Reading 8

HYPOTHESIS TESTING

1. (A) Nonparametric tests rely on population parameters.

Explanation

Nonparametric tests are not concerned with parameters; they make minimal assumptions about the population from which a sample comes. It is important to distinguish between the test of the difference in the means and the test of the mean of the differences. Also, it is important to understand that parametric tests rely on distributional assumptions, whereas nonparametric tests are not as strict regarding distributional properties.

(Module 8.2, LOS 8.c)

2. (B) 19.99.

Explanation

With a large sample size (75) the z-statistic is used. The z-statistic is calculated by subtracting the hypothesized parameter from the parameter that has been timated and dividing the difference by the standard error of the sample statistic. Here, the test statistic

= (sample mean – hypothesized mean) / (sample standard deviation / (sample size)$^{1/2}$

= $(X- \mu) / (\sigma / n^{1/2})$ = (57,000 – 54,000) / (1,300 / $75^{1/2}$) = (3,000) / (1,300 / 8.66) = 19.99.

(Module 8.2, LOS 8.b)

3. (B) nonparametric test

Explanation

A rank correlation test is best described as a nonparametric test.

(Module 8.2, LOS 8.c)

4. (A) made a Type II error.

Explanation

This statement is an example of a Type II error, which occurs when you fail to reject a hypothesis when it is actually false.

The other statements are incorrect. A Type I error is the rejection of a hypothesis when it is actually true.

(Module 8.2, LOS 8.b)

5. (B) The value of a population variance.

Explanation

A chi-square test is a hypothesis test used to assess the value of a population variance. The value of a population mean will use either a t-test (for a small sample) or a z-test (for a large sample). An F-test can be used to assess the equality of two population variances.

(Module 8.2, LOS 8.b)

6. (A) A Type I error is the probability of rejecting the null hypothesis when the null hypothesis is false.

Explanation

A Type I error is the probability of rejecting the null hypothesis when the null hypothesis is true.

(Module 8.1, LOS 8.a)

7. (B) 10.56.

Explanation

With a large sample size (135) the z-statistic is used. The z-statistic is calculated by subtracting the hypothesized parameter from the parameter that has been estimated and dividing the difference by the standard error of the sample statistic. Here, the test statistic

= (sample mean – hypothesized mean) / (population standard deviation / (sample size)$^{1/2}$)

= $(X - \mu) / (\sigma / n^{1/2})$ = (64,000 – 59,000) / (5,500 / $135^{1/2}$)

= (5,000) / (5,500 / 11.62) = 10.56.

(Module 8.2, LOS 8.b)

8. (B) 19.06.

Explanation

With a large sample size (115) the z-statistic is used. The z-statistic is calculated by subtracting the hypothesized parameter from the parameter that has been estimated and dividing the difference by the standard error of the sample statistic. Here, the test statistic

= (sample mean – hypothesized mean) / (population standard deviation / (sample size)$^{1/2}$

= $(X - \mu) / (\sigma / n^{1/2})$ = (65,000 – 57,000) / (4,500 / $115^{1/2}$)

= (8,000) / (4,500 / 10.72) = 19.06.

(Module 8.2, LOS 8.b)

9. (C) the confidence level of the test is 95%.

Explanation

Rejecting the null hypothesis when it is true is a Type I error. The probability of a Type Ierror is the significance level of the test and one minus the significance level is the confidence level. The power of a test is one minus the probability of a Type II error, which cannot be calculated from the information given.

(Module 8.1, LOS 8.a)

10. (B) significance level of the test is 5%.

Explanation

Rejecting the null hypothesis when it is true is a Type I error. The probability of a Type I error is the significance level of the test. The power of a test is one minus the probability of a Type II error, which cannot be calculated from the information given.

(Module 8.1, LOS 8.a)

11. (B) keeping the significance level the same and increasing the sample size.

Explanation

A Type I error, which is equivalent to the level of significance, is the probability of incorrectly rejecting a true null hypothesis. A Type II error is the probability of incorrectly not rejecting a false null hypothesis. The "power of the test" is equal to 1 minus the probability of a Type II error and represents the probability of correctly rejecting a false null hypothesis.

