Hillcrest Mathematics Knowledge Organiser

41 - Independent and Dependant Probability

Independent vs Dependent Events: The probability of 2 events is dependent if the probability of one event changes depending on the outcome of the other. If neither event affects the probability of the other then they are independent.

Rules for Independent Probability:

OR Probability:
To calculate the probability of an "or" event happening you must first check if the 2 events are mutually exclusive.

Mutually Exclusive: Events are mutually exclusive if they can happen at the same time. E.g a coin cannot land on heads and tails at the same time, the events are mutually exclusive.

P(A or B) when A and B are not mutually exclusive:

$$P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$$

P(A or B) when A and B are mutually exclusive:

$$P(A\ or\ B) = P(A) + P(B)$$

AND Probability:
E.g: The probability of rolling a 6 followed by a 1 on a single dice (And situation).

$$P(A\ and\ B) = P(A) \times P(B)$$

$$P(6\ and\ 1) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

Example 1: P(rolling a 1 or 6 on a single dice) = $\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$

Example 2: P(rolling a single 6 on 2 dice rolled at the same time) = $\frac{1}{6} + \frac{1}{6} - \frac{1}{36}$

Rules for Dependent or Conditional Probability:
Because the probability of dependent results changes if an event does or not happen the rules for "and" are a little different:

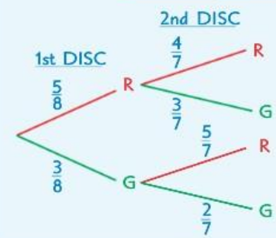
Dependent $P(A\ and\ B) = P(A) \times P(B\ given\ A\ happens)$

EXAMPLE: Alia either watches TV or reads before bed. The probability she watches TV is 0.3. If she reads, the probability she is tired the next day is 0.8. What is the probability that Alia reads and isn't tired the next day?

1) Label the events A and B. — We want to find P(she reads AND isn't tired). So call "she reads" event A and "isn't tired" event B.

2) Use the information given in the question to work out the probabilities that you'll need to use the formula. — P(A) = P(she reads) = 1 − 0.3 = 0.7; P(B given A) = P(isn't tired given she reads) = 1 − 0.8 = 0.2; P(A and B) = P(A) × P(B given A) = 0.7 × 0.2 = 0.14

EXAMPLE: A box contains 5 red discs and 3 green discs. Two discs are taken at random without replacement. Find the probability that both discs are the same colour.



The probabilities for the 2nd pick depend on the colour of the 1st disc picked. This is because the 1st disc is not replaced.

P(both discs are red) = P(R and R) = $\frac{5}{8} \times \frac{4}{7} = \frac{20}{56}$

P(both discs are green) = P(G and G) = $\frac{3}{8} \times \frac{2}{7} = \frac{6}{56}$

P(both discs are same colour) = P(R and R or G and G) = $\frac{20}{56} + \frac{6}{56} = \frac{26}{56} = \frac{13}{28}$

Linked Prior Topics: Fractions, decimals, percentages, Venn diagrams, listing outcomes, multiplicative reasoning, collecting data, testing hypotheses.

Vocabulary: Probability, event, outcome, result, likelihood, chance, impossible, certain, fraction, decimal, percentage, theoretical, expected, experimental, trials, mutually exclusive, conditional.

Linked Future Topics: Tree diagrams, replacement, conditional, independent and dependent events, sets, Venn diagrams.