

A TWO DIGIT NUMBER IS WRITTEN AT RANDOM. DETERMINE THE POSSIBILITY THAT THE NUMBER IS A MULTIPLE OF 5

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UNDERSTANDING PROBABILITY IS FUNDAMENTAL IN MATHEMATICS, PARTICULARLY WHEN DEALING WITH RANDOM SELECTIONS FROM A SET OF OUTCOMES. WHEN WE ARE ASKED TO FIND THE PROBABILITY THAT A RANDOMLY SELECTED TWO-DIGIT NUMBER IS A MULTIPLE OF 5, WE NEED TO CAREFULLY ANALYZE THE SET OF POSSIBLE OUTCOMES AND IDENTIFY THOSE THAT SATISFY THE GIVEN CONDITION. THIS INVOLVES UNDERSTANDING THE PROPERTIES OF TWO-DIGIT NUMBERS, THE CONCEPT OF MULTIPLES OF 5, AND THE PRINCIPLES OF CALCULATING PROBABILITY.

DEFINING THE SAMPLE SPACE: ALL TWO-DIGIT NUMBERS

WHAT ARE TWO-DIGIT NUMBERS?

TWO-DIGIT NUMBERS ARE INTEGERS THAT RANGE FROM 10 TO 99, INCLUSIVE. THESE NUMBERS ARE CHARACTERIZED BY:

- A TENS DIGIT THAT IS AT LEAST 1 (SINCE NUMBERS LESS THAN 10 ARE SINGLE-DIGIT).
- A UNITS (ONES) DIGIT THAT CAN BE ANY DIGIT FROM 0 TO 9.

COUNTING THE TOTAL NUMBER OF TWO-DIGIT NUMBERS

TO DETERMINE THE TOTAL NUMBER OF OUTCOMES IN THE SAMPLE SPACE, WE NEED TO COUNT ALL INTEGERS FROM 10 THROUGH 99.

- THE SMALLEST TWO-DIGIT NUMBER IS 10.
- THE LARGEST TWO-DIGIT NUMBER IS 99.

$$\text{NUMBER OF TWO-DIGIT NUMBERS} = (99 - 10) + 1 = 90.$$

THEREFORE, THE SAMPLE SPACE CONTAINS 90 OUTCOMES: $\{10, 11, 12, \dots, 99\}$.

IDENTIFYING FAVORABLE OUTCOMES: TWO-DIGIT NUMBERS THAT ARE MULTIPLES OF 5

UNDERSTANDING MULTIPLES OF 5

A MULTIPLE OF 5 IS ANY NUMBER THAT CAN BE EXPRESSED AS $5 \times n$, WHERE n IS AN INTEGER. IN DECIMAL NOTATION, A NUMBER IS DIVISIBLE BY 5 IF AND ONLY IF ITS LAST DIGIT (UNITS DIGIT) IS EITHER 0 OR 5.

LISTING ALL TWO-DIGIT MULTIPLES OF 5

TO FIND ALL TWO-DIGIT NUMBERS DIVISIBLE BY 5, WE CAN LIST NUMBERS FROM 10 TO 99 WHOSE LAST DIGIT IS 0 OR 5.

- NUMBERS ENDING WITH 0: 10, 20, 30, 40, 50, 60, 70, 80, 90
- NUMBERS ENDING WITH 5: 15, 25, 35, 45, 55, 65, 75, 85, 95

TOTAL TWO-DIGIT MULTIPLES OF 5:

- 9 NUMBERS ENDING WITH 0
- 9 NUMBERS ENDING WITH 5

TOTAL FAVORABLE OUTCOMES = $9 + 9 = 18$.

