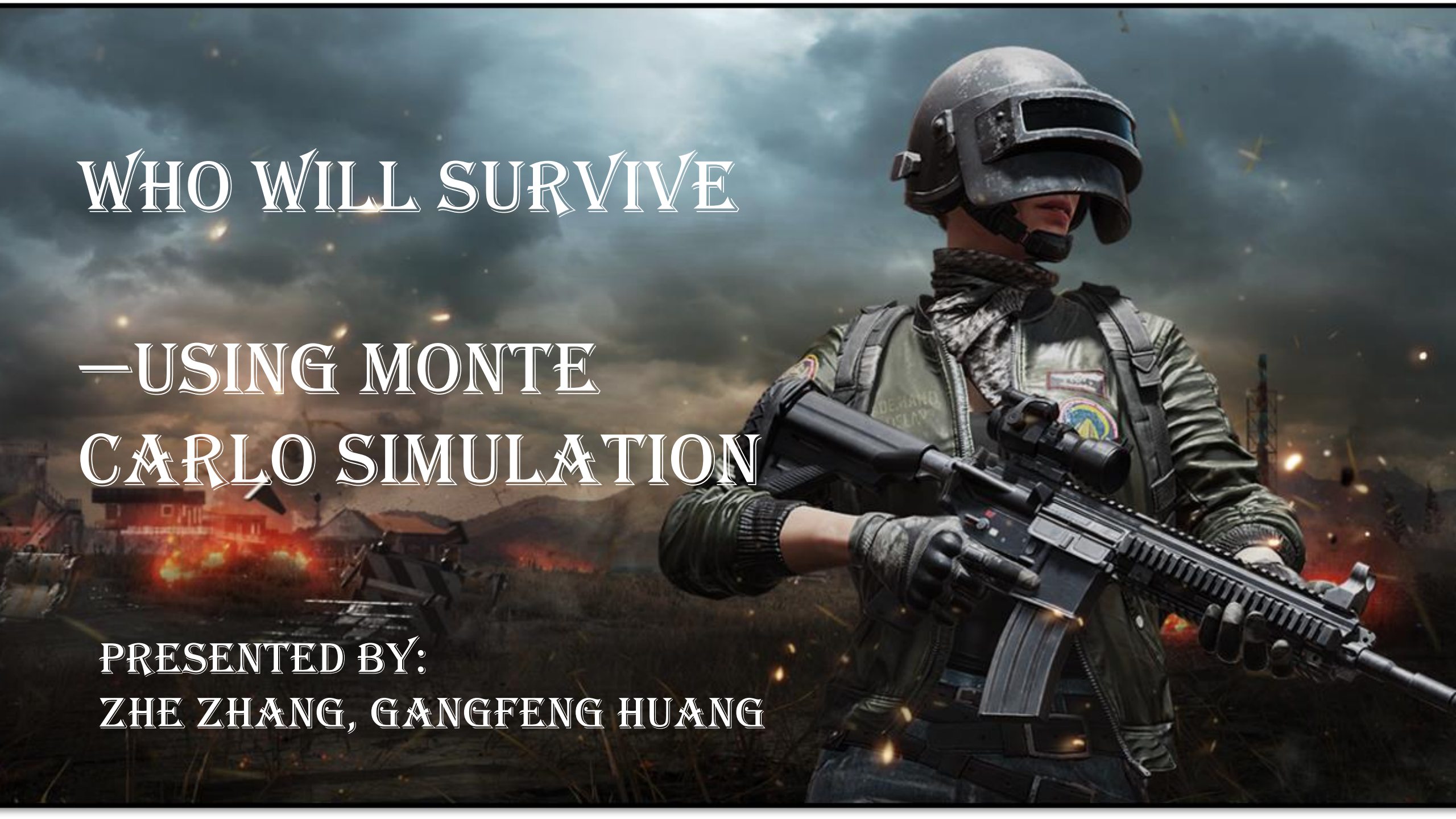

Who Will Survive

—Using Monte Carlo Simulation

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Basic Game Conditions:

1. There are 100 players in each game, and the last player standing on the ground is the winner. In each game, the shooting hit rate of the players follows a normal distribution
2. At the beginning of each game, each player's shooting hit rate will be reset.
3. Each player has an HP value of 100. When HP is less than or equal to 0, the player will be eliminated
4. The damage to players who get shot depend on which body parts are shot. There is 30% being shot on head and 70% on other body parts. The damage to the head and the damage to other parts of body follow normal distributions as well.

