PROBABILITY – "THE BASICS"

Probability is the branch of mathematics that helps you measure the chance of an event happening. Essentially, there are two ways of determining the probability.

Finding Probability by Experiment

Experimental Probability of an event is the ratio of the number of times the event occurs to the total number of trials or observed outcomes.

$$\textbf{Experimental Probability} = \frac{\text{Number of Favourable Outcomes}}{\text{Number of } \textbf{\textit{Observed}} \text{ Outcomes}}$$

*Note: The more times you perform an experiment, the closer you should get to what is "supposed to happen".

Finding Theoretical Probability

Theoretical Probability of an event is the ratio of the number of ways the event can occur to the total number of possibilities in the sample space.

Recall, that the sample space is the set of all possible outcomes.

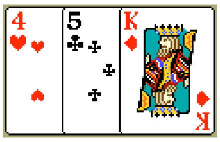
$$\textbf{Theoretical Probability} = \frac{\text{Number of Favourable Outcomes}}{\text{Number of } \textbf{\textit{Possible}} \text{ Outcomes}}$$

The Complement of an Event

The **complement** of an event A is written as $\bar{A}$, and is read as A bar. It is the set of all outcomes in the sample space that are not included in the outcomes of event A.

If the probability of an event occurring is P(A), written as a fraction, then the probability of the event not occurring would be: $P(\bar{A}) = 1 - P(A)$.

Example



A single card is chosen at random from a standard deck of 52 playing cards. What is the probability of choosing a card that is not a club?

Solution

$$
\begin{aligned}
P(\text{not club}) &= 1 - P(\text{club}) \\
&= 1 - \frac{13}{52} \\
&= \frac{52}{52} - \frac{13}{52} \\
&= \frac{39}{52} \\
&= \frac{3}{4}
\end{aligned}
$$

Tree Diagrams

Tree diagrams, as the name suggests, look like a tree as they branch out symmetrically. They are used to help you visualize and organize more complicated probability problems.

Example

If you have a box with two red, two green and two white balls in it, and you choose two balls without looking, what is the probability of getting two balls of the same color?

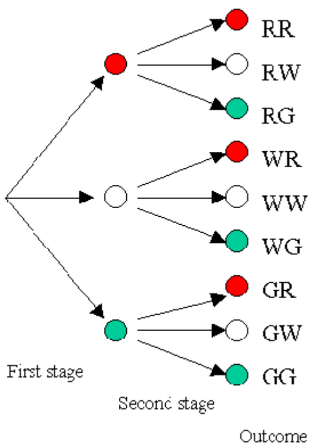
P(same color) = P(RR or GG or WW)

Solution

You can use the tree diagram below to help you identify the possible combinations of outcomes. Here you see that there are nine possible outcomes, listed to the right of the tree diagram. This number is the size of the sample space for this two state experiment, and will be in the denominator of each of our probabilities.

Each of these possible nine outcomes has a probability of $\frac{1}{9}$, therefore: **P(RR or GG or WW)** $= \frac{3}{9}$

$= \frac{1}{3}$



<u>PROBABILITY</u> – "REMINDERS"

DON'T FORGET

- The probability of a **certain** event is 1.
- The probability of an **impossible** event is 0.

CARDS

A standard deck of playing cards consists of ***4 suits*** of 13 cards each, for a total of 52 cards.

- There are 2 red suits, diamonds and hearts.
- There are 2 black suits, clubs and spades.
- Each suit has 13 cards: the ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, and King.
- The Jack, Queen, and King of each suit are called ***face cards.***

If a card is drawn from the deck, there are 52 <u>**equally likely**</u> possible outcomes, that is, the drawn card could be any of the 52 cards.

Homework

① a) $P(K) = \frac{4}{52} = \frac{1}{13}$

b) $P(A) = \frac{1}{13}$

c) $P(5\heartsuit) = \frac{1}{52}$

d) $P(6\spadesuit) = \frac{1}{52}$

e) $P(\text{red ace}) = \frac{2}{52} = \frac{1}{26}$