MAYANG ANCHALIK COLLEGE

HOME ASSIGNMENT

3rd SEMESTER

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STATISTICAL METHODS FOR ECONOMICS

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Question : 1 Explained the addition and multiplication theorem of probability ?

Ans:- Addition theorem

The addition theorem states that if two events A and B are mutually exclusive the probability of the occurrence of either A or B is the sum of the individual probability of A and B. symbolically.

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

proof of the theorem: If an event A can happen in a_1 ways and B in a_2 ways, then the number of ways in which either event can happen is $a_1 + a_2$. If the total number of possibilities is n, then by definition the probability of either the first or the second event happening is

$$\frac{a_1 + a_2}{n} = \frac{a_1}{n} + \frac{a_2}{n}$$

But $\frac{a_1}{n} = P(A)$

and $\frac{a_2}{n} = P(B)$

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

The theorem can be extended to three or more mutually exclusive events.

Thus $P(A \text{ or } B \text{ or } C) = P(A) + P(B) + P(C)$

Multiplication theorem

This theorem states that if two event A and B are independent the probability that they both will occur is equal to the product of their independent probability. Symbolically, if A and B are independent, then.

$$P(A \text{ and } B) = P(A) \times P(B)$$

The theorem can be extended to three or more independent events.

Thus $$P(A, B \text{ and } C) = P(A) \times P(B) \times P(C)$$

Proof of the theorem :- If an event A can happen in n_1 ways of which a_1 are successful and the event B can happen in n_2 ways of which a_2 are successful. we can combine each successful event in the first with each successful event in the second case. Thus, the total number of successful happenings in both cases is $a_1 \times a_2$. Similarly, the total number of possible cases in $n_1 \times n_2$.

Then by definition the probability of the occurrence of both events is

$$\frac{a_1 \times a_2}{n_1 \times n_2} = \frac{a_1}{n_1} \times \frac{a_2}{n_2}$$

But $\frac{a_1}{n_1} = P(A)$

and $\frac{a_2}{n_2} = P(B)$

$\therefore P(A \text{ and } B) = P(A) \times P(B)$

In a similar way the theorem can be extended to three or more events.

2. What is bionomial distribution? Explained the properties of bionomial distribution.

Ans:- The bionomial distribution also known as Bernaulli distribution is associated with the name of a swiss mathematician Jacob Bernoulli also known as Jacques or James Bernaulli (1654-1705). Bionomial distribution is a probability distribution expressing the probability of one set of dichotomous alternatives, ie, success or failure.

This distribution has been used to describe a wide variety of processes in business and social science as well as other areas. The type of process which gives rise to this distribution is usually referred to as Bernaulli trail or as a Bernaull process. The mathematical model for a Bernaulli process is developed under a very specific set of assumption involving the concept of a series of experimental trails. The general from of the distribution is:

The Bionomial distribution

$$p(r) = {}^nC_r \, {}^{n-r} p^r$$

where p = probability of success in a single trial

$q = 1 - p$

n = Number of trials

r = Number of success in n trials.

Properties of Bionomial distribution

1. The shape and location of binomial distribution changes as p changes for a given n or as n changes for a given p. As p increases for a fixed n. The bionomial distribution shifts to the right.

2. The mode of the bionomial distribution is equal to the value of x which has the largest probability For example, if $n = 6$ and $p = 0.3$ the mode is equal to 2. while for $n = 6$ and $p = 0.9$ The mode is equal to 6. The mean and mode are

equal if np is an integer. For example, when $n = 6$ and $p = 0.50$, the mean and mode are both equal to 3. For fixed n, both mean and mode increase as p increases.

3. As n increases for a fixed p, the. bionomial The distribution moves to the right, flattens, and spreads out. The mean of the bionomial distribution np, obviously increases as n increases with p held constant. For larger n there are more possible outcomes of a bionomial experiment and the probability associated with any particular outcome becomes smaller.

4. If n is large and if neither p nor q is too close to zero, the bionomial distribution can be closely approximated by a normal distribution with standardized variable given by $Z = \frac{X - np}{\sqrt{npq}}$. The approximation becomes better with increasing n.

Question#3 Explain fully the multi-stage random sampling method.

Ans:- Multi - Stage sampling or cluster sampling:- under this method, the random selection is made of primary, intermediate and final for the stages in which the Sampling process is carried out. At first, the first stage units are sampled by some suitable method, such as simple random sampling then, a sample of second stage units is selected from each of the selected ~~first~~ first stage units, again by some suitable method which may be the same as or different from the method employed for the first stage units. Further stages may be added as required. The procedure may be illustrated as follows:-

Suppose we want to take a sample of 50,000 households from the state of U.P. At the first stage, the state may be divided into a number of districts and a few districts selected at random. At the second stage, each district may be subdivided into a number of villages and a sample of villages may be taken at random. At the thired stage, a number of households may be selected from each of the villages selected at the second stage. To take another example Suppose in a particular survey. we wish to take a Sample of 20.000 Students from Madras university. we may take college - primary units - as the first Stage, then draw deparments as the second stage, and choose students as the thired and last stage.

Merits : Multi-stage sampling introduces flexibility in the sampling method which is lacking in the other methods. It enables existing divisions and sub-divisions of the population to be used as units at various Stage, and permits the field work to be concentrated and yet large area to be covered. Another ~~advang~~ advantage of the method is that subdivision into second stage units (i,e, the construction of the second stage frame) need be carried out for only those first stage units which are included in the sample. It is, therefore, particularly valuable in surveys of underdeveloped areas where no frame is generally sufficiently detailed and accurate for subdivision of the material into reasonably small sampling units.

Limitations : However, a multi-stage sample is in general less accurate than a sample

Containing the same number of final stage less units which we have discussed above the various random ~~Procedures~~ Procedures in 4 independent designs. In practice we often combine two or more of these methods into a single design.