BY: DR. SHAILESH KR. SINGH
ASSISTANT PROFESSOR (GUEST)

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B.COM. PART 1

CORE CONCEPT OF BUSINESS MATHMATICS & STATISTICS

PROBABILITY THEOREMS

1) **Addition Theorem-** If two events (A & B) are mutually exclusive and probability of occurrence of A is P (A) and that B is P (B), then probability of occurrence of any event (A & B) will be the sum of the individual probabilities of A & B. If two events are mutually exclusive, then the probability of either occurring is the sum of the probabilities of each occurring.

   Symbolically Addition Rule

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

Non-Mutually Exclusive Events

In events which aren't mutually exclusive, there is some overlap. When P(A) and P(B) are added, the probability of the intersection (and) is added twice. To compensate for that double addition, the intersection needs to be subtracted.

General Addition Rule

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

Example-27: If a card is drawn random at from a pack of cards what is the probability that-

a) Either a king or a queen
b) Either a club or the Ace of Diamond

Solution- 27:

a) Either a king or a queen- For king P (A)= 1/52

For Queen P (B) = 1/52

Probability for either a king or a queen P (A or B) = P (A) + P (B)

$$= \frac{1}{52} + \frac{1}{52} \quad = \frac{2}{52} = \frac{1}{26}$$

b) Either a club or the Ace of Diamond- For Club P (A)= 13/52

For Ace of Diamond P (B) = 1/52

Probability for either a king or a queen P (A or B) = P (A) + P (B)

$$= \frac{13}{52} + \frac{1}{52}$$

$$= \frac{14}{52} = \frac{7}{26}$$

Multiplication Theorem- This theorem is also called as "Theorem of Compound Probability". According to this theorem "If two events are independent, and probability of occurrence of A is P (A) and that B is P (B), then probability of occurrence of any event (A & B) will be the product of both these event of the individual probabilities of A & B.

Symbolically Multiplication Rule:

P (A and B) = P (A) * P (B)

Example-28: A bag contains 5 white and 7 black balls. A ball is drawn out of it and replaced in the bag. Then a ball is drawn again. What is the probability that: (i) both the balls drawn were white, (ii) both were black, (iii) the first ball was white and the second black.

Solution-28: (i) Probability of first ball being white P (A) = 5/12

Probability of second ball being white P (A) = 5/12

Both these events are independent. So the probability of both balls being white:

P (A and B) = P (A) * P (B) = $= \frac{5}{12} * \frac{5}{12} = \frac{25}{144}$

(ii) Probability of first ball being black P (A) = 7/12

Probability of second ball being black P (A) = 7/12

Both these events are independent. So the probability of both balls being white:

P (A and B) = P (A) * P (B) = $= \frac{7}{12} * \frac{7}{12} = \frac{49}{144}$

(iii) Probability of first ball being white P (A) = 5/12

Probability of second ball being black P (B) = 7/12

Both these events are independent. So the probability of both balls being white and black:

P (A and B) = P (A) * P (B) = $= \frac{5}{12} * \frac{7}{12} = \frac{35}{144}$

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Theorem of Conditional Probability: According to this theorem, "The probability of simultaneous occurrence of the dependent event in the product of the probability of the first event and the probability of the second after the first sub event has occurred."

P (A and B) = P (A) * P (B|A)

P (A and B) = P (A) * P (A|B)