To increase the power of the test, James could keep the significance level the same and increase the sample size. Lowering the level of significance will reduce the probability of a Type I error, increase the probability of a Type II error, and decrease the power of the test. Increasing the probability of a Type II error will decrease the power of the test.

(Module 8.2, LOS 8.b)

12. (C) a Type II error increases.

Explanation

If P(Type I error) decreases, then P(Type II error) increases. A null hypothesis is never accepted. We can only fail to reject the null.

(Module 8.1, LOS 8.a)

13. (C) A hypothesized mean of 3, a sample mean of 6, and a standard error of the sampling means of 2 give a sample Z-statistic of 1.5.

Explanation

Z = (6 - 3)/2 = 1.5. A Type II error is failing to reject the null hypothesis when it is false. The null hypothesis that the population mean is less than or equal to 5 should be rejected when the sample Z-statistic is greater than the critical Z-statistic.

(Module 8.1, LOS 8.a)

14. (C) the probability of rejecting a false null hypothesis.

Explanation

This is the definition of the power of the test: the probability of correctly rejecting the null hypothesis (rejecting the null hypothesis when it is false).

(Module 8.1, LOS 8.a)

15. (B) true null hypothesis 5% of the time.

Explanation

The level of significance is the probability of rejecting the null hypothesis when it is true. The probability of rejecting the null when it is false is the power of a test.

(Module 8.1, LOS8.a)

16. (A) rejects the null hypothesis when it is actually true.

Explanation

A Type I error is defined as rejecting the null hypothesis when it is actually true. It can be thought of as a false positive.

A Type II error occurs when a researching fails to reject the null hypothesis when it is false. It can be thought of as a false negative.

(Module 8.1, LOS 8.a)

17. (B) simple random sampling.

Explanation

In simple random sampling, each item in the population has an equal chance of being selected. The analyst's method meets this criterion.

(Module 8.1, LOS 8.a)

18. (B) rejects a true null hypothesis.

Explanation

A Type I Error is defined as rejecting the null hypothesis when it is actually true. The probability of committing a Type I error is the significance level or alpha risk.

(Module 8.1, LOS 8.a)

19. (C) An increase in the sample size to 140.

Explanation

Even though numbers are provided, no calculations are needed. An increase in the sample size will produce a lower standard error, and a lower standard error will equate to a higher test statistic. Note that all numbers provided are positive, such that the critical value will be a positive number. The higher the test statistic is relative to the critical value, the more likely it is that the null hypothesis is rejected.

A decrease in the mean return will lower the test statistic, while an increase in the standard deviation will increase the standard error (which will decrease the test statistic).

(Module 8.2, LOS 8.b)

20. (C) 21.62.

Explanation

With a large sample size (175) the z-statistic is used. The z-statistic is calculated by subtracting the hypothesized parameter from the parameter that has been estimated and dividing the difference by the standard error of the sample statistic. Here, the test statistic

= (sample mean – hypothesized mean) / (population standard deviation / (sample size)$^{1/2}$

= $(X - \mu) / (\sigma / n^{1/2})$ = (67,000 – 58,500) / (5,200 / $175^{1/2}$)

= (8,500) / (5,200 / 13.22) = 21.62.

(Module 8.2, LOS 8.b)

21. (B) A type I error is acceptance of a hypothesis that is actually false.

Explanation

A type I error is the rejection of a hypothesis that is actually true.

(Module 8.1, LOS 8.a)

22. (B) The alternative hypothesis would be H_a: mean > 7.

Explanation

The way the question is worded, this is a two tailed test. The alternative hypothesis is not H_a: M > 7 because in a two-tailed test the alternative is =, while < and > indicate one-tailed tests. A test statistic is calculated by subtracting the hypothesized parameter from the parameter that has been estimated and dividing the difference by the standard error of the sample statistic. Here, the test statistic = (sample mean – hypothesized mean) /(standard error of the sample statistic) = (5 - 7) / (1) = -2. The calculated Z is -2, while the critical value is -1.96. The calculated test statistic of -2 falls to the left of the critical Z-statistic of -1.96, and is in the rejection region. Thus, the null hypothesis is rejected and the conclusion is that the sample mean of 5 is significantly different than 7. What the negative sign shows is that the mean is less than 7; a positive sign would indicate that the mean is more than 7. The way the null hypothesis is written, it makes no difference whether the mean is more or less than 7, just that it is not 7.

