FA-2 R 4.10 Projects

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FA2 Questions

***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 a well-shuffled deck;
(c) an even number is 0.5 if a fair die is rolled repeatedly.

A. Answer with Trials set to 100

```
coin_outcomes <- c("H", "T")
prob_head <- 0.5
no_trialsA <- 100
no_trialsB <- 1000
no_trialsC <- 10000

coin_toss_sample <- sample(coin_outcomes, no_trialsA, replace = TRUE, prob = c(prob_head, 1 - prob_head

head_freq <- sum(coin_toss_sample == "H") / no_trialsA
tail_freq <- sum(coin_toss_sample == "T") / no_trialsA

cat("Frequency of getting a head:", head_freq, "\n")
```

```
## Frequency of getting a head: 0.46
```

```
cat("Frequency of getting a tail:", tail_freq, "\n\n")
```

```
## Frequency of getting a tail: 0.54
```

B. Answer with Trials set to 1000

```
deckCards <- rep(c("Red", "Black"), each = 26)
red_card_prob <- 0.5
card_draws <- sample(deckCards, no_trialsB, replace = TRUE)

red_freq <- sum(card_draws == "Red") / no_trialsB
black_freq <- sum(card_draws == "Black") / no_trialsB

cat("Frequency of red Cards:", red_freq, "\n")
```

```
## Frequency of red Cards: 0.507
```

```
cat("Frequency of black Cards:", black_freq, "\n\n")
```

```
## Frequency of black Cards: 0.493
```

C. Answer with Trials set to 10000

```r
die_outcomes <- 1:6
even_numbers <- die_outcomes[die_outcomes %% 2 == 0]
even_prob <- 0.5


die_rolls <- sample(die_outcomes, no_trialsC, replace = TRUE)

# Calculating relative frequency
even_freq <- sum(die_rolls %in% even_numbers) / no_trialsC
odd_freq <- sum(!(die_rolls %in% even_numbers)) / no_trialsC

cat("Frequency of getting an even number:", even_freq, "\n")
```

```
## Frequency of getting an even number: 0.4902
```

```r
cat("Frequency of getting an odd number:", odd_freq, "\n")
```

```
## Frequency of getting an odd number: 0.5098
```

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.** ***Answer with Trials set to 100***

```r
coin_results <- c("Head", "Tail")
trials_simulate <- 100

count_head_tail <- function() {
  coins <- sample(coin_results, 2, replace = TRUE)
  return(sum(coins == "Head") == 1)
}

# Simulating the experiment
results <- replicate(trials_simulate, count_head_tail())

# Calculating relative frequency
prob_OHOT <- sum(results) / trials_simulate

cat("Probability of getting one head and one tail in any order:", prob_OHOT, "\n")
```

```
## Probability of getting one head and one tail in any order: 0.54
```

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.** ***Answer with Trials set to 600***

```r
die_outcomes <- 1:6
num_rolls <- 600

die_rolls <- sample(die_outcomes, num_rolls, replace = TRUE)

rel_freq <- table(die_rolls) / num_rolls
rel_freq <- rel_freq[order(names(rel_freq))]

cat("Relative frequencies:\n")
```

```
## Relative frequencies:
```

```r
for (outcome in 1:6) {
  cat("Outcome", outcome, ":", rel_freq[outcome], "\n")
}
```

```
## Outcome 1 : 0.2
## Outcome 2 : 0.1783333
## Outcome 3 : 0.135
## Outcome 4 : 0.155
## Outcome 5 : 0.155
## Outcome 6 : 0.1766667
```