STATISTICS WORKSHEET-1

Q1 to Q9 have only one correct answer. Choose the correct option to answer your question.

1. Bernoulli random variables take (only) the values 1 and 0.
a) True
b) False

ANS- a) True

2. Which of the following theorem states that the distribution of averages of iid variables, properly normalized, becomes that of a standard normal as the sample size increases?

a) Central Limit Theorem
b) Central Mean Theorem
c) Centroid Limit Theorem
d) All of the mentioned

ANS- a) Central Limit Theorem

3. Which of the following is incorrect with respect to use of Poisson distribution?
a) Modeling event/time data
b) Modeling bounded count data
c) Modeling contingency tables
d) All of the mentioned

ANS- b) Modeling bounded count data

4. Point out the correct statement.

a) The exponent of a normally distributed random variables follows what is called the log- normal distribution
b) Sums of normally distributed random variables are again normally distributed even if the variables are dependent
c) The square of a standard normal random variable follows what is called chi-squared distribution
d) All of the mentioned

ANS- d) All of the mentioned

5. _____ random variables are used to model rates.
a) Empirical
b) Binomial
c) Poisson
d) All of the mentioned

ANS- c) Poisson

6. 10. Usually replacing the standard error by its estimated value does change the CLT.
a) True
b) False

ANS- b) False

7. 1. Which of the following testing is concerned with making decisions using data?
a) Probability
b) Hypothesis

c) Causal
d) None of the mentioned

ANS- b) Hypothesis

8. 4. Normalized data are centered at_____and have units equal to standard deviations of the original data.
a) 0
b) 5
c) 1
d) 10

ANS- a) 0

9. Which of the following statement is incorrect with respect to outliers?
a) Outliers can have varying degrees of influence
b) Outliers can be the result of spurious or real processes
c) Outliers cannot conform to the regression relationship
d) None of the mentioned

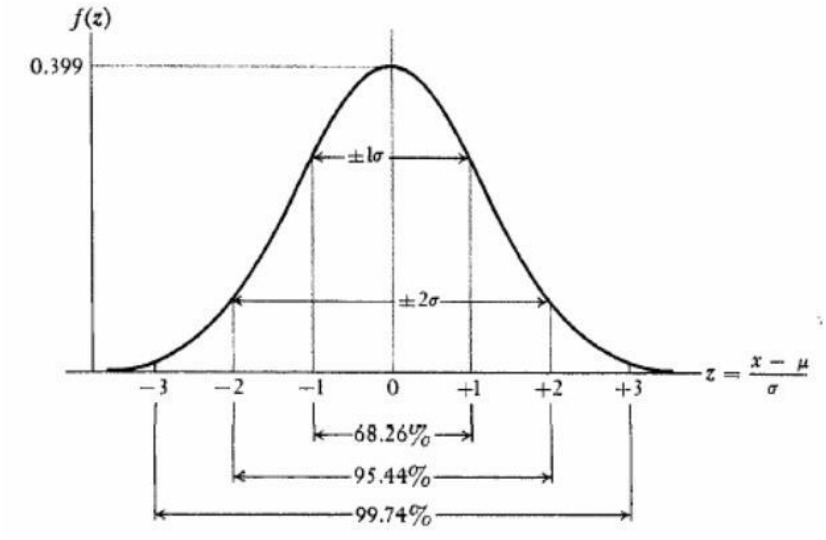
ANS- c) Outliers cannot conform to the regression relationship

Q10and Q15 are subjective answer type questions, Answer them in your own words briefly.

10. What do you understand by the term Normal Distribution?

Ans-

Normal Distribution: The normal distribution is the most widely known and used of all distributions. Because the normal distribution approximates many natural phenomena so well, it has developed into a standard of reference for many probability problems.



Why Normal Distribution? Many things actually are normally distributed, or very close to it. For example, height and intelligence are approximately normally distributed; measurement errors also often have a normal distribution. The normal distribution is easy to work with mathematically. In many practical cases, the methods developed using normal theory work quite well even when the distribution is not normal. There is a very strong connection between the size of a sample N and the extent to which a sampling distribution approaches the normal form. Many sampling distributions based on large N can be approximated by the normal distribution even though the population distribution itself is definitely not normal.

11. How do you handle missing data? What imputation techniques do you recommend?

ANS-

Best techniques to handle missing data

Use deletion methods to eliminate missing data

The deletion methods only work for certain datasets where participants have missing fields. There are several deleting methods – two common ones include Listwise Deletion and Pairwise Deletion. It means deleting any participants or data entries with missing values. This method is particularly advantageous to samples where there is a large volume of data because values can be deleted without significantly distorting readings. Alternatively, data scientists can fill out the missing values by contacting the participants in question. The problem with this method is that it may not be practical for large datasets. Furthermore, some corporations obtain their information from third-party sources, which only makes it unlikely that organisations can fill out the gaps manually. Pairwise deletion is the process of eliminating information

when a particular data point, vital for testing, is missing. Pairwise deletion saves more data compared to likewise deletion because the former only deletes entries where variables were necessary for testing, while the latter deletes entire entries if any data is missing, regardless of its importance.

