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Probability

Complementary events

In this lesson, we identify and use some rules of probability to do with complementary events.

Lesson Outcomes

By the end of this lesson, you should be able to:

- explain why $P(S) = 1$
- calculate complementary events

Curriculum Links

LO 4: Data Handling and Probability

- 10.4.2 (b) Use Venn diagrams as an aid to solving probability problems, appreciating and correctly identifying:
- the sample space of a random experiment;
 - an event of the random experiment as a subset of the sample space;
 - the union and intersection of two or more subsets of the sample space;
 - $P(S) = 1$ (where S is the sample space);
 - complementary events, and is therefore able to calculate the probability of an event not occurring: $P(\text{not } A) = 1 - P(A)$.

Lesson Notes

$P(S) = 1$

The probability of the whole sample space is always 1.

$0 \leq P(E) \leq 1$

No probability can be smaller than zero (you cannot have less than a zero chance of something). So the probability of an event is always greater than or equal to zero, and smaller than or equal to one.

$P(E) + P(\text{not } E) = 1$

The probability of an event happening added to the probability of it *not* happening, is 1.

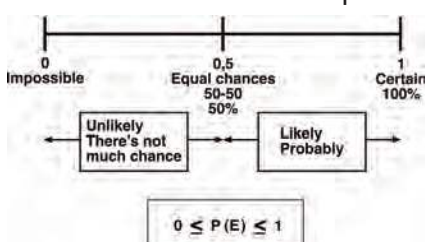
$P(\text{not } E) = 1 - P(E)$

The probability of something not happening can be calculated by subtracting the probability that it *will* happen, from one.

$P(E)$ and $P(\text{not } E)$ are **complementary** events. Complementary events are events which together make up the whole sample space.

$P(\text{not } E)$ is the **complement** of $P(E)$.

This makes sense on the probability scale:



Example 1: The weather forecast for tomorrow is 80% chance of rain. What chance is there that it will NOT rain?

If $P(\text{rain}) = 80\%$, then $P(\text{no rain}) = 20\%$
 $80\% + 20\% = 100\%$

$$\frac{8}{10} + \frac{2}{10} = 1$$

$$0,8 + 0,2 = 1$$

Example 2: The probability of throwing a 6 on the dice.

$$P(\text{throwing a 6}) = \frac{1}{6}$$

$$P(\text{not throwing a 6}) = 1 - \frac{1}{6} = \frac{5}{6}$$

Task

In a motor race, there are seven teams. Each team has two cars in the race.

1. Write a probability statement for Team A's chance of winning the race.
2. Write a probability statement for Team A's chance of NOT winning. Use the statement for a complementary event.