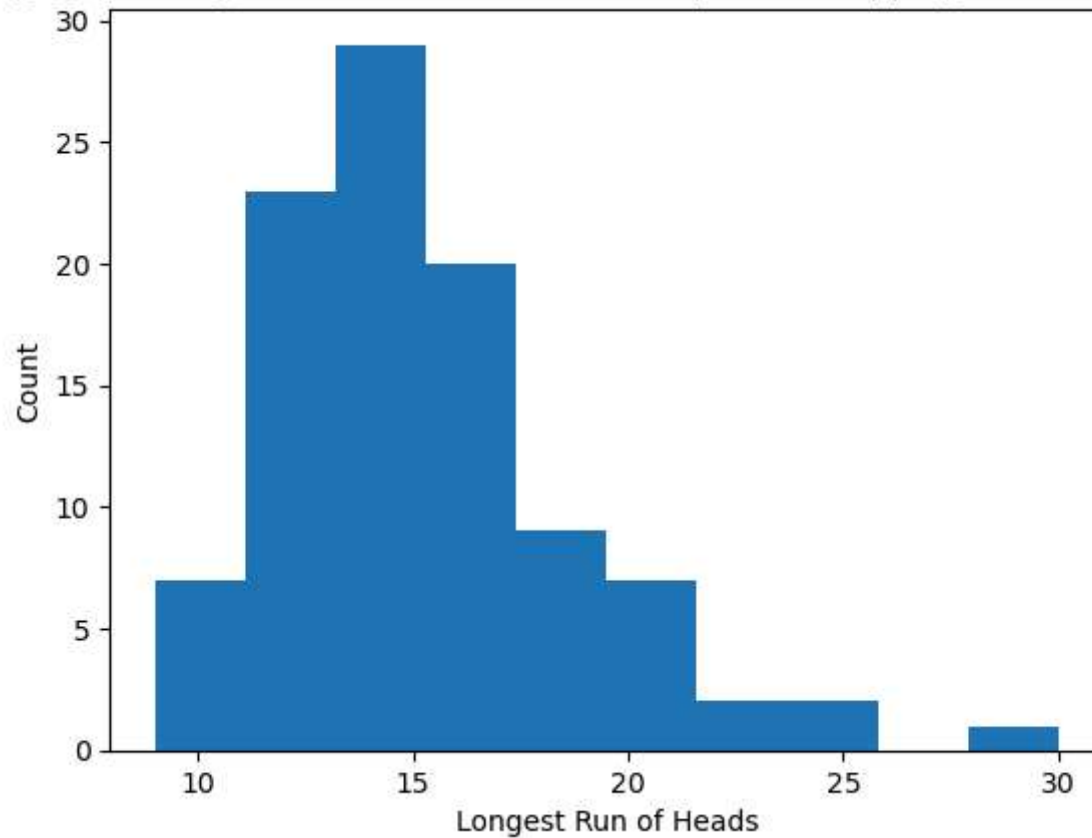


```
In [8]: num_repeats = 100

longest_heads_run_list = [get_longest_run_heads(get_trials(num_trials)) for i in range(num_repeats)]

plt.figure()
plt.hist(longest_heads_run_list)
plt.xlabel("Longest Run of Heads")
plt.ylabel("Count")
plt.title(f"Histogram of Longest Run of Heads for {num_repeats} repeats of flipping the coin {num_trials} times")
plt.show()
```

Histogram of Longest Run of Heads for 100 repeats of flipping the coin 500 times

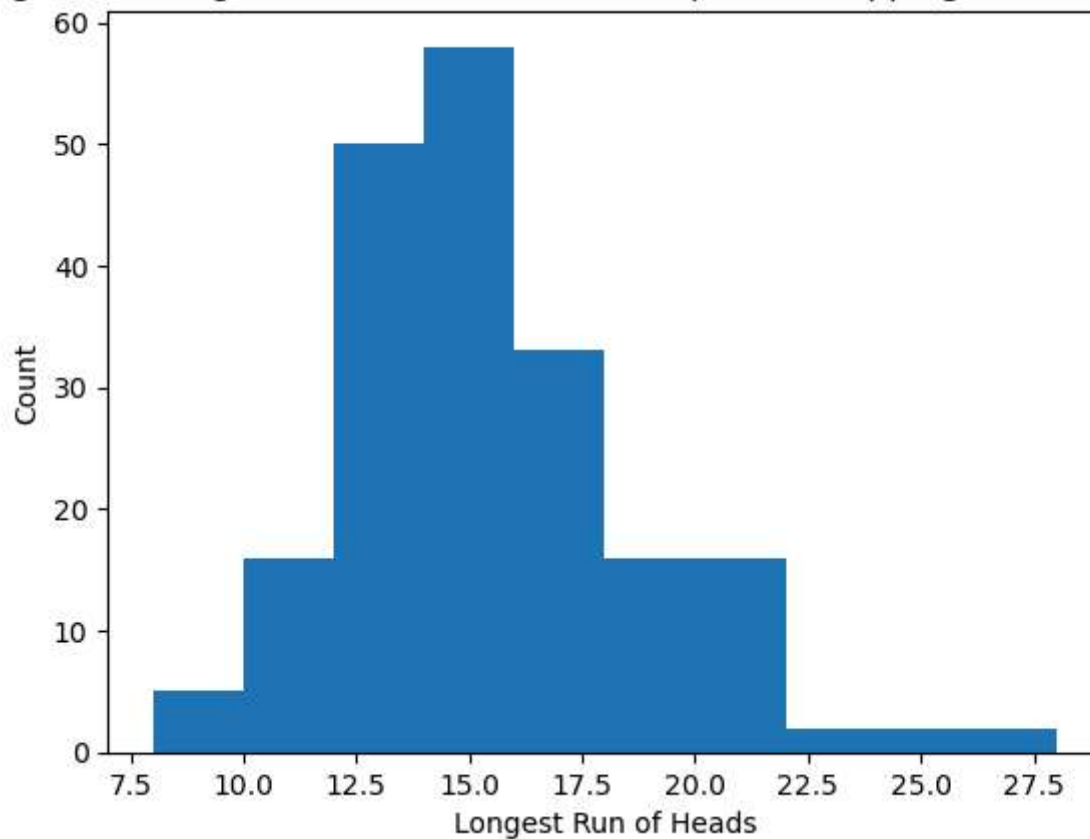


```
In [9]: num_repeats = 200

longest_heads_run_list = [get_longest_run_heads(get_trials(num_trials)) for i in range(num_repeats)]
```

```
plt.figure()
plt.hist(longest_heads_run_list)
plt.xlabel("Longest Run of Heads")
plt.ylabel("Count")
plt.title(f"Histogram of Longest Run of Heads for {num_repeats} repeats of flipping the coin {num_trials} times")
plt.show()
```

Histogram of Longest Run of Heads for 200 repeats of flipping the coin 500 times



```
In [10]: num_repeats = 1000

longest_heads_run_list = [get_longest_run_heads(get_trials(num_trials)) for i in range(num_repeats)]

plt.figure()
plt.hist(longest_heads_run_list)
```

```
plt.xlabel("Longest Run of Heads")  
plt.ylabel("Count")  
plt.title(f"Histogram of Longest Run of Heads for {num_repeats} repeats of flipping the coin {num_trials} times")  
plt.show()
```

Histogram of Longest Run of Heads for 1000 repeats of flipping the coin 500 times

