TYPES OF EVENTS

Equally Likely Events

Two or more events, which have same probability of occurrence in an experiment, are called equally likely events.

$$\text{Probability of each event}, P = \frac{1}{\text{size of the sample space}}$$

Note that equally likely events have same probability

Example 1: Die rolling

Probabilities

P() = $\frac{1}{6}$

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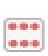
P() = $\frac{1}{6}$

OR

Probabilities

$P(1) = \frac{1}{6}$

$P(2) = \frac{1}{6}$

$P(3) = \frac{1}{6}$

$P(4) = \frac{1}{6}$

$P(5) = \frac{1}{6}$

$P(6) = \frac{1}{6}$

Let A = getting score 1 on dice
B = getting score 2 on dice
C = getting score 3 on dice
D = getting score 4 on dice
E = getting score 5 on dice
F = getting score 6 on dice

Observe that P(A) = P(B) = P(C) = P(D) = P(E) = P(F) =1/6. So, the events A, B, C, D, E, F events are said to be equally likely.

Mutually Exclusive Events

Two or more events are called M.E.E if they cannot occur simultaneously in a single trial.

If E1 and E2 are two mutually exclusive events, then
$E1 \cap E2 = \emptyset$

P(AUB) = P(A) + P(B)

For example, in connection with throw a die “even face” and “odd face” are mutually exclusive.

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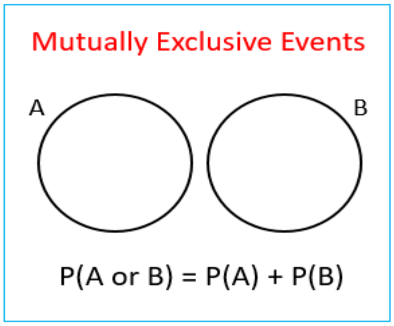
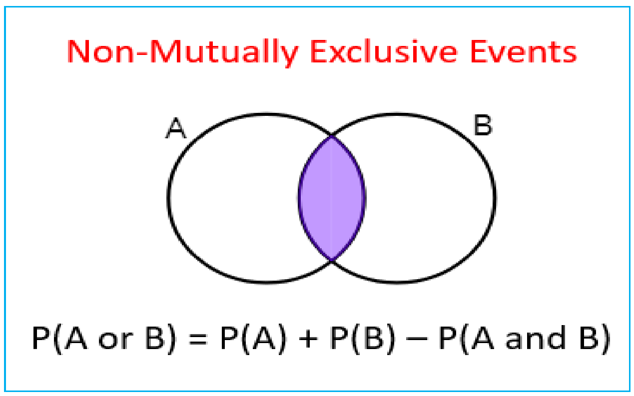


NOT MUTUALLY EXCLUSIVE EVENTS:

- Suppose A & B are two events in an experiment if A occur then B may also occur & if B occur then A may also occur then these events are called Not M.E.E

P (A or B) = P (A) + P (B) – P (A and B)



Example 1: Coin toss

When a coin is tossed, occurrence of Head prevents the occurrence of Tail. So, Head and tail mutually exclusive events.

Example 2: Die throw

When a fair die is thrown, occurrence of #4 prevents the occurrence of other numbers 1, 2, 3, 5, 6. Note that 'no two/more events can occur simultaneously'.

Addition theorem of Probability:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

In case of coin, $P(A \cap B) = 0$, because both Head and Tail can't occur at same time. So, head and Tail are mutually exclusive events.

Addition theorem of probability for 2 events A, B, C:

$$P(A \cup B \cup) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$$

If A, B, and C are mutually exclusive events

$P(A \cap B \cap C) = 0$
$P(A \cap B) = 0$
$P(B \cap C) = 0$
$P(A \cap C) = 0$, Then $P(AUBUC) = P(A) + P(B) + P(C)$

EXHAUSTIVE EVENTS

it is the total no of all possible outcomes of an experiment.

For example; throwing a die there are 6 exhaustive events in a trial.

INDEPENDENT EVENT

If the probability of the 2nd event B is not changed due to the occurrence of the 1st

Event A then these events are called I.E.

$P(A \cap B \cap C) = P(A)\,P(B)\,P(C)$

$P(A \cap B) = P(A)\,P(B)$

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Q You win a game if you roll a die and get an odd number. Flip a coin and get tails. What is the probability that you win?

Sol:

Let the experiment 1 = Rolling a die
Rolling a DIE has sample space S = {1, 2, 3, 4, 5, 6}
Required event = 'Getting an odd number on the die face'
Sample points favoured to required event A = {1, 3, 5}
So, P (A) = Probability of getting odd number on the die

$$P(A) = \frac{\#\ of\ outcomes\ belongs\ to\ eventA}{Total\ possible\ outcomes\ in\ S}$$

$$P(A) = \frac{3}{6} = 0.5$$

Let the experiment 2 = Flip a coin
Flipping a coin has sample space S = {H, T}
Required event = 'Getting tail'
Sample points favoured to required event A = {T}
So, P (B) = Probability of getting tail

$$P(B) = \frac{\#\ of\ outcomes\ belongs\ to\ eventB}{Total\ possible\ outcomes\ in\ S}$$

$$P(A) = \frac{1}{2} = 0.5$$

Note that above events A, B are independent. As per the problem statement, P(A ∩ B) indicates probability of winning.
P(A ∩ B) = Probability of getting odd number on the die and tail on the coin

$$\therefore P(A \cap B) = P(A).P(B) = \frac{1}{2}.\frac{1}{2} = \frac{1}{4} = 0.25$$

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Complementary Events

The symbol for the complement of event A is $\overline{A}$. Note that complementary events are mutually exclusive.

The sum of the probabilities of complementary events is 1.

$P(A) + P(\overline{A}) = 1$ $\qquad \overline{A}$ = not A

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

Hence, if we know the probability of occurrence of an event P(A), it is easy to compute the probability that the event does not occur $P(\overline{A})$.

DEPENDENT EVENT:

- Suppose A & B are two events in an experiment. If A occur firstly & B occur secondly if the probability of 2nd event B change due to the occurrence of 1st event A. Then these events are said to be dependent event.

$$P(A \cap B) = P(A).P(B/A)$$

$$P(A \cap B \cap C) = P(A).P(B/A) \quad P(C/A \cap B)$$

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