Statistics

Q1. Bernoulli random variables take (only) the values 1 and 0

Ans a) True

Q2 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?

Ans a) Central Limit Theorem

Q3 . Which of the following is incorrect with respect to use of Poisson distribution?

Ans b) Modeling bounded count data

Q4. Point out the correct statement

Ans d) All of the mentioned

5. _____ random variables are used to model rates.

Ana c) Poisson

6. 10. Usually replacing the standard error by its estimated value does change the CLT.

Ans b) False

7. 1. Which of the following testing is concerned with making decisions using data?

Ans b) Hypothesis

8. 4. Normalized data are centered at_____and have units equal to standard deviations of the original data.

Ans a) 0

9. Which of the following statement is incorrect with respect to outliers?

Ans c) Outliers cannot conform to the regression relationship

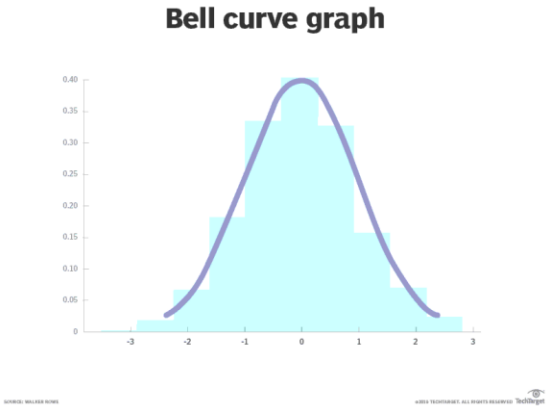
10. What do you understand by the term Normal Distribution?

Ans A normal distribution is a type of continuous probability distribution in which most data points cluster toward the middle of the range, while the rest taper off symmetrically toward either extreme. The middle of the range is also known as the mean of the distribution.

$$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

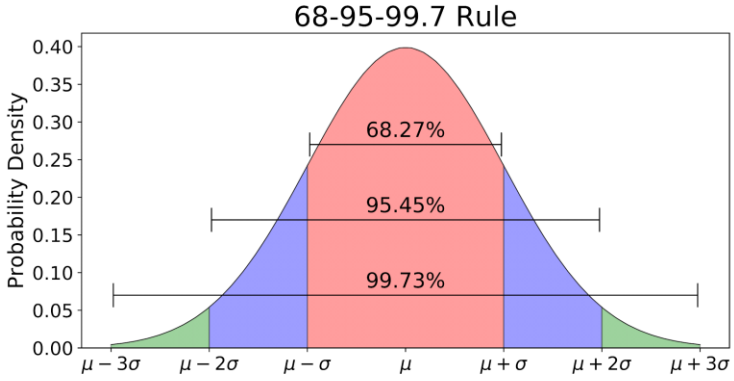
$\mu =$ Mean
$\sigma =$ Standard Deviation
$\pi \approx 3.14159\cdots$
$e \approx 2.71828\cdots$

The normal distribution is also known as a Gaussian distribution or probability bell curve. It is symmetric about the mean and indicates that values near the mean occur more frequently than the values that are farther away from the mean.



- The Empirical Rule

For all normal distributions, 68.2% of the observations will appear within plus or minus one standard deviation of the mean; 95.4% of the observations will fall within +/- two standard deviations; and 99.7% within +/- three standard deviations. This fact is sometimes referred to as the "empirical rule," a heuristic that describes where most of the data in a normal distribution will appear.



Q11 . How do you handle missing data? What imputation techniques do you recommend?

Ans Missing data can be dealt with in a variety of ways. I believe the most common reaction is to ignore it. Choosing to make no decision, on the other hand, indicates that your statistical programme will make the decision for you.

Your application will remove things in a listwise sequence most of the time. Depending on why and how much data is gone, listwise deletion may or may not be a good idea.

Another common strategy among those who pay attention is imputation. Imputation is the process of substituting an estimate for missing values and analyzing the entire data set as if the imputed values were the true observed values.

The following are some of the most prevalent methods:

- Mean imputation

Calculate the mean of the observed values for that variable for all non-missing people. It has the advantage of maintaining the same mean and sample size, but it also has a slew of drawbacks. Almost all of the methods described below are superior to mean imputation.

- Regression imputation

The result of regressing the missing variable on other factors to get a predicted value. As a result, instead of utilizing the mean, you're relying on the anticipated value, which is influenced by other factors. This keeps the associations between the variables in the imputation model, but not the variability around the anticipated values.

- Stochastic regression imputation

The predicted value of a regression plus a random residual value. This has all of the benefits of regression imputation plus the random component's benefits. The majority of multiple imputations are based on stochastic regression imputation.

Q12. What is A/B testing?

Ans 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.

A/B Testing explanation

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.

Q13. Is mean imputation of missing data acceptable practice?

Ans 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.

Any statistic that uses the imputed data will have a standard error that's too low.

In other words, yes, you get the same mean from mean-imputed data that you would have gotten without the imputations. And yes, there are circumstances where that mean is unbiased. Even so, the standard error of that mean will be too small.

Because the imputations are themselves estimates, there is some error associated with them. But your statistical software doesn't know that. It treats it as real data.

Ultimately, because your standard errors are too low, so are your p-values. Now you're making Type I errors without realizing it.

That's not good.

14. What is linear regression in statistics?

Ans Linear regression strives to show the relationship between two variables by applying a linear equation to observed data. One variable is supposed to be an independent variable, and the other is to be a dependent variable. For example, the weight of the person is linearly related to his height. Hence this shows a linear relationship between the height and weight of the person. As the height is increased, the weight of the person also gets increased.

It is not necessary that here one variable is dependent on others, or one causes the other, but there is some critical relationship between the two variables. In such cases, we use a scatter plot to imply the strength of the relationship between the variables. If there is no relation or linking between the variables, the scatter plot does not indicate any increasing or decreasing pattern

- Linear Regression Equation

The measure of the extent of the relationship between two variables is shown by the correlation coefficient. The range of this coefficient lies between -1 to +1. This coefficient shows the strength of the association of the observed data for two variables.

A linear regression line equation is written in the form of:

$Y = a + bX$

where X is the independent variable and plotted along the x-axis

Y is the dependent variable and is plotted along the y-axis

The slope of the line is b, and a is the intercept (the value of y when x = 0).

Q15. 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 is a branch of statistics that makes use of various analytical tools to draw inferences about the population data from sample data. Apart from inferential statistics, descriptive statistics forms another branch of statistics. Inferential statistics help to draw conclusions about the population while descriptive statistics summarizes the features of the data set.

There are two main types of inferential statistics - hypothesis testing and regression analysis. The samples chosen in inferential statistics need to be representative of the entire population.