Special Conditions

1. Select high magnification scope: increase X% shooting rate, but will reduce the ability to resist damage Y%
2. Choose body armor: increase the capability that resists damage by Y%, but will reduce the shooting hit rate X%
3. Use the initial settings

Hypotheses:

1. The chance of player X to win the game is three times higher than that of other players
2. For player X, selecting high magnificent scope can increase his chance to win most
3. Player X is unlikely to survive more than 20 rounds in a game

Code Review

Key parameters:

acc_change:	the amount of accuracy change of skill 1 and 2
def_change:	the amount of defense change of skill 1 and 2
other_acc:	the mean accuracy of other players
acc_std:	the standard deviation accuracy of other players
head_mean_damage	the mean damage when shooting a person in his head
head_std_damage:	the standard deviation damage when shooting a person in his head
body_mean_damage:	the mean damage when shooting a person in his body
body_std_damage:	the standard deviation damage when shooting a person in his body
self.acc:	the accuracy of the main character after choosing the ability
self.blood:	the actual blood of the main character after choosing the ability

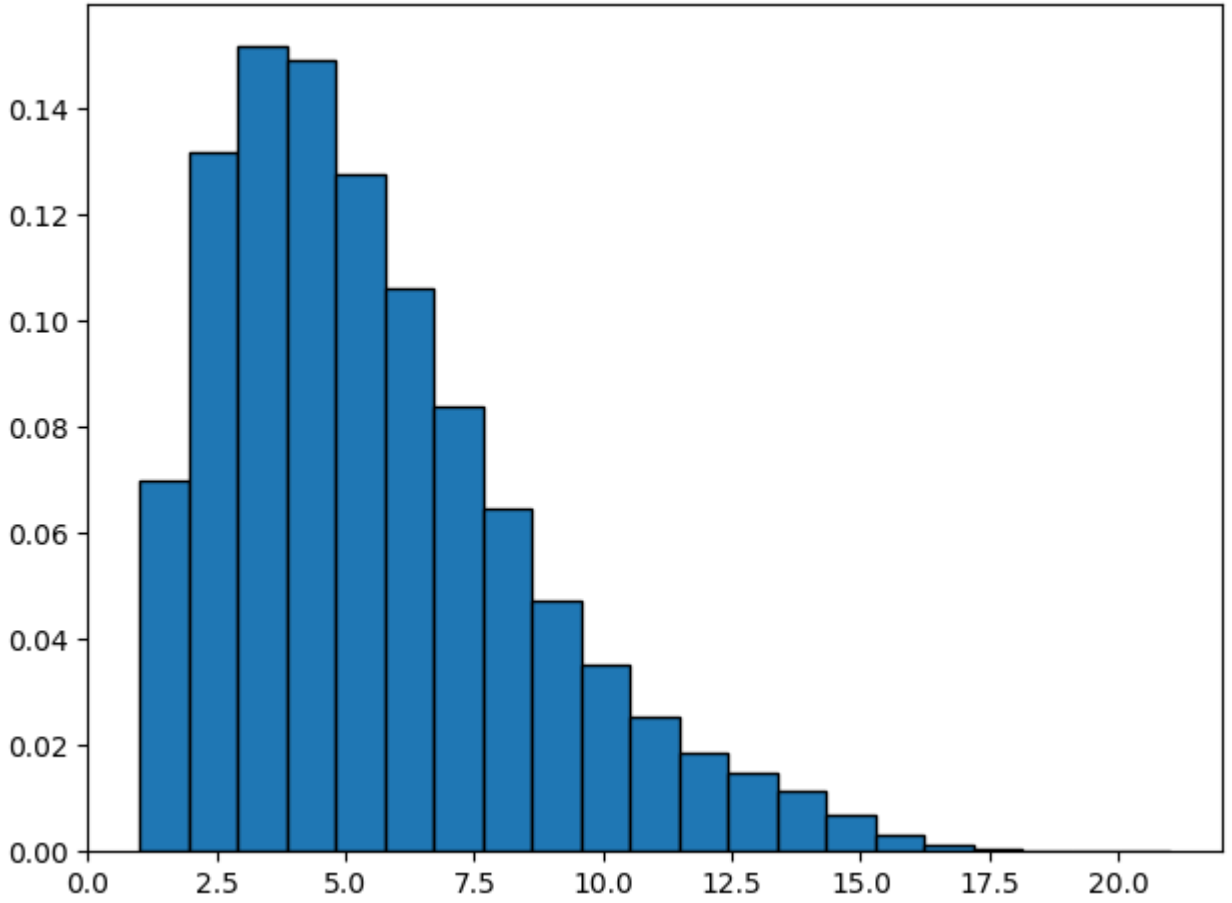
```python
import numpy as np
import time
import matplotlib.pyplot as plt
import collections


class Game:
    def __init__(self, basic_acc, acc_change, def_change, other_acc, acc_std, num_players,
                 head_percentage, head_mean_damage, head_std_damage, body_mean_damage, body_std_damage):...

    def choose_skill(self, skill):...

    def start_a_game(self):...

    def initialize_a_game(self):...

    def set_target(self, num_players):...

    def generate_hit_damage(self, target, accuracy, num_players):...


num_game = 100000
g = Game(0.5, 0.1, 0.05, 0.5, 0.05, 100, 0.3, 0.9, 0.06, 0.45, 0.03)
g.choose_skill(1)
count = 0
round = []
tic = time.time()
for j in range(num_game):
    a, b = g.start_a_game()
    if a:
        count += 1
    round.append(b)
toc = time.time()
print('Running time:', str(toc - tic)+'s')
print('Winning rate of main character:', str(count/num_game*100)+'%')
print('Winning rate of other characters:', str((100-count/num_game*100)/99)+'%')
count = collections.Counter(round)
plt.hist(round, bins=len(count), density=1, edgecolor="black")
plt.show()
```

