Khyati Naik: Data 605 - HW6

Oct 8, 2023

Contents

Problem 1

A bag contains 5 green and 7 red jellybeans. How many ways can 5 jellybeans be withdrawn from the bag so that the number of green ones withdrawn will be less than 2?

```
# Calculate the number of ways to withdraw jellybeans
green_jellybeans <- 0:1
ways <- sum(choose(5, green_jellybeans) * choose(7, 5 - green_jellybeans))
cat("Number of ways:", ways, "\n")
```

```
## Number of ways: 196
```

Problem 2

A certain congressional committee consists of 14 senators and 13 representatives. How many ways can a subcommittee of 5 be formed if at least 4 of the members must be representatives?

```
# Number of senators and representatives
num_senators <- 14
num_representatives <- 13

# Total number of members in the subcommittee
total_members <- 5

# Calculate the number of subcommittees with 4 representatives and 1 senator
```

```r
case_1 <- choose(num_representatives, 4) * choose(num_senators, 1)

# Calculate the number of subcommittees with all 5 representatives
case_2 <- choose(num_representatives, 5)

# Total number of subcommittees
total_subcommittees <- case_1 + case_2

total_subcommittees
```

```
## [1] 11297
```

Problem 3

If a coin is tossed 5 times, and then a standard six-sided die is rolled 2 times, and finally a group of three cards are drawn from a standard deck of 52 cards without replacement, how many different outcomes are possible?

```r
# Number of outcomes for each event
coin_outcomes <- 2^5  # Coin toss
die_outcomes <- 6^2   # Die roll
card_outcomes <- choose(52, 3)  # Card drawing (combination)

# Total number of different outcomes
total_outcomes <- coin_outcomes * die_outcomes * card_outcomes

total_outcomes  # Print the result
```

```
## [1] 25459200
```

Problem 4

3 cards are drawn from a standard deck without replacement. What is the probability that at least one of the cards drawn is a 3? Express your answer as a fraction or a decimal number rounded to four decimal places.

```r
# Step 1: Calculate the total number of ways to draw 3 cards from a standard deck of 52 cards
total_ways <- choose(52, 3)

# Step 2: Calculate the number of ways to draw 3 cards without any 3s
non_3_ways <- choose(48, 3)

# Step 3: Calculate the probability of not drawing any 3s
probability_no_3s <- non_3_ways / total_ways

# Step 4: Calculate the probability of drawing at least one 3 using the complement rule
probability_at_least_one_3 <- 1 - probability_no_3s

# Step 5: Print the result
probability_at_least_one_3
```

```
## [1] 0.2173756
```

Problem 5

Lorenzo is picking out some movies to rent, and he is primarily interested in documentaries and mysteries. He has narrowed down his selections to 17 documentaries and 14 mysteries.

Step 1: How many different combinations of 5 movies can he rent

```
# Number of documentaries
num_documentaries <- 17

# Number of mysteries
num_mysteries <- 14

# Number of movies to pick (5 in this case)
num_movies_to_pick <- 5

# Calculate the number of combinations
total_combinations <- choose(num_documentaries + num_mysteries, num_movies_to_pick)

# Print the total number of combinations
total_combinations
```

```
## [1] 169911
```

Step 2. How many different combinations of 5 movies can he rent if he wants at least one mystery?

```
# Calculate the total number of combinations (same as Step 1)
total_combinations <- choose(num_documentaries + num_mysteries, num_movies_to_pick)

# Calculate the number of combinations with no mysteries
combinations_without_mystery <- choose(num_documentaries, num_movies_to_pick)

# Calculate the number of combinations with at least one mystery
combinations_with_at_least_one_mystery <- total_combinations - combinations_without_mystery

# Print the number of combinations with at least one mystery
combinations_with_at_least_one_mystery
```

```
## [1] 163723
```

Problem 6

In choosing what music to play at a charity fund raising event, Cory needs to have an equal number of symphonies from Brahms, Haydn, and Mendelssohn. If he is setting up a schedule of the 9 symphonies to be played, and he has 4 Brahms, 104 Haydn, and 17 Mendelssohn symphonies from which to choose, how many different schedules are possible? Express your answer in scientific notation rounding to the hundredths place

```
# Define the number of symphonies for each composer
num_brahms <- 4
num_haydn <- 104
num_mendelssohn <- 17
```

```r
# Define the number of symphonies to choose from each composer
num_to_choose <- 3

# Calculate the number of different schedules
# Using combinations formula (n choose k)
combinations_brahms <- choose(num_brahms, num_to_choose)
combinations_haydn <- choose(num_haydn, num_to_choose)
combinations_mendelssohn <- choose(num_mendelssohn, num_to_choose)

# Multiply the combinations for each composer to get the total number of schedules
total_schedules <- combinations_brahms * combinations_haydn * combinations_mendelssohn

# Format the result in scientific notation rounded to the hundredths place
formatted_result <- formatC(total_schedules, format = "e", digits = 2)

# Print the result
formatted_result
```

```
## [1] "4.95e+08"
```

