

Probability and expected frequency

Topic cliff notes / objectives, key ideas and examples

Learning objectives

- Calculate probabilities and use complementary outcomes.
- Find an expected frequency and combine independent events.

Key ideas

- For equally likely outcomes, count favourable outcomes out of the total.

$$P(A) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

- Probabilities lie between zero and one; all mutually exclusive exhaustive outcomes total one.
- The probability of an event not happening is its complement.

$$P(\text{not } A) = 1 - P(A)$$

- An expected frequency predicts a long-run average, not a guaranteed result.

$$E = \text{number of trials} \times P(A)$$

- Multiply probabilities to combine independent events; without replacement, probabilities may change.

$$P(A \text{ and } B) = P(A)P(B) \quad \text{if independent}$$

Worked example

Predict the number of even results in ninety rolls of a fair six-sided die.

$$\text{even outcomes: } 2, 4, 6 \quad P(\text{even}) = \frac{3}{6} = \frac{1}{2}$$

$$E = 90 \times \frac{1}{2} = 45$$

Answer

45 even results expected

Quick example

A fair coin and fair six-sided die are independent. Find the probability of heads and a six.

$$P(\text{heads and six}) = \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$$

Answer

$$\frac{1}{12}$$

Watch out

Expected frequency is not a promise. Multiplication of unchanged probabilities needs independent events.