Preliminary Results (1)

Select skill one: increase 10% shooting rate, but will reduce the ability to resist damage 5%

- Winning rate of Player X: 1.425%

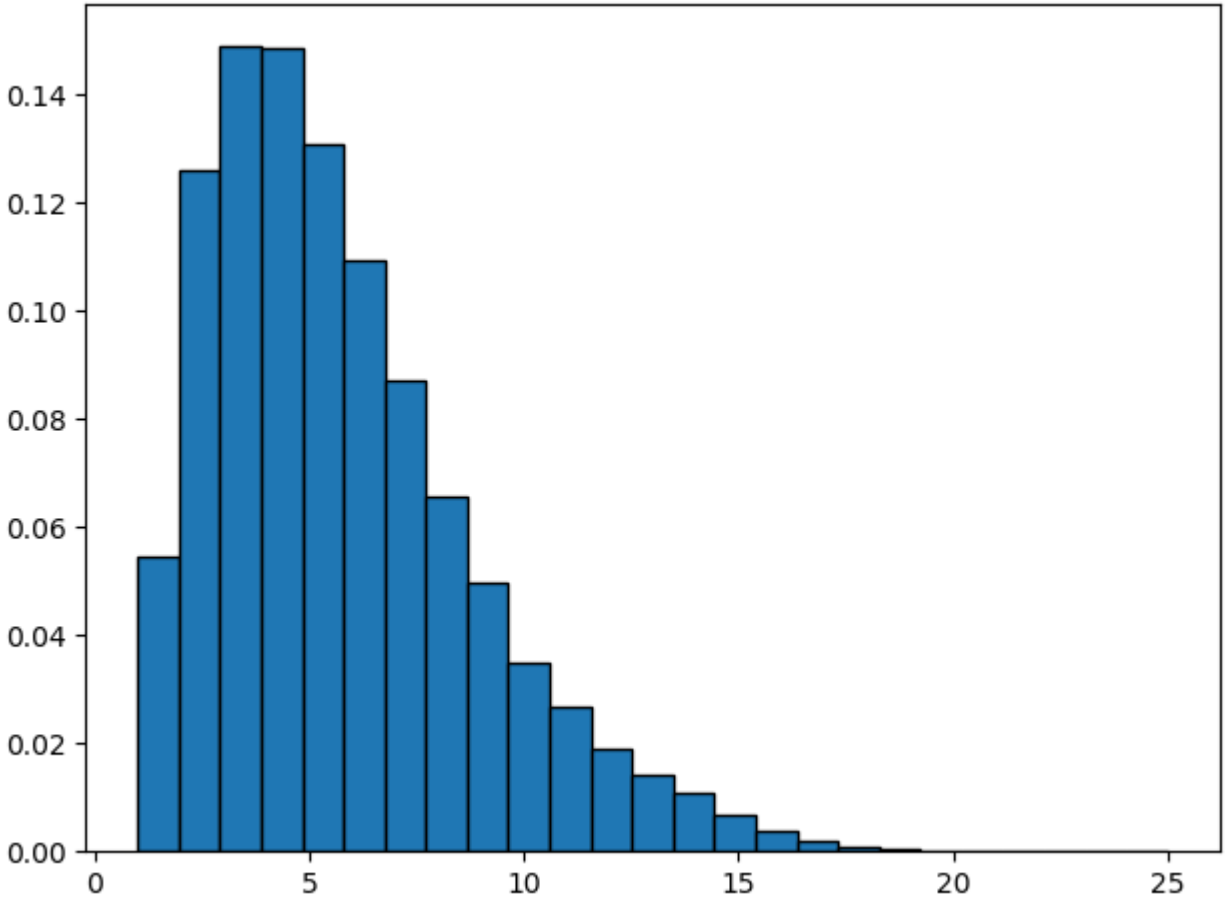
- Winning rate of other players: 0.9957070707070708%



