Week 3 Quiz

Quiz, 14 questions

Congratulations! You passed!

Next Item

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1.

People of different ages were asked to stand on a “force platform” and maintain a stable upright position. The ``wiggle" of the board in the forward-backward direction is recorded; more wiggle corresponds to less balance. The participants are divided into two age groups: young and elderly. The average wiggle among elderly people was 26.33 mm, and the average among young people was 18.125 mm. The bootstrap distribution for the difference in means is shown below, based on 100 bootstrap samples. Of the following choices, which is the **most accurate** 90% bootstrap confidence interval for the true difference in means?

(3.75 mm, 15 mm)

Correct

This question refers to the following learning objective(s):

Construct bootstrap confidence intervals using one of the following methods:

- Percentile method: XX% confidence level is the middle XX% of the bootstrap distribution.
- Standard error method: If the standard error of the bootstrap distribution is known, and the distribution is nearly normal, the bootstrap interval can also be calculated as $\bar{x}_{boot} \pm z^{\star} SE_{boot}$.

Recognize that when the bootstrap distribution is extremely skewed and sparse, the bootstrap confidence interval may not be appropriate.

For a 90% confidence interval we would want to exclude 10% of samples outside of the confidence interval, i.e. 5% on each tail. With 100 samples, that means we just count off 5 points corresponding to 5 bootstrap sample statistics from each end of the bootstrap distribution to determine what the endpoints of the confidence interval are.

(2.5 mm, 18 mm)

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2.

Suppose we wanted to compare the rates of return for two stocks: the technology company Intel and the U.S. airline Southwest Airlines. To compare the rates of return, we take a random sample of 50 days of Intel's stock returns and another random sample of 50 days for Southwest's stock returns (not necessarily the same days). These data should not be treated as paired. Why would these data not be considered paired data?

- The data can't be considered paired data because the two companies are in different industries.
- 50 observations is not enough to be able to consider the data as paired.
- The data can't be considered paired data because the days for which we have Intel data may be different from the days for which we have Southwest Airlines data.

Correct

This question refers to the following learning objective(s):

- Define observations as paired if each observation in one dataset has a special correspondence or connection with exactly one observation in the other data set.
- Carry out inference for paired data by first subtracting the paired observations from each other, and then treating the set of differences as a new numerical variable on which to do inference (such as a confidence interval or hypothesis test for the average difference).

In this case, the data would be considered paired if the 50 days of returns were the same 50 days for both Intel and Southwest Airlines. Without that special correspondence the data can't be treated as paired.

- When random sampling is involved, data can't be treated as paired.

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3.

The distribution of duration of unemployment for all 18-24 year-old Americans is nearly normal with mean 12.7 weeks and standard deviation 0.3 weeks. Suppose we randomly sample 20 people from this population, ask them about the duration of their unemployment (in number of weeks), and record the sample mean. We repeat this 5,000 times, and build a a distribution of sample means. What is the name of this distribution?

- randomization distribution
- population distribution
- sample distribution
- sampling distribution

Correct

This question refers to the following learning objective(s):
Describe how bootstrap distributions are constructed, and recognize how they are different from sampling distributions.

- bootstrap distribution

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4.

A study examining the relationship between weight of school children (4th to 6th graders) found a 95% confidence interval for the difference between the average number of school days missed by overweight and normal weight children ($\mu_{overweight} - \mu_{normal}$) to be 1.3 to 2.8 days. Which of the following is **true** based on this confidence interval?

- At 10% significance level, the data do not provide convincing evidence of a difference between the average number of missed days by overweight and normal weight children.
- At 5% significance level, the data do not provide convincing evidence of a difference between the average number of missed days by overweight and normal weight children.
- We are 95% confident that overweight children on average miss 1.3 to 2.8 days more than children with normal weight.

Correct

This question refers to the following learning objective(s):

- Recognize that a good interpretation of a confidence interval for the difference between two parameters includes a comparative statement (mentioning which group has the larger parameter).
- Recognize that a confidence interval for the difference between two parameters that doesn't include 0 is in agreement with a hypothesis test where the null hypothesis that sets the two parameters equal to each other is rejected.

- We are 95% confident that overweight children on average miss 1.3 to 2.8 days fewer than children with normal weight.

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5. An insurance company wants to estimate (using a confidence interval) its average claim amount using data from 20 randomly selected claims. Which of the following is **false**?

- A confidence interval based on this sample is not accurate since the sample size is small.
- The confidence interval can also be calculated using bootstrapping.

This should not be selected

This is always true.

