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Course title: Statistical Decision making
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Ans: to the Q.N (1-02)

Discuss Different Random variables

A Random variable is a rule that assigns a numerical value to each outcome in a sample space. Random variables many be either discrete or continuous. A random variable is said to be discrete if it assumes only specified values in an interval. otherwise, it is continuous. We generally denote the random variables with capital letters such as X and Y. When X takes values 1, 2, 3, --- it is said to have to a

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discrete random variable. As a function, a random variable is needed to be measured, which allows Probabilities to be assigned to a set of potential values. It is obvious that the results depend on some Physical variables which are not predictable. Say, when we toss a fair coin, the final result of happening to be heads or tails will depend on the possible physical conditions. We cannot predict which outcome will be noted.

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Variate: A variate can be define as a generalization of the random variable. It has the same properties as that of the random variables without stressing to any particular type of probabilistic experiment. It always obeys a particular probabili- stic law.

* A variate is called discrete variate when that variate is not capable of assuming all the values in the provided range.

* If the variate is able to assume all the numerical values provided

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range.

* If the variate is able to assume all the numerical values provided in the whole range. Then it is called continuous variate.

Types of Random variable

As discussed in the introduction, there are two random variables, such as

* Discrete Random variable
* continuous Random variable

let's understand these types of variables in detail along with suitable example below.

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Discrete Random variable

A discrete random variable can take only a finite number of distinct values such as 0, 1, 2, 3, 4 and so on. The probability distribution of a random variable has a list of probabilities compared with each of its possible values known as probability mass function

In an analysis, let a person be chosen at random, and the person weight is demonstrated by a random variable. Logically the random variable is described as a finite

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which relates the person to the person's hight. now in relation with the random variable, if is a probability distribution that enable the calculation of the probability that the height is in any subset of likely values, such as the likelihood that the height is between 175 and 185 cm, on the possibility that the height is either less than 145 or more than 180 cm. now another random variable could be the person's age which could be either between 45 years to 50 years or

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Continuous Random variable

A numerically valued variable is said to be continuous if, in unit of measurement, whenever it can take on the values a and. If the random variable X can assume an infinite and uncountable set of values it is said to be a continuous random variable. When x takes any value in a given interval it is said to be a continuous random variable in that interval.

Formally, a continuous random

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variable is such whose cumulative distribution function is constant throughout. there are no gaps in between which would comp- one to numbers which have a limited probability of occurring. Alternately, these variables almost never take an accurately prescribed value but there is a positive probability that value will rest in particular intervals which can be very small.

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Random variable formula

for a given set of data the mean and variance random variable is calculated by the formula. So, here we will define two major formulas.

* Mean of random variable
* variance of random variable

Mean of Random variable:

If X is the random variable and P is the respective probabilities the mean of a random variable

Mean (μ) = ΣXP

when variable X consists of all possible values and P consist of respective probabilities.

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Variance of Random variable

The variance tell how much is the spread of random variable X around the mean value. The formula for the variable variance of a random variable is given by:

$var(X) = \sigma^2 = E(X^2) - [E(X)]^2$

where $E(x^2) = \sum x^2 p$ and $E(X) = \sum xp$

Functions of Random variables

Let the random variable X assume the values $X_1, X_2, \ldots$ with the corresponding probability $P(X_1)$ $P(X_2) \ldots$ than the expected value of the random variable is given

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expectation of X, $E(X) = \sum x P(X)$.

A new random variable y can be stated by using a real Borel measurable function: $R \to R$, to the results of a real valued random variable X. That is, $y = F(X)$. The cumulative distribution function of y is then given by.

$F_y(y) = P(g(X) \leq y)$

If function g is invertible (say $h = g^{-1}$) and is either increasing or decreasing, then the previous relationship can be extended to obtain.

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$F_y(y) = P(g(X) \leq y) = \{ P(X \leq h(y)) = F$
$P(X \geq h(y)) = 1-$

Now if we differentiate both the sides of the above expression with respect to y, then the relation between the probability density functions can be found.

$F_y(y) = F_x(h(y)) | dh(y)/dy |$'

Random variable and probability Distribution: The probability distribution of a random variable can be.

* Theoretical listing of outcomes and probabilities of the outcome to there some at inverse,

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* An experimental listing of outcomes associated with their observed relative frequencies.

* A subjective listing of outcomes associated with their subjective probabilities.