CALCULATING THE PROBABILITY

PROBABILITY FORMULA

PROBABILITY (P) OF AN EVENT IS GIVEN BY:

$$P(\text{EVENT}) = \frac{\text{NUMBER OF FAVORABLE OUTCOMES}}{\text{TOTAL NUMBER OF OUTCOMES IN THE SAMPLE SPACE}}$$

IN THIS CASE:

$$P(\text{NUMBER IS A MULTIPLE OF 5}) = \frac{18}{90}$$

SIMPLIFYING THE FRACTION

DIVIDE NUMERATOR AND DENOMINATOR BY THEIR GREATEST COMMON DIVISOR (WHICH IS 18):

$$\frac{18}{90} = \frac{18 \div 18}{90 \div 18} = \frac{1}{5}$$

THEREFORE, THE PROBABILITY THAT A RANDOMLY SELECTED TWO-DIGIT NUMBER IS A MULTIPLE OF 5 IS $1/5$ OR 20%.

ADDITIONAL INSIGHTS AND VARIATIONS

CONSIDERING DIFFERENT SETS OF NUMBERS

- IF THE SELECTION WAS FROM ALL INTEGERS (INCLUDING 1-DIGIT AND 3-DIGIT NUMBERS), THE PROBABILITY WOULD CHANGE.
- FOR EXAMPLE, SELECTING FROM 1 TO 100, THE TOTAL OUTCOMES WOULD BE 100, AND THE FAVORABLE OUTCOMES WOULD BE THOSE ENDING WITH 0 OR 5 WITHIN THAT RANGE.

PROBABILITY IN REAL-LIFE CONTEXTS

UNDERSTANDING SUCH PROBABILITIES CAN BE USEFUL IN VARIOUS REAL-LIFE SCENARIOS, SUCH AS:

- ESTIMATING CHANCES IN GAMES INVOLVING NUMBERS.
- ANALYZING PATTERNS IN DATASETS.
- DEVELOPING ALGORITHMS THAT DEPEND ON NUMERICAL PROPERTIES.

SUMMARY AND CONCLUSION

IN CONCLUSION, WHEN SELECTING A TWO-DIGIT NUMBER AT RANDOM FROM THE SET $\{10, 11, 12, \dots, 99\}$, THE PROBABILITY THAT THE NUMBER IS A MULTIPLE OF 5 IS PRECISELY $1/5$. THIS OUTCOME IS DERIVED FROM IDENTIFYING ALL TWO-DIGIT MULTIPLES OF 5 AND DIVIDING THEIR COUNT BY THE TOTAL NUMBER OF TWO-DIGIT NUMBERS.

UNDERSTANDING HOW TO APPROACH SUCH PROBLEMS INVOLVES:

- CLEARLY DEFINING THE SAMPLE SPACE.
- RECOGNIZING THE PROPERTY THAT CHARACTERIZES FAVORABLE OUTCOMES.
- COUNTING THE TOTAL AND FAVORABLE OUTCOMES ACCURATELY.
- APPLYING THE PROBABILITY FORMULA AND SIMPLIFYING WHERE POSSIBLE.

SUCH PROBLEMS REINFORCE FUNDAMENTAL CONCEPTS IN PROBABILITY THEORY AND DEMONSTRATE THE IMPORTANCE OF SYSTEMATIC REASONING AND ENUMERATION IN SOLVING MATHEMATICAL QUESTIONS.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE TOTAL NUMBER OF TWO-DIGIT NUMBERS FROM 10 TO 99?

THERE ARE 90 TWO-DIGIT NUMBERS, RANGING FROM 10 TO 99 INCLUSIVE.

HOW MANY TWO-DIGIT NUMBERS ARE MULTIPLES OF 5?

THERE ARE 18 TWO-DIGIT MULTIPLES OF 5, WHICH ARE 10, 15, 20, ..., 95.

WHAT IS THE PROBABILITY OF RANDOMLY SELECTING A TWO-DIGIT NUMBER THAT IS A MULTIPLE OF 5?

THE PROBABILITY IS THE NUMBER OF FAVORABLE OUTCOMES DIVIDED BY TOTAL OUTCOMES, WHICH IS $18/90 = 1/5$.

HOW DO YOU DETERMINE IF A TWO-DIGIT NUMBER IS A MULTIPLE OF 5?

A TWO-DIGIT NUMBER IS A MULTIPLE OF 5 IF ITS LAST DIGIT IS EITHER 0 OR 5.

