Probability

1. A single attempt at doing something is called a trial.

2. An experiment is performed by repeating the same trial over and over.

3. A fair object used in a trial has outcomes that are all equally likely to occur.

4. A biased object has been tampered with so that one outcome is more likely to occur than another.

5. Empirical probability is the assigning of a number to the likelihood of a certain outcome based on the observation of many trials.

6. **Sample space** is a set of all possible outcomes or results for a given activity.

7. A sample space has **uniform probability** when each outcome in the sample space is equally likely to occur.

8. **An Event** is a subset of the sample space. It is the desired result or outcome of an activity.

9. When there is only **one** outcome for an event, the event is called a singleton event.

10. The theoretical probability of an event is the number of ways that an event can occur divided by the total possible outcomes. This is mathematically expressed as follows:

$$P(E) = \frac{n(E)}{n(S)}$$

where , $P(E) =$ Probability of an event E
$n(E) =$ Number of ways that event E can occur
$n(S) =$ Number of possible outcomes in the sample space S

11. The probability of a **certain** event is 1.
The probability of an **impossible** event is 0.
Therefore, the probability of any event is greater than or equal to 0 and less than or equal to 1.
Expressing this mathematically we have: $0 \le P(E) \le 1$

12. If $P(E) = p$, then $P(\text{not } E) = 1 - p$

Probability of (A and B)

The probability of event (A and B) is the probability of two desirable outcomes happening at the same time. As an example, we may wish to find the probability of getting an **even number** (event A) and a **number less than three** (event B) on **one** roll of a die. This type of probability is found by using the following formula:

$$P(A \text{ and } B) = \frac{n(A \text{ and } B)}{n(s)}$$

Where, $n(A \text{ and } B) =$ the number of outcomes that are in both event A and event B

$n(s) =$ the total number of outcomes in the sample space.

There is no rule whereby the values of $P(A)$ and $P(B)$ can be used to find $P(A \text{ and } B)$

Probability of (A or B)

The probability of an event A or event B occurring can be computed using the following formula:

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

Probability of (not A)

If the probability of an event A is p, then the probability of the event $\overline{A}$ $(\text{read not } A)$ is found as follows:

$$P\left(\overline{A}\right) = 1 - P\left(A\right) = 1 - p$$

Probability Involving Two Independent Events

If event E_1 and event E_2 are independent events, and if the probability of E_1 is m and the probability of E_2 is n, then the probability of E_1 and E_2 occurring jointly is $m \times n$

Bernoulli Experiment

An experiment with only two possible outcomes is called a Bernouli Experiment. For a Bernouli experiment, the probability of obtaining exactly r successes out of n independent trials of the experiment is given by:

$$ {}_nC_r\, p^r q^{n-r} $$

where , $n =$ number of independent trials for the experiment.

$r =$ exact number of successes desired.

$p =$ probability of a success.

$q =$ probability of failure. ($q = 1 - p$)