Preliminary Results (2)

Select skill two: increase the capability that resists damage by 10%., but will reduce the shooting hit rate 5%

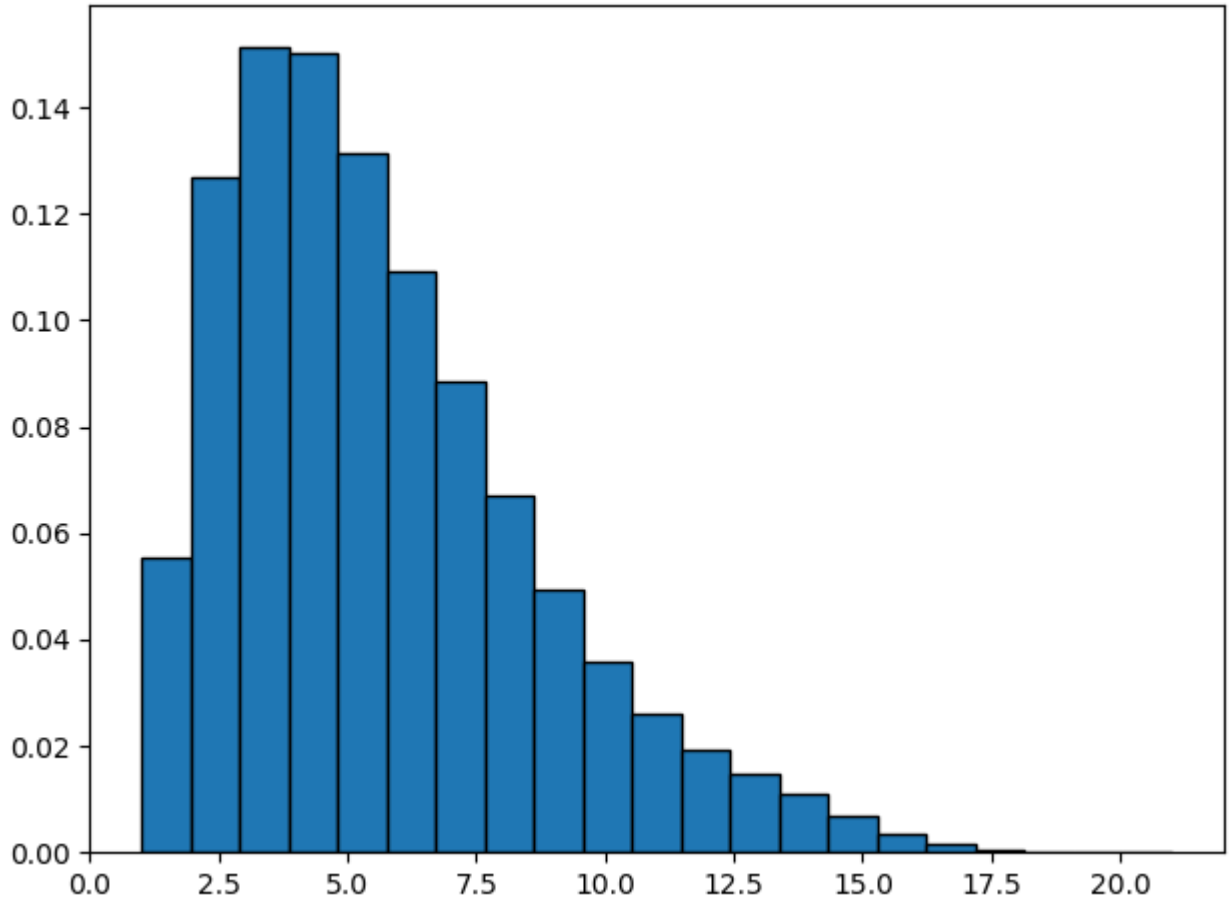
- Winning rate of Player X: 1.0210000000000001%
- Winning rate of other players: 0.9997878787878788%



Preliminary Results (3)

Use the initial settings

- Winning rate of Player X: 1.168%
- Winning rate of other players: 0.9983030303030302%



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