Percia_FA2

2024-02-18

Answered 3 even though only 1 is required.

Number 1

Use R to illustrate that the probability of getting:

a. a head is 0.5 if a fair coin is tossed repeatedly;
b. a red card is 0.5 if cards are drawn repeatedly with replacement from awell-shuffled deck;
c. an even number is 0.5 if a fair die is rolled repeatedly.

```
### NUMBER 1

# Define the number of trials
num_trials <- 1000

# (a) Simulating coin toss
coin_toss <- sample(c("Head", "Tail"), num_trials, replace = TRUE)
prob_head <- mean(coin_toss == "Head")

# (b) Simulating card drawing
deck <- rep(c("Red", "Black"), times = 26)
card_draw <- sample(deck, num_trials, replace = TRUE)
prob_red <- mean(card_draw == "Red")

# (c) Simulating die rolling
die_roll <- sample(1:6, num_trials, replace = TRUE)
prob_even <- mean(die_roll %% 2 == 0)

cat("(a) Probability of getting a head in coin toss:", prob_head, "\n")
```

```
## (a) Probability of getting a head in coin toss: 0.464
```

```
cat("(b) Probability of drawing a red card:", prob_red, "\n")
```

```
## (b) Probability of drawing a red card: 0.499
```

```
cat("(c) Probability of getting an even number in die roll:", prob_even, "\n")
```

```
## (c) Probability of getting an even number in die roll: 0.519
```

Interpretation:

a. Probability of Getting a head

- In the simulated experiment, the probability of getting a head in a fair coin toss was found to be approximately 0.5.
- This result indicates that, on average, half of the tosses resulted in heads, which aligns with the theoretical probability for a fair coin.
- The interpretation suggests that when a fair coin is tossed repeatedly, there's an equal likelihood of getting a head or a tail.

b. Probability of Drawing a Red Card

- From the simulation of drawing cards repeatedly with replacement from a well-shuffled deck, the probability of drawing a red card was approximately 0.5.
- This finding implies that each time a card is drawn, there's an equal chance of getting a red card or a black card, assuming the deck is well-shuffled and has equal numbers of red and black cards.

c. Probability of Rolling an Even Number

- In the experiment of rolling a fair die repeatedly, the probability of rolling an even number was approximately 0.5.
- This result indicates that when a fair die is rolled repeatedly, there's an equal chance of getting an even number (2, 4, or 6) or an odd number (1, 3, or 5).

Number 2

An experiment consists of tossing two fair coins. Use R to simulate this experiment 100 times and obtain the relative frequency of each possible outcome. Hence, estimate the probability of getting one head and one tail in any order.

```
### NUMBER 2

# Simulate 100 times
num_experiments <- 100
coin_outcomes <- replicate(num_experiments, {
  tosses <- sample(c("H", "T"), 2, replace = TRUE)
  paste(sort(tosses), collapse = "")
})
# Count the frequency of each outcome
outcome_counts <- table(coin_outcomes)
# Calculate the relative frequency
relative_freq <- prop.table(outcome_counts)
relative_freq
```

```
## coin_outcomes
##   HH   HT   TT
## 0.11 0.64 0.25
```

Interpretation

Outcome Analysis for Tossing Two Fair Coins:

- The relative frequency of each possible outcome (HH, HT, TH, TT) was calculated based on 100 simulations.
- To estimate the probability of getting one head and one tail in any order, we observed the frequencies of outcomes HT and TH.
- Interpretation per Outcome:
    - HT and TH outcomes represent situations where one coin shows heads and the other shows tails.
    - The relative frequency of these outcomes provides an estimate of the probability of getting one head and one tail in any order when tossing two fair coins.

Number 3

An experiment consists of rolling a die. Use R to simulate this experiment 600 times and obtain the relative frequency of each possible outcome. Hence, estimate the probability of getting each of 1, 2, 3, 4, 5, and 6.

```
### NUMBER 3

# Simulate 600 times
num_experiments <- 600
die_outcomes <- sample(1:6, num_experiments, replace = TRUE)
# Count the frequency of each outcome
outcome_counts <- table(die_outcomes)
# Calculate the relative frequency
relative_freq <- prop.table(outcome_counts)
relative_freq
```

```
## die_outcomes
##         1         2         3         4         5         6
## 0.1966667 0.1533333 0.1566667 0.1500000 0.1716667 0.1716667
```

Interpretation

Outcome Analysis for Rolling a Fair Die:

- The relative frequency of each possible outcome (1 to 6) was obtained from 600 simulations.
- These frequencies were used to estimate the probability of rolling each number (1 to 6).
- Interpretation per Number:
    - Each number (1 to 6) corresponds to the outcome of rolling a fair six-sided die.
    - The relative frequency of each number represents the likelihood of rolling that specific number.
    - The interpretation per number provides insights into the fairness and randomness of the die rolls, indicating whether each face of the die has an equal chance of appearing.