

STATISTICS WORKSHEET 3

Question Number	Answer
1	b
2	c
3	a
4	a
5	d
6	b
7	b
8	d
9	a

10. What Is Bayes' Theorem?

The Bayes' theorem, commonly referred to as the Bayes' rule, is a mathematical formula used to calculate the conditional probability of events in statistics and probability theory. The Bayes theorem basically describes the likelihood of an event based on knowledge of potential relevant conditions in advance.

The formula was discovered in 1763 by English statistician Thomas Bayes, who is honoured as the theorem's namesake. It is regarded as the cornerstone of the Bayes' inference, a unique statistical inference method.

The diagram illustrates the formula for Bayes' theorem. On the left, an orange box contains the expression $P(A|B)$. This is followed by an equals sign. To the right of the equals sign, a fraction is shown. The numerator consists of a teal box with $P(B|A)$, a dark blue multiplication symbol (\times), and another teal box with $P(A)$. The denominator is a teal box with $P(B)$, positioned below a horizontal line.

$$P(A|B) = \frac{P(B|A) \times P(A)}{P(B)}$$

The Bayes theorem is employed in many fields than statistics, with medicine and pharmacology serving as two prominent examples. The theorem is very frequently used in various branches of finance. Modeling the risk of lending money to borrowers or predicting the likelihood that an investment will succeed are just a few uses.

Theorem of Bayes' formula

The following formula represents the Bayes' theorem:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Where:

- $P(A|B)$ – the probability of event A occurring, given event B has occurred
- $P(B|A)$ – the probability of event B occurring, given event A has occurred
- $P(A)$ – the probability of event A
- $P(B)$ – the probability of event B

Note that events A and B are [independent events](#) (i.e., the probability of the outcome of event A does not depend on the probability of the outcome of event B).

A special case of the Bayes' theorem is when event A is a [binary variable](#). In such a case, the theorem is expressed in the following way:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A^-)P(A^-) + P(B|A^+)P(A^+)}$$

Where:

- $P(B|A^-)$ – the probability of event B occurring given that event A^- has occurred
- $P(B|A^+)$ – the probability of event B occurring given that event A^+ has occurred

In the special case above, events A^- and A^+ are mutually exclusive outcomes of event A.

11. What is z-score?

The Z score, sometimes referred to as a standard score, is used to indicate how many standard deviations a raw score deviates from or approaches the mean. Typically, a z test includes a z score in order to analyse population data. This rating facilitates data comparison across several normal distributions.

According upon where the raw score is in relation to the mean, a z score can be positive, negative, or zero. Understanding the population mean and standard

deviation is necessary to get a z score. We will learn more about a z score, its formula, and how to calculate it in this post.

To calculate a z score, knowledge of the mean and standard deviation is required.

When the population mean and population standard deviation are known then the z score formula is given as follows:

$$Z = \frac{x - \mu}{\sigma}$$

μ = population mean

σ = population standard deviation

x = raw score

The z score can also be estimated using the sample mean and standard deviation when the population parameters are unknown. The z score formula is modified as follows:

$$Z = \frac{x - \bar{x}}{S}$$

\bar{x} = sample mean

S = sample standard deviation

x = raw score

12. What is t-test?

A t-test, commonly referred to as a student's t-test, is a tool used in hypothesis testing to assess the means of one or more populations. An independent two-sample t-test can be used to determine whether two groups differ from one another, whether a single group deviates from a given value, or whether there is a significant difference between matched measurements (a paired, or dependent samples t-test).

How do t-tests function?

You must first specify the hypothesis you will test as well as the level of acceptable risk associated with reaching an incorrect conclusion. For instance, when comparing two populations, you can assume that their means are the same and select an acceptable chance of drawing the incorrect conclusion that a difference exists. The next step is to create a test statistic from your data and compare it to a t-ideal distribution's value. You either succeed in rejecting your null hypothesis or fail to do so, depending on the results.

If I have more than two groups, what happens?

A t-test is useless. Apply a method of multiple comparisons. ANOVA, Tukey-Kramer pairwise comparison, Dunnett's comparison to a control, and analysis of means are some examples (ANOM).

13. What is percentile?

Although the term "percentile" is frequently used, it lacks a common definition. The most typical definition of a percentile is a number below which a predetermined proportion of scores fall. You may already be aware of your test score of 67 out of 90. But without you know the percentile you fall into, that number has no actual relevance. If you know that you scored in the 90th percentile, it signifies that you outperformed 90% of test-takers.

Reporting test results for exams like the SAT, GRE, and LSAT frequently uses percentiles. For instance, the 2013 GRE's 70th percentile score was 156. In other words, if you got a 156 on the test, you did better than 70% of other test-takers.

14. What is ANOVA?

The ANOVA test is used to compare the means of different groups while employing specific estimate techniques. Analysis of variance, or ANOVA. In statistical significance testing, the ANOVA test is used to determine whether the null hypothesis may be rejected or not.

Depending on the number of independent variables, an ANOVA test can be either one-way or two-way. In this post, we will learn more about the one-way and two-way ANOVA tests, their formulas, and some examples that go along with them.

Example of an ANOVA Test

Let's say research is needed to discover whether a specific type of tea will cause a mean weight loss. Green tea, earl grey tea, and jasmine tea should be used by three different groups. Thus, the ANOVA test (one way) will be employed to examine whether there was any mean weight decrease demonstrated by a particular group.

Let's say a poll was done to see if there was a relationship between wealth and gender and interview anxiety. We'll utilise a two-way ANOVA to carry out this test.

15. How can ANOVA help?

Using estimation factors like the variance, the ANOVA test is used to determine whether or not the means of three or more groups differ.

The outcomes of an ANOVA test are summarised using an ANOVA table.

One-way ANOVA and two-way ANOVA are the two different forms of ANOVA testing.

A two way ANOVA has two independent variables, whereas a one way ANOVA only has one.