Problem 7

An English teacher needs to pick 13 books to put on his reading list for the next school year, and he needs to plan the order in which they should be read. He has narrowed down his choices to 6 novels, 6 plays, 7 poetry books, and 5 nonfiction books.

Step 1. If he wants to include no more than 4 nonfiction books, how many different reading schedules are possible? Express your answer in scientific notation rounding to the hundredths place.

```r
# Number of nonfiction books to choose from
nonfiction_books <- 5

# Number of other books (novels, plays, and poetry books) to choose from
other_books <- 6 + 6 + 7

# Calculate the total number of different reading schedules
total_schedules <- 0

# Loop through the possible number of nonfiction books (from 1 to 4)
for (num_nonfiction in 1:4) {
  # Calculate the combinations for choosing nonfiction books
  combinations_nonfiction <- choose(nonfiction_books, num_nonfiction)

  # Calculate the combinations for choosing other books
  combinations_other <- choose(other_books, 13 - num_nonfiction)

  # Calculate the total combinations for this number of nonfiction books
  total_schedules <- total_schedules + (combinations_nonfiction * combinations_other)
}

# Format the result in scientific notation
result <- formatC(total_schedules, format = "e")
```

```r
# Print the result
cat("Different Reading Schedules are", result, "\n")
```

```
## Different Reading Schedules are 2.3934e+06
```

Step 2. If he wants to include all 6 plays, how many different reading schedules are possible? Express your answer in scientific notation rounding to the hundredths place.

```r
# Number of plays to choose from
plays <- 6

# Number of novels, poetry books, and nonfiction books to choose from
other_books <- 6 + 7 + 5

# Calculate the total number of different reading schedules
total_schedules <- choose(other_books, 13 - plays)

# Format the result in scientific notation
result <- formatC(total_schedules, format = "e")

# Print the result
cat("Different Reading Schedules are", result, "\n")
```

```
## Different Reading Schedules are 3.1824e+04
```

Problem 8

Zane is planting trees along his driveway, and he has 5 sycamores and 5 cypress trees to plant in one row. What is the probability that he randomly plants the trees so that all 5 sycamores are next to each other and all 5 cypress trees are next to each other? Express your answer as a fraction or a decimal number rounded to four decimal places

```r
# Calculate the number of ways to arrange 5 sycamores among 5 positions
ways_to_arrange_sycamores <- choose(5, 5)

# Calculate the number of ways to arrange 5 cypress trees among 5 positions
ways_to_arrange_cypress <- choose(5, 5)

# There are two possible orders: sycamores followed by cypress or cypress followed by sycamores
total_arrangements <- ways_to_arrange_sycamores * ways_to_arrange_cypress * 2

# Calculate the probability
probability <- 1 / total_arrangements

# Print the result rounded to four decimal places
cat("The probability is:", round(probability, 4), "\n")
```

```
## The probability is: 0.5
```

Problem 9

If you draw a queen or lower from a standard deck of cards, I will pay you $4. If not, you pay me $16. (Aces are considered the highest card in the deck.)

Step 1. Find the expected value of the proposition. Round your answer to two decimal places. Losses must be expressed as negative values

```
# Probability of winning $4
p_win = 44/52

# Probability of losing $16
p_lose = 8/52

# Expected value calculation
expected_value = (4 * p_win) + (-16 * p_lose)

# Display the expected value
paste0("Expected Value is ", round(expected_value, 4))
```

```
## [1] "Expected Value is 0.9231"
```

Step 2. If you played this game 833 times how much would you expect to win or lose? Round your answer to two decimal places. Losses must be expressed as negative values.

```
# Number of times played
n <- 833

# Expected value calculated in Step 1
expected_value_step1 <- 0.9231

# Calculate expected total winnings or losses
expected_total <- n * expected_value_step1

# Round to two decimal places
expected_total <- round(expected_total, 2)

expected_total
```

```
## [1] 768.94
```