Use regression analysis to systematically eliminate data

Regression is useful for handling missing data because it can be used to predict the null value using other information from the dataset. There are several methods of regression analysis, like Stochastic regression. Regression methods can be successful in finding the missing data, but this largely depends on how well connected the remaining data is. Of course, the one drawback with regression analysis is that it requires significant computing power, which could be a problem if data scientists are dealing with a large dataset.

Data scientists can use data imputation techniques

Data scientists use two data imputation techniques to handle missing data: Average imputation and common-point imputation. Average imputation uses the average value of the responses from other data entries to fill out missing values. However, a word of caution when using this method – it can artificially reduce the variability of the dataset. Common-point imputation, on the other hand, is when the data scientists utilise the middle point or the most commonly chosen value. For example, on a five-point scale, the substitute value will be 3. Something to keep in mind when utilising this method is the three types of middle values: mean, median and mode, which is valid for numerical data (it should be noted that for non-numerical data only the median and mean are relevant).

Keeping things under control

Missing data is a sad fact of life when it comes to data analytics. We cannot avoid situations like these entirely because there are several remedial steps data scientists need to take to make sure it doesn't adversely affect the analytics process. While these methods are helpful, they are not foolproof because they are contentious, meaning, their effectiveness depends heavily on circumstances. The best option available to data scientists is to work with powerful, processing tools that can make the data capturing and analysis process significantly easier. It is the best way to handle missing data.

12. What is A/B testing?
ANS-

A/B testing is a popular way to test your products and is gaining steam in the data science field

Here, we'll understand what A/B testing is and how you can leverage A/B testing in data science using Python. A/B testing is a basic randomized control experiment. It is a way to compare the two versions of a variable to find out which performs better in a controlled environment.

For instance, let's say you own a company and want to increase the sales of your product. Here, either you can use random experiments, or you can apply scientific and statistical methods. A/B testing is one of the most prominent and widely used statistical tools.

In the above scenario, you may divide the products into two parts – A and B. Here A will remain unchanged while you make significant changes in B's packaging. Now, on the basis of the response from customer groups who used A and B respectively, you try to decide which is performing better.It is a hypothetical testing methodology for making decisions that estimate population parameters based on sample statistics. The **population** refers to all the customers buying your product, while the **sample** refers to the number of customers that participated in the test.

13. Is mean imputation of missing data acceptable practice?

ANS-

The process of replacing null values in a data collection with the data's mean is known as mean imputation.

Mean imputation is typically considered terrible practice since it ignores feature correlation. Consider the following scenario: we have a table with age and fitness scores, and an eight-year-old has a missing fitness score. If we average the fitness scores of people between the ages of 15 and 80, the eighty-year-old will appear to have a significantly greater fitness level than he actually does.

Second, mean imputation decreases the variance of our data while increasing bias. As a result of the reduced variance, the model is less accurate and the confidence interval is narrower.

14. What is linear regression in statistics?

ANS-

Linear regression is a basic and commonly used type of predictive analysis. The overall idea of regression is to examine two things: (1) does a set of predictor variables do a good job in predicting an outcome (dependent) variable? (2) Which variables in particular are significant predictors of the outcome variable, and in what way do they–indicated by the magnitude and sign of the beta estimates–impact the outcome variable? These regression estimates are used to explain the relationship between one dependent variable and one or more independent variables. The simplest form of the regression equation with one dependent and one independent variable is defined by the formula y = c + b*x, where y = estimated dependent variable score, c = constant, b = regression coefficient, and x = score on the independent variable.

Naming the Variables. There are many names for a regression's dependent variable. It may be called an outcome variable, criterion variable, endogenous variable, or regressand. The independent variables can be called exogenous variables, predictor variables, or regressors.

Three major uses for regression analysis are (1) determining the strength of predictors, (2) forecasting an effect, and (3) trend forecasting

15. What are the various branches of statistics?

ANS-

The two main branches of statistics are descriptive statistics and inferential statistics. Both of these are employed in scientific analysis of data and both are equally important for the student of statistics.

Descriptive Statistics

Descriptive statistics deals with the presentation and collection of data. This is usually the first part of a statistical analysis. It is usually not as simple as it sounds, and the statistician needs to be aware of designing experiments, choosing the right focus group and avoid biases that are so easy to creep into the experiment. Different areas of study require different kinds of analysis using descriptive statistics. For example, a physicist studying turbulence in the laboratory needs the average quantities that vary over small intervals of time. The nature of this problem requires that physical quantities be averaged from a host of data collected through the experiment.

Inferential Statistics

Inferential statistics, as the name suggests, involves drawing the right conclusions from the statistical analysis that has been performed using descriptive statistics. In the end, it is the inferences that make studies important and this aspect is dealt with in inferential statistics.
Most predictions of the future and generalizations about a population by studying a smaller sample come under the purview of inferential statistics. Most social sciences experiments deal with studying a small sample population that helps determine how the population in general behaves. By designing the right experiment, the researcher is able to draw conclusions relevant to his study.

While drawing conclusions, one needs to be very careful so as not to draw the wrong or biased conclusions. Even though this appears like a science, there are ways in which one can manipulate studies and results through various means. For example, data dredging is increasingly becoming a problem as computers hold loads of information and it is easy, either intentionally or unintentionally, to use the wrong inferential methods.

Both descriptive and inferential statistics go hand in hand and one cannot exist without the other. Good scientific methodology needs to be followed in both these steps of statistical analysis and both these branches of statistics are equally important for a researcher.