WHAT IS THE PROBABILITY EXPRESSED AS A PERCENTAGE THAT A RANDOMLY CHOSEN TWO-DIGIT NUMBER IS A MULTIPLE OF 5?

IT IS 20% BECAUSE $(18/90) 100 = 20\%$.

ARE ALL TWO-DIGIT NUMBERS ENDING WITH 0 OR 5 MULTIPLES OF 5?

YES, ALL TWO-DIGIT NUMBERS ENDING WITH 0 OR 5 ARE MULTIPLES OF 5.

IF A TWO-DIGIT NUMBER IS SELECTED AT RANDOM, WHAT IS THE LIKELIHOOD IT IS NOT A MULTIPLE OF 5?

THE LIKELIHOOD IS $72/90$ OR $4/5$, SINCE 72 OUT OF 90 NUMBERS ARE NOT MULTIPLES OF 5.

CAN THE PROBABILITY OF SELECTING A TWO-DIGIT MULTIPLE OF 5 BE SIMPLIFIED?

YES, THE PROBABILITY SIMPLIFIES TO $1/5$.

ADDITIONAL RESOURCES

A TWO DIGIT NUMBER IS WRITTEN AT RANDOM. DETERMINE THE POSSIBILITY THAT THE NUMBER IS A MULTIPLE OF 5

INTRODUCTION

PROBABILITY, A FUNDAMENTAL BRANCH OF MATHEMATICS, OFFERS TOOLS TO QUANTIFY THE LIKELIHOOD OF VARIOUS EVENTS OCCURRING UNDER UNCERTAINTY. ONE COMMON PROBLEM IN ELEMENTARY PROBABILITY INVOLVES SELECTING A NUMBER AT RANDOM FROM A WELL-DEFINED SET AND DETERMINING THE PROBABILITY THAT IT SATISFIES A PARTICULAR PROPERTY.

IN THIS CONTEXT, WE EXPLORE THE QUESTION: A TWO-DIGIT NUMBER IS WRITTEN AT RANDOM. DETERMINE THE POSSIBILITY THAT THE NUMBER IS A MULTIPLE OF 5. THIS PROBLEM IS MORE THAN AN ACADEMIC EXERCISE; IT ILLUSTRATES CORE PRINCIPLES OF PROBABILITY, COMBINATORICS, AND NUMBER THEORY, SERVING AS A PEDAGOGICAL CORNERSTONE FOR UNDERSTANDING HOW TO APPROACH SIMILAR PROBLEMS INVOLVING DISCRETE UNIFORM DISTRIBUTIONS.

THIS ARTICLE AIMS TO THOROUGHLY EXAMINE THIS PROBLEM, DELVING INTO THE SET DEFINITIONS, COUNTING TECHNIQUES, AND CALCULATIONS REQUIRED TO ARRIVE AT AN ACCURATE PROBABILITY. THE ANALYSIS WILL ALSO CONSIDER POTENTIAL VARIATIONS, SUCH AS DIFFERENT RANGES AND DIFFERENT DIVISIBILITY CRITERIA, PROVIDING COMPREHENSIVE INSIGHTS INTO THE PROBLEM'S STRUCTURE AND SOLUTION.

DEFINING THE SAMPLE SPACE

THE SET OF TWO-DIGIT NUMBERS

THE FIRST STEP IN ANY PROBABILITY PROBLEM INVOLVING RANDOM SELECTION IS TO CLEARLY DEFINE THE SAMPLE SPACE—THE SET OF ALL POSSIBLE OUTCOMES.

- TWO-DIGIT NUMBERS ARE THOSE INTEGERS FROM 10 THROUGH 99, INCLUSIVE.
- TOTAL NUMBER OF SUCH NUMBERS: $(99 - 10 + 1 = 90)$.

HENCE, THE SAMPLE SPACE (S) CONTAINS 90 ELEMENTS:

$$S = \{10, 11, 12, \dots, 98, 99\}$$

EACH NUMBER IN (S) IS EQUALLY LIKELY TO BE SELECTED IF THE SELECTION IS AT RANDOM WITH UNIFORM PROBABILITY.