The probability of a random variable X which takes the values x is defined as a probability function of X is denoted by $f(X) = F(X = x)$

A probability distribution always satisfies two conditions:

* $F(X \geq 0$

* $\sum F(X) = 1$

The important probability distributions are:

* Binomial distribution
* Poisson distribution
* Bernoulli's distribution
* Exponential distribution
* Normal distribution.

<u>Transformation of Random variables</u>: The transformation of a random variable means to reassign the value to another variable. The transformation is actually inserted to remap the number line from X to y, then the transm

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Discuss about Binomial experiment

A binomial experiment is an experiment using a fixed number of independent trials with only two outcome. these experiments have outcomes. that are defined as either success or failure outcomes in these experiments can only ever be successes or failures because of the nature of what is being tested. this lesson contains further explanation of these types of experiments, the requirements of this types

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type of experiment, and example of this types of experiment.

Understanding Binomial experiments

Binomial experiments are distinct types of experiments because they have a fixed number of outcomes possible in each trial conducted in the experiment. Specifically, binomial experiments can only ever result in one of two outcomes. To help answer the question of what is a binomial experiment, it is necessary to understand statistical term. When a binomial

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experiment is conducted, one outcome will be labeled a success, and the other will be referred to as a failure. These terms will be used to help determine the statistical significance of the results of multiple trials in the analysis portion of the experiment. Sometimes success relates to a colloquially positive outcome, such as someone answering yes to a question asked. However in this context success and

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and failure are terms used in statistics that are based on the phrasing of the experimental question. Success means that the outcome of the trial supported the statistical question or hypothesis. An example of this is if an experimenter hypothesized that a coin flipped would land on heads more than 50% of the time in a certain environment. In this case, success would correspond to

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the coin landing on heads and failure would relate to the coin landing on tails. see in this example, how these terms do not carry in this example how theses terms do everyday meanings of good and bad, but rather relate to the statistical qestion at hand. Binomial experiments can have outcomes such as heads or tails, yes or no true or false, and many others possibilities. Despite

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The range of possible periods of outcomes, the trials conducted in these experiments are only ever have two possible outcomes.

Binomial Experiment Requirements: There are specific binomial experiment requirements that must be meet for an experiment to accurately fit this definition. There are four discrete facts that must be true about the experiment for it to be defined as a binomial pity.

...mial experiment:

(1) There are a fixed number of trials that will be conducted in the experiment. In statistical equations, this number of trials is labeled.

(2) There are only two possible outcomes for each of the fixed trials conducted in the experiment. One outcome will be labeled a failure.

(3) The probability of success in each trial must remain the same for each trial

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conducted. probability in statistics equations is represented by.

(4) Each trial in the experiment must be independent of the other trials. when one trial is conducted, it cannot influence the outcome of the other trials in any way.

these four requirements must be present for an experiment to be considered binomial. If any one aspect is missing the experiment cannot be classified as binomial. even

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if an experiment has trials with two outcomes, it would not be a binomial experiment if the other rules were not followed.

(1) There must be a fixed number of trials.

(2) Each trial must be independent of the others.

(3) Each trial must have a success and a failure.

(4) The probability of success must be the same for all trials.

Binomial experiment give rise to binomial random variables which will be the topic of our next couple of lessons. A binomial experiment is a very specific type of experiment. In order to be a binomial experiment, there are qualifications that the experiment must meet.

① There must be a fixed number of trials: The experiment cannot just be to roll a die until you get a 2, because the number of rolls trials is not fixed.

(2) Each trial must be independent of the others. You cannot have a situation like if you flip a coin and get heads, flip twice more, and if you get tails, flip three more times.

(3) Each trial must have a success and a failure: Depending on the trial, these may be identified as "yes" and "no", on back and white etc. However, from a statistics standpoint, the outcome you are studying is generally called the success and the other is failure.

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(4) The probability of success must be the same for all trials: the experiment cannot be 10 trials of pulling and keeping a card card from a deck to see how many are hearts because the probability of getting a heart would change each trial. to make this a binomial experiment, you need to replace the the card each time. In probability theory and statistics, the binomial distribution with parameters and is the discrete

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probability distribution of the number of successes in a sequence of independent experiments each asking a yes no question, and each with its own Boolean valued outcome. success with probability or failure with probability. A single success/failure experiment is also called a bernoulle trial or Bernoll Bernoulle experiment and a Bernoulli experiment, and a sequence of outcomes is called a Bernoulli process

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The binomial distribution is frequently used to model the number of successes in a sample of size drawn with replacement from a population of size.

If the sampling is carried out without replacement the draws are not independent and so that resulting distribution is a hypergeometric distribution, not a binomial one. However for N much large than n, the binomial distribution remains and