- The critical t-score, $t^\star$, has 19 degrees of freedom.
- If the distribution of the sampled claim amounts is not extremely skewed, a T interval is appropriate.

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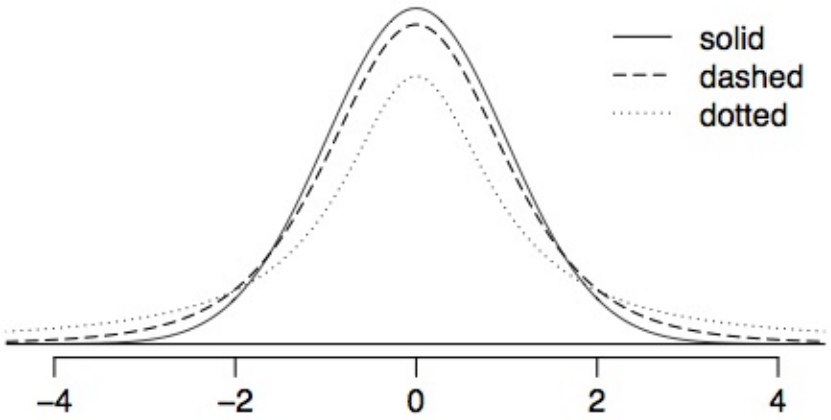
6.

The figure below shows three t-distribution curves. Which curve has the highest degree of freedom?



- dotted
- Solid

Correct

This question refers to the following learning objective(s):

- Describe how the t-distribution is different from the normal distribution, and what ``heavy tail'' means in this context.
- Note that the t-distribution has a single parameter, degrees of freedom, and as the degrees of freedom increases this distribution approaches the normal distribution.

As the degrees of freedom increases the t distribution starts approaching the normal distribution, and t distributions with lower degrees of freedom will have heavier tails than t distributions with higher degrees of freedom.

- dashed

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7.

My friend, Tom, believes that his supermarket's prices are lower than mine, and sets an alternative hypothesis test reflecting this. We construct a list of 10 identical items and purchase them at our respective stores. Tom wants to know if these data support his hypothesis. Which of the following is the **correct** description of Tom's situation?

- Tom has a two-sided alternative hypothesis and should do a paired t-test.
- Tom has a two-sided alternative hypothesis and should do an independent samples t-test.
- Tom has a one-sided alternative hypothesis and should do an independent samples t-test.
- Tom has a one-sided alternative hypothesis and should do a paired t-test.

Correct

The test is a paired test because the same 10 items were bought at each store; i.e. each observation in one data set has a special correspondence to exactly one observation in the other data set.

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0 / 1 points

8.

Suppose that a one-tail t test is being applied to find out if the population mean is less than 100. The level of significance is 0.05 and 25 observations were sampled. The null hypothesis would be rejected for t scores in which of the following regions? Choose the best answer.

- $T < -1.32$
- $T < 1.96$
- $T > 1.71$

This should not be selected

This question refers to the following learning objective(s):

- Use a T-statistic, with degrees of freedom $df = n - 1$ for inference for a population mean.
- Use a T-statistic, with degrees of freedom $df = min(n_1 - 1, n_2 - 1)$ for inference for difference between means of two population means using data from two small samples.
- Describe how to obtain a p-value and a critical t-score ($t^\star_{df}$) for a confidence interval.

Note that the alternative hypothesis is less than so we need the the cutoff value corresponding to the lower 5% of the t24 curve.

- $T > 1.32$
- $T < -1.71$

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9.

When doing an ANOVA, you observe large differences in means between groups. Within the ANOVA framework this would most likely be interpreted as:

- Evidence strongly favoring the alternative hypothesis.

Correct
If there is more variability between groups compared to within groups, it's likely there is some difference between at least some of the means.

- Evidence strongly favoring the null hypothesis.
- Evidence revealing which group mean is different from the others.
- None of the above

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10.

Which of the following is **most** useful for checking the equal variance across groups condition for ANOVA?

- Summary statistics suggesting roughly equal ranges for each group.
- Side-by-side box plots showing roughly equally sized boxes for each group.

Correct

This question refers to the following learning objective(s):

List the conditions necessary for performing ANOVA

- the observations should be independent within and across groups
- the data within each group are nearly normal
- the variability across the groups is about equal

and use graphical diagnostics to check if these conditions are met.

Equal variability across groups is one of the required conditions for ANOVA.

- Summary statistics suggesting that the means of each group are roughly equal.
- Histograms suggesting nearly normal distributions of data in each group.