ASSUMPTIONS

- UNIFORM PROBABILITY DISTRIBUTION: EACH TWO-DIGIT NUMBER IS EQUALLY LIKELY TO BE CHOSEN.
- RANDOM SELECTION: THE PROCESS IS UNBIASED, WITH NO PREFERENCE FOR ANY PARTICULAR NUMBER WITHIN THE SET.

UNDER THESE CONDITIONS, THE PROBABILITY OF AN EVENT (E) IS GIVEN BY:

$$P(E) = \frac{\text{NUMBER OF FAVORABLE OUTCOMES}}{\text{TOTAL OUTCOMES IN THE SAMPLE SPACE}}$$

OUR TASK REDUCES TO COUNTING THE NUMBER OF TWO-DIGIT NUMBERS DIVISIBLE BY 5 AND DIVIDING BY 90.

IDENTIFYING FAVORABLE OUTCOMES: MULTIPLES OF 5 AMONG TWO-DIGIT NUMBERS

CHARACTERISTICS OF MULTIPLES OF 5

A NUMBER IS A MULTIPLE OF 5 IF AND ONLY IF ITS LAST DIGIT IS EITHER 0 OR 5. THIS DIVISIBILITY RULE SIMPLIFIES THE IDENTIFICATION PROCESS.

- LAST DIGIT 0 OR 5: ENSURES DIVISIBILITY BY 5.

LISTING THE TWO-DIGIT MULTIPLES OF 5

LET'S EXPLICITLY IDENTIFY ALL TWO-DIGIT NUMBERS WITH LAST DIGIT 0 OR 5:

- NUMBERS ENDING WITH 0: 10, 20, 30, 40, 50, 60, 70, 80, 90
- NUMBERS ENDING WITH 5: 15, 25, 35, 45, 55, 65, 75, 85, 95

TOTAL FAVORABLE OUTCOMES:

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\[
\text{NUMBER ENDING WITH 0} = 9
\]
\[
\text{NUMBER ENDING WITH 5} = 9
\]
\[
\text{TOTAL FAVORABLE OUTCOMES} = 9 + 9 = 18
\]
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VERIFYING THE LIST

THE LIST CONFIRMS THAT THERE ARE 18 TWO-DIGIT NUMBERS DIVISIBLE BY 5, WHICH ARE:

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\[
\{10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95\}
\]
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NOTE: A QUICK CHECK ENSURES THAT ALL THESE NUMBERS LIE WITHIN THE 10 TO 99 RANGE.

CALCULATING THE PROBABILITY

GIVEN THE TOTAL SAMPLE SPACE OF 90 NUMBERS AND 18 FAVORABLE OUTCOMES, THE PROBABILITY (P) THAT A RANDOMLY SELECTED TWO-DIGIT NUMBER IS A MULTIPLE OF 5 IS:

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\[
P = \frac{18}{90} = \frac{1}{5} = 0.2
\]
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EXPRESSED AS A PERCENTAGE, THIS IS 20%.

DEEPER ANALYSIS AND VARIATIONS

WHILE THE STRAIGHTFORWARD CALCULATION YIELDS A SIMPLE RESULT, DEEPER CONSIDERATIONS AND POTENTIAL VARIATIONS CAN ENRICH UNDERSTANDING.

1. PROBABILITIES WITH DIFFERENT RANGES

- THREE-DIGIT NUMBERS: IF THE PROBLEM EXTENDS TO THREE-DIGIT NUMBERS (100-999), THE ANALYSIS WOULD CHANGE ACCORDINGLY.
- INCLUDING OR EXCLUDING BOUNDARY NUMBERS: FOR INSTANCE, IF THE RANGE WAS 11 THROUGH 99, THE COUNT OF FAVORABLE OUTCOMES WOULD ADJUST.

