simulation

September 14, 2024

[1]:
```
# Import the libraries
import random
import matplotlib.pyplot as plt

#Define the cards and create the tuple to hold the whole deck
suits = ['hearts', 'diamonds', 'clubs', 'spades']
ranks = ['2', '3', '4', '5', '6', '7', '8', '9', '10', 'Jack', 'Queen', 'King',␣
 ↪'Ace']
deck = [(rank, suit) for suit in suits for rank in ranks]

# What is known
total_cards = 52
hearts_count = 13
face_card_count = 12

heart_prob = hearts_count / total_cards
face_prob = face_card_count / total_cards
```

[2]:
```
print(f'Probability of picking the heart: \n {heart_prob}')
print(f'Probability of picking face card: \n {face_prob:.2f}')
```

```
Probability of picking the heart:
 0.25
Probability of picking face card:
 0.23
```

[3]:
```
# Calculate probabilities in a sample
def calculate_sample_probabilities(sample):
    hearts_in_sample = sum(1 for card in sample if card[1] == 'hearts')
    face_cards_in_sample = sum(1 for card in sample if card[0] in ['Jack',␣
 ↪'Queen', 'King'])
    return hearts_in_sample / len(sample), face_cards_in_sample / len(sample)
```

[7]:
```
# Simulate drawing cards
sample_size_range = list(range(1, 53))
prob_heart_simulation = []
prob_face_simulation = []
```

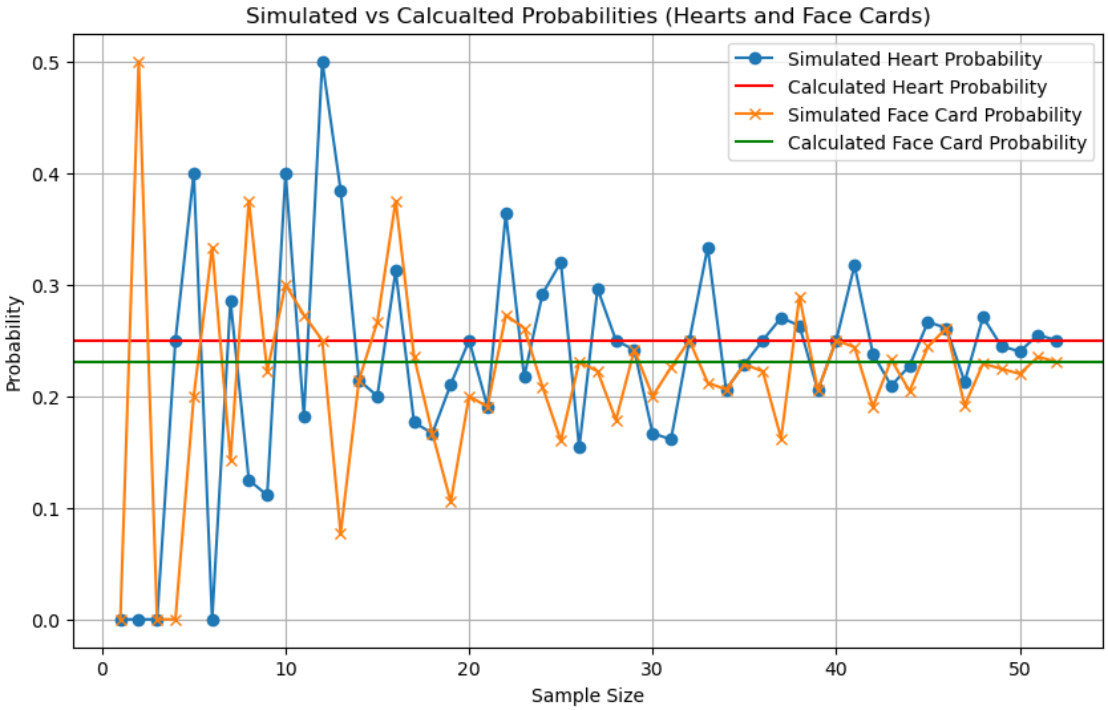
```
# Run simulations for sample sizes from 1 to 52
for sample_size in sample_size_range:
    sample = random.sample(deck, sample_size)
    prob_heart, prob_face = calculate_sample_probabilities(sample)
    prob_heart_simulation.append(prob_heart)
    prob_face_simulation.append(prob_face)

# Plot calculated and simulated probabilities for hearts and face cards
plt.figure(figsize=(10, 6))

# Plot hearts probabilities
plt.plot(sample_size_range, prob_heart_simulation, label='Simulated Heart␣
 ↪Probability', marker='o')
plt.axhline(y=heart_prob, color='r', linestyle='-', label='Calculated Heart␣
 ↪Probability')

# Plot face card probabilities
plt.plot(sample_size_range, prob_face_simulation, label='Simulated Face Card␣
 ↪Probability', marker='x')
plt.axhline(y=face_prob, color='g', linestyle='-', label='Calculated Face Card␣
 ↪Probability')

plt.xlabel('Sample Size')
plt.ylabel('Probability')
plt.title('Simulated vs Calcualted Probabilities (Hearts and Face Cards)')
plt.legend()
plt.grid(True)
plt.show()
```


Simulated vs Calcualted Probabilities (Hearts and Face Cards)
Simulated Heart Probability
Calculated Heart Probability
Simulated Face Card Probability
Calculated Face Card Probability
Probability
Sample Size
0.0
0.1
0.2
0.3
0.4
0.5
0
10
20
30
40
50

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