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11.

Based on the ANOVA output below, what is the value of the F-statistic? Choose the closest answer.

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
section	7	525.01	75.00	[redacted]	0.0767
Residuals	189	7584.11	40.13		

- 14.45
- 27.00
- 0.54
- 1.87

Correct

This question refers to the following learning objective(s): Recognize that the test statistic for ANOVA, the F statistic, is calculated as the ratio of the mean square between groups (MSG, variability between groups) and mean square error (MSE, variability within errors). Also recognize that the F statistic has a right skewed distribution with two different measures of degrees of freedom: one for the numerator ($df_G = k - 1$, where k is the number of groups), and one for the denominator ($df_E = n - k$, where n is the total sample size).

The F statistic is calculated as the ratio of the mean square between groups (MSG, variability between groups) and mean square error (MSE, variability within errors): 75/40.13=1.87

- 10.71

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12.

A study compared five different methods for teaching descriptive statistics. The five methods were traditional lecture and discussion, programmed textbook instruction, programmed text with lectures, computer instruction, and computer instruction with lectures. 45 students were randomly assigned, 9 to each method. After completing the course, students took a 1-hour exam. We are interested in finding out if the average test scores are different for the different teaching methods. Which of the following is the appropriate set of hypotheses?

- $H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

  $H_A : \mu_1 \neq \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5$

- $H_0 : \mu_{between} = \mu_{within}$

  $H_A : \mu_{between} \neq \mu_{within}$

- $H_0 : s_{between} = s_{within}$

  $H_A : s_{between} \neq s_{within}$

- $H_0 : \mu_{between} \neq \mu_{within}$

  $H_A : \sigma_{between} \neq \sigma_{within}$

- $H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

  H_A : at least one μ_i is different

Correct

This question refers to the following learning objective(s):
Recognize that the null hypothesis in ANOVA sets all means equal to each other, and the alternative hypothesis suggest that at least one mean is different.

- $H_0 : \mu_1 = \mu_2 = \cdots = \mu_k$
- H_A : At least one mean is different

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13.

Researchers studying people's sense of smell devised a measure of smelling ability. A higher score on this scale means the subject can smell better. A random sample of 36 people (18 male and 18 female) were involved in the study. The average score for the males was 10 with a standard deviation of 3.4 and the average score for the females was 11 with a standard deviation of 2.7. Which of the following is the correct standard error for the test evaluating whether the males and females have differing smelling abilities, on average? Choose the closest answer.

- 0.801
- 1.023

Correct

This question refers to the following learning objective(s):

- Use a t-statistic, with degrees of freedom $df = n - 1$ for inference for a population mean:

$$\text{CI: } \bar{x} \pm t^\star_{df} SE \qquad \text{HT: } T_{df} = \frac{\bar{x} - \mu}{SE}$$

where $SE = \frac{s}{\sqrt{n}}$.

- Use a t-statistic, with degrees of freedom $df = n_{diff} - 1$ for inference for the difference in two paired (dependent) means:

$$\text{CI: } \bar{x}_{diff} \pm t^\star_{df} SE \qquad \text{HT: } T_{df} = \frac{\bar{x}_{diff} - \mu_{diff}}{SE}$$

where $SE = \frac{s}{\sqrt{n}}$. Note that μ_{diff} is often 0, since often $H_0 : \mu_{diff} = 0$

$$SE = \sqrt{\frac{3.4^2}{18} + \frac{2.7^2}{18}}$$

- 3.504
- 1.047
- 0.724

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14.

A study compared five different methods for teaching descriptive statistics. The five methods were traditional lecture and discussion, programmed textbook instruction, programmed text with lectures, computer instruction, and computer instruction with lectures. 45 students were randomly assigned, 9 to each method. After completing the course, students took a 1-hour exam. We are interested in finding out if the average test scores are different for the different teaching methods.

If the original significance level for the ANOVA was 0.05, what should be the adjusted significance level for the pairwise tests to compare all pairs of means to each other?

- 0.5
- 0.25
- 0.005

Correct

This question refers to the following learning objective(s):
Describe why conducting many t-tests for differences between each pair of means leads to an increased Type 1 Error rate, and we use a corrected significance level (Bonferroni correction, $\alpha^\star = \alpha/K$, where K is the number of comparisons being considered) to combat inflating this error rate.

- Note that $K = \frac{k(k-1)}{2}$, where k is the number of groups.

$K = \frac{5x4}{2}$, $\alpha\star = 0.05/10 = 0.005$

- 0.01
- 0.05

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