2. NON-UNIFORM SELECTION

IN CASES WHERE THE SELECTION PROCESS ISN'T UNIFORM, PROBABILITY CALCULATIONS WOULD DEMAND WEIGHTED CONSIDERATIONS BASED ON THE LIKELIHOOD OF SELECTING SPECIFIC NUMBERS.

3. DIVISIBILITY BY OTHER NUMBERS

THE METHODOLOGY APPLIES TO OTHER DIVISIBILITY CRITERIA, SUCH AS MULTIPLES OF 3, 4, OR 7, WITH ADJUSTMENTS IN THE COUNTING PROCESS.

4. PROBABILISTIC DISTRIBUTIONS BEYOND UNIFORMITY

IN REAL-WORLD APPLICATIONS, THE ASSUMPTION OF UNIFORM DISTRIBUTION MAY NOT HOLD. FOR EXAMPLE, IN CERTAIN DATA SETS, SOME NUMBERS MAY BE MORE PREVALENT, AFFECTING THE PROBABILITY CALCULATIONS.

ADDITIONAL CONSIDERATIONS

EDGE CASES AND COMMON MISCONCEPTIONS

- COUNTING ERRORS: IT IS CRUCIAL TO VERIFY THAT ALL IDENTIFIED NUMBERS MEET THE CRITERIA AND LIE WITHIN THE SPECIFIED RANGE.
- INCLUSIVE VS EXCLUSIVE BOUNDS: ENSURING BOUNDS ARE CORRECTLY SET (E.G., 10 TO 99 INCLUSIVE).
- DIVISIBILITY RULES: REMEMBERING THAT DIVISIBILITY BY 5 DEPENDS SOLELY ON THE LAST DIGIT SIMPLIFIES THE COUNTING PROCESS.

TEACHING AND PEDAGOGICAL IMPLICATIONS

THIS PROBLEM OFFERS AN EXCELLENT EXAMPLE FOR TEACHING FUNDAMENTAL PROBABILITY CONCEPTS, SUCH AS:

- SAMPLE SPACE ENUMERATION
- FAVORABLE OUTCOME COUNTING
- THE USE OF DIVISIBILITY RULES
- SIMPLIFICATION OF FRACTIONS

CONCLUSION

THE PROBABILITY THAT A TWO-DIGIT NUMBER WRITTEN AT RANDOM IS A MULTIPLE OF 5 IS $\frac{1}{5}$ OR 20%. THIS OUTCOME RESULTS FROM STRAIGHTFORWARD ENUMERATION BASED ON DIVISIBILITY CRITERIA AND UNIFORM PROBABILITY ASSUMPTIONS.

THIS PROBLEM UNDERSCORES THE IMPORTANCE OF CLEAR SET DEFINITIONS, CAREFUL COUNTING, AND UNDERSTANDING DIVISIBILITY RULES IN PROBABILITY CALCULATIONS. IT ALSO DEMONSTRATES HOW SIMPLE NUMERICAL PROPERTIES CAN BE LEVERAGED TO SOLVE SEEMINGLY COMPLEX QUESTIONS EFFICIENTLY.

BEYOND ITS THEORETICAL INTEREST, SUCH PROBLEMS CULTIVATE CRITICAL THINKING AND ANALYTICAL SKILLS APPLICABLE IN VARIOUS MATHEMATICAL AND REAL-WORLD CONTEXTS, FROM DATA ANALYSIS TO DECISION-MAKING UNDER UNCERTAINTY.

IN SUMMARY:

- TOTAL TWO-DIGIT NUMBERS: 90
- TWO-DIGIT MULTIPLES OF 5: 18
- PROBABILITY: $\frac{18}{90} = \frac{1}{5}$

THIS EFFECTIVE APPROACH EXEMPLIFIES HOW FOUNDATIONAL MATHEMATICAL PRINCIPLES SERVE AS ROBUST TOOLS FOR ANALYZING PROBABILISTIC SCENARIOS INVOLVING DISCRETE, EQUALLY LIKELY OUTCOMES.

A Two Digit Number Is Written At Random Determine The Possibility That The Number Is A Multiple Of 5

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