11.16.4.9.2

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Problem Statement

QUESTION

If 4-digit numbers greater than 5,000 are randomly formed from the digits 0, 1, 3, 5, and 7, what is the probability of forming a number divisible by 5 when the repetition of digits is not allowed?

Solution

Total Valid 4-Digit Numbers A 4-digit number greater than 5,000 must start with either 5 or 7. The remaining digits can be any of the remaining digits without repetition.

- First Digit: 2 choices (5 or 7).
- Second Digit: 4 choices (excluding the first digit).
- Third Digit: 3 choices (excluding the first two digits).
- Fourth Digit: 2 choices (excluding the first three digits).

Total valid numbers:

$$2 \times 4 \times 3 \times 2 = 48$$

Numbers Divisible by 5

A number is divisible by 5 if its last digit is either 0 or 5. We consider two cases:

1. **Last Digit is 0**
   - First Digit: 2 choices (5 or 7).
   - Second Digit: 3 choices (excluding the first digit and 0).
   - Third Digit: 2 choices (excluding the first two digits and 0).
   - Fourth Digit: 1 choice (0).

   Total numbers:

$$2 \times 3 \times 2 \times 1 = 12$$

Numbers Divisible by 5

2. **Last Digit is 5**
   - First Digit: 1 choice (7, since 5 is already used as the last digit).
   - Second Digit: 3 choices (excluding the first digit and 5).
   - Third Digit: 2 choices (excluding the first two digits and 5).
   - Fourth Digit: 1 choice (5).

   Total numbers:

$$1 \times 3 \times 2 \times 1 = 6$$

Total numbers divisible by 5:

$$12 + 6 = 18$$

Probability Calculation

The probability P is the ratio of numbers divisible by 5 to the total valid numbers:

$$P = \frac{18}{48} = \frac{3}{8} = 0.375$$

Summary of Steps

1. Generate All Valid 4-Digit Numbers:
   - Generate all combinations of 4-digit numbers starting with 5 or 7.
   - Ensure no repetition of digits.
2. Check Divisibility by 5:
   - For each valid number, check if the last digit is 0 or 5.
3. Count and Calculate Probability:
   - Count the total valid numbers and the numbers divisible by 5.
   - Compute the probability as the ratio of the two counts.

STEM PLOT

C-code

https://github.com/Srihaas15/EE1003/11.16.4.9.2/codes/sol.c

Python-code

https://github.com/Srihaas15/EE1003/11.16.4.9.2/codes/sol.py