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Subject : Statistical Inference

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Q1: The average rainfall in an area recorded is 9.22cm for a month. Given the distribution to be normally distributed with a standard deviation of 2.83cm

ANSWER:

Find the probability that the rainfall in the next month will be less than 1.84cm.

$$H = 9.22\text{cm} \quad \sigma = 2.83\text{cm}$$

$$P(x < 1.84) = ?$$

$$Z =$$

$$Z = -2.607$$

$$P(x < 1.84) = P(Z < -2.607) = 0.0038$$

$$(i) P(7 < x < 13.8) = ?$$

$$Z_1 =$$

$$=$$

$$= 0.784$$

$$P(x > 7) = ?$$

$$P(x > 7) = P(Z > -0.784) = 0.2177$$

$$P(13.8 > x) = ?$$

$$Z_2 =$$

$$P(x < 13.8) = P(Z < 1.618) = 0.9463$$

(2) Rainfall will be between 7 cm and 13.8cm.

$$P(7 < x < 13.8)$$

$$= P(-0.784 < Z < 1.618)$$

$$= 0.9463 - 0.2177$$

$$= 0.7286$$

(3) Rainfall is more than 11.05 cm

$$P(x > 11.05)$$

$$Z =$$

$$\begin{aligned} Z &= \\ Z &= 0.646 \\ P(x > 11.05) \\ P(Z > 0.646) \\ &= 0.7389 \end{aligned}$$

Q2: (a) Discuss any 3 characteristics of normal distribution and discuss its uses in the business world.

ANSWER:

USES OF NORMAL DISTRIBUTION:

The normal distribution has great significance in statistical work because of the following reason:

- The normal distribution has the remarkable property stated in the so-called central limit theorem.
- Even if a variable is not normally distributed, it can sometimes be brought to normal form by simple transformation of variable.
- Many of the sampling distributions like student's t , Snadeeos's F , etc. Also tend to normal distribution.
- The sampling theory and tests of significance are based upon the assumption that samples have been drawn from a normal population with mean and variance.
- Normal distribution finds large applications in Statistical Quality Control.

b) Suppose you are going to be conducting a study on students, asking for their opinion on an issue of interest to you (could be related to the university, or a wider societal issue). Describe how you would carry out the sampling of students using the following methods:

- (i) simple random sampling
- (ii) stratified sampling

(iii) cluster sampling Think about what attributes of the student population make sense to stratify vs. cluster

ANSWER:

i) simple random sampling

In this technique, each member of the population has an equal chance of being selected as subject. The entire process of sampling is done in a single step with each subject selected independently of the other members of the population. ... Another way would be to let a computer do a random selection from your population.

(ii) Stratified sampling

A sample may be selected from a population through a number of ways, one of which is the stratified random sampling method. A stratified random sampling involves dividing the entire population into homogeneous groups called strata (plural for stratum). Random samples are then selected from each stratum

(ii) cluster sampling

Think about what attributes of the student population make sense to stratify vs. cluster.

1. In stratified sampling, a sample is drawn from each strata (using a random sampling method like simple random sampling or systematic sampling). ...
2. In cluster sampling, the sampling unit is the whole cluster; Instead of sampling individuals from within each group, a researcher will study whole clusters

Q3: (a) Determine the type of sampling used (simple random, stratified, systematic, cluster, or convenience).

1. A group of test subjects is divided into twelve groups; then four of the groups are chosen at random.
2. A market researcher polls every tenth person who walks into a store.
3. The first 50 people who walk into a sporting event are polled on their television preferences.
4. A computer generates 100 random numbers, and 100 people whose names correspond with the numbers on the list are chosen.

Answer :

- 1) cluster
- 2) systematic
- 3) simple random
- 4) convenience

(b) Differentiate between

- Descriptive statistics and inferential statistics
- Variance and standard deviation
- Cluster and strata

ANSWER:

(1) Descriptive Statistics

Descriptive statistics describe a sample. That's pretty straightforward. You simply take a group that you're interested in, record data about the group members, and then use summary statistics and graphs to present the group properties. With descriptive statistics, there is no uncertainty because you are describing only the people or items that you actually measure. You're not trying to infer properties about a larger population.

*Inferential Statistics

Inferential statistics takes data from a sample and makes inferences about the larger population from which the sample was drawn. Because the goal of inferential statistics is to draw conclusions from a sample and generalize them to a population, we need to have confidence that our sample accurately reflects the population. This requirement affects our process.

(2) Variance deviation:

The variance is the average of the squared differences from the mean. To figure out the variance, first calculate the difference between each point and the mean; then, square and average the results

The variance measures the average degree to which each point differs from the mean—the average of all data points.

*standard deviation:

Standard deviation is a statistic that looks at how far from the mean a group of numbers is, by using the square root of the variance. The calculation of variance uses squares because it weighs outliers more heavily than data closer to the mean. This calculation also prevents differences above the mean from canceling out those below, which would result in a variance of zero.

Standard deviation is calculated as the square root of variance by figuring out the variation between each data point relative to the mean.

Standard deviation looks at how spread out a group of numbers is from the mean, by looking at the square root of the variance.

(3) Cluster:

Cluster sampling is a sampling plan used when mutually homogeneous yet internally heterogeneous groupings are evident in a statistical population. ... In this sampling plan, the total population is divided into these groups (known as clusters) and a simple random sample of the groups is selected.

* Strata:

In statistics, a stratum (plural strata) refers to a subset (part) of the population (entire collection of items under consideration) which is being sampled. Stratification thus consists of dividing the population into strata within each of which an independent sample can be chosen