(Module 8.2, LOS 8.b)

23. (A) reject the null because the test statistic is greater than the critical value.

Explanation

At a 10% level of significance, the critical z-values for a two-tailed test are + or –1.645, so the decision rule is to reject the null if the test statistic < –1.645 or > +1.645.

With a sample size of 252 and a standard deviation of 0.12%, the standard error is equal to:

$$S_x = \frac{S}{\sqrt{n}} = \frac{0.12\%}{\sqrt{252}} = 0.0075593\%$$

The test statistic is equal to:

$$= \frac{0.0007}{0.000075593} = 9.26$$

Because the test statistic of 9.26 > 1.645, Rigley will reject the null that the daily equityreturn is equal to zero.

(Module 8.2, LOS 8.b)

24. (A) rejecting a true null hypothesis.

Explanation

The Type I error is the error of rejecting the null hypothesis when, in fact, the null is true.

(Module 8.1, LOS 8.a)

25. (C) 0.82.

Explanation

The power of the test is 1 – the probability of failing to reject a false null (Type II error); 1 –0.18 = 0.82.

(Module 8.2, LOS 8.b)

26. (A) If the alternative hypothesis is H_a : $\mu > \mu_0$, a two-tailed test is appropriate.

Explanation

The hypotheses are always stated in terms of a population parameter. Type I and Type II are the two types of errors you can make – reject a null hypothesis that is true or fail to reject a null hypothesis that is false. The alternative may be one-sided (in which case a > or< sign is used) or two-sided (in which case a ≠ is used).

(Module 8.1, LOS 8.a)

27. (A) The probability of a Type I error is equal to the significance level of the test.

Explanation

The probability of getting a test statistic outside the critical value(s) when the null is true is the level of significance and is the probability of a Type I error. The

power of a test is 1minus the probability of a Type II error. Hypothesis testing does not prove a hypothesis, we either reject the null or fail to reject it.

(Module 8.1, LOS 8.a)

28. (C) a Type I error only.

Explanation

Rejection of a null hypothesis when it is actually true is a Type I error.

Here, H_0: $\mu \leq 18$inches and H_a: $\mu > 18$ inches. Type II error is failing to reject a null hypothesis when it is actually false.

Because a Type I error can only occur if the null hypothesis is true, and a Type II error can only occur if the null hypothesis is false, it is logically impossible for a test to result in both types of error at the same time.

(Module 8.2, LOS 8.b)

29. (B) fails to reject a false null hypothesis.

Explanation

A Type II error is defined as accepting the null hypothesis when it is actually false. The chance of making a Type II error is called beta risk.

(Module 8.1, LOS 8.a)

30. (C) reject the null hypothesis that the P/E ratio variances between the two companies are not significantly different.

Explanation

The F-test is used to assess the equality of two population variances. Here, the comparison is between two companies' P/E ratios over a period of 20 years. The null hypothesis for the two-tailed test is that the variances are not significantly different, while the alternative hypothesis is that they are significantly different.

Because the calculated F-statistic is higher than the critical F-statistic value, the null hypothesis will be rejected.

(Module 8.2, LOS 8.b)

31. (C) The significance level of the test represents the probability of making a Type I error.

Explanation

A Type I error is the rejection of the null when the null is actually true. The significance level of the test (alpha) (which is one minus the confidence level) is the probability of making a Type I error. A Type II error is the failure to reject the null when it is actually false.

(Module 8.1, LOS 8.a)

32. (A) failing to reject a false null hypothesis.

Explanation

The Type II error is the error of failing to reject a null hypothesis that is not true.

(Module 8.1, LOS 8.a)

33. (B) has a significance level of 95%.

Explanation

This test has a significance level of 5%.

The relationship between confidence and significance is: significance level = 1 – confidence level. We know that the significance level is 5% because the sample size is large and the critical value of the test statistic is 1.96 (2.5% of probability is in both the upper and lower tails).

(Module 8.2, LOS 8.b)

34. (A) the null hypothesis cannot be rejected.

Explanation

For a two-tailed test at a 5% level of significance the calculated z-statistic would have to be greater than the critical z value of 1.96 for the null hypothesis to be rejected.

(Module 8.2, LOS 8.b)