Topic: Test statistics for one- and two-tailed tests

Question: If we're conducting a two-tailed test, what are the signs in the null and alternative hypotheses?

Answer choices:

A $=$ and $\neq$

B $\leq$ and $>$

C $\geq$ and $<$

D $\leq$ and $\geq$

Solution: A

When the null and alternative hypotheses use the = and ≠ signs, we'll use a two-tailed test.

When using a two-tailed test, we need to use the null hypothesis of no difference, =, and an alternative hypothesis that states there is a difference between the population parameter and the hypothesized value, ≠.

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Question: Consider the hypothesis, “Reading more about statistics changes the reader’s desire to learn about statistics.” What type of test would be used to investigate this hypothesis?

Answer choices:

A One-tailed test

B Two-tailed test

C Both a one- and two-tailed test

D Neither a one- nor two-tailed test

Solution: B

The hypothesis is non-directional because the hypothesis stated that the desire to learn statistics will change after reading more about statistics, but it doesn't specifically say whether that desire will specifically increase or decrease.

If we tested this hypothesis statistically, the test would be a two-tailed test, in which the null hypothesis would include an = sign, and the alternative hypothesis would include a ≠ sign.

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Question: We've decided to give all of our friends a small box of homemade cookies. We've already baked a variety of cookies and randomly placed them into boxes. We want to make sure that each box is close to 0.5 pounds, so we sample 10 boxes and find a mean of 0.54 pounds and a standard deviation of $s = 0.3$ pounds. Assuming that the weights of all the boxes are normally distributed, calculate the test statistic.

Answer choices:

A $t \approx -0.42$

B $t \approx 0.42$

C $t \approx -0.58$

D $t \approx 0.58$

Solution: B

Because population standard deviation is unknown (we were only given sample standard deviation), and because we were told that we can assume the population is normally distributed, the test statistic will be

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

$$t = \frac{0.54 - 0.5}{\frac{0.3}{\sqrt{10}}}$$

$$t = \frac{0.04\sqrt{10}}{0.3}$$

$$t \approx 0.42$$