Week 3 Quiz

Quiz, 14 questions

✖ **Try again once you are ready.**

Required to pass: 80% or higher

You can retake this quiz up to 3 times every 8 hours.

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Retake

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1.

Which of the following is **false** about bootstrapping?

- Bootstrap distributions that are extremely skewed or have isolated clumps of values may yield unreliable confidence intervals.
- The endpoints of a 95% bootstrap confidence interval are the cutoff values for the top and bottom 2.5% of the bootstrap distribution.
- A bootstrap confidence interval constructed based on a biased sample will still yield an unbiased estimate for the population parameter of interest.

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.

If the original sample is biased then the bootstrap distribution will yield a **biased** estimated for the population of interest, bootstrapping is not a remedy for bad data collection.

- Bootstrap distributions are constructed by sampling with replacement from the original sample, while sampling distributions are constructed by sampling with replacement from the population.

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2.

Which of the following is **false** regarding paired data?

- Each observation in one data set is subtracted from the average of the other data set's observations.

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).

It doesn't make any sense to subtract each observation in one data set from the average of the other data set's observations, we subtract the paired observations from each other.

- Each observation in one data set has a natural correspondence with exactly one observation from the other data set.
- In a paired analysis we first subtract the paired observations from each other, and then do inference on the differences.
- Two data sets of different sizes cannot be analyzed as paired data.

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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?

- sampling distribution
- randomization distribution
- population distribution
- bootstrap distribution

This should not be selected

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

We are collecting a new sample **from the population** each time, not from a sample.

- sample distribution

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4. Your friend, who took statistics a few years ago, recently read a study which examined whether there is any difference between the average birth weights of babies born to smoking mothers vs. non-smoking mothers. Your friend asked you to remind him what it means when the study says ``a 95% confidence interval for the difference between the average birth weight from non-smoking mothers and smoking mothers ($\mu_{non} - \mu_{smoke}$) is 0.2 to 0.9 pounds." Of the following possible responses to your friend's question, which is **true** according to the study?

- The study data does not provide convincing evidence (at 10% significance level) of a difference between the average birth weight from smoking mothers and non-smoking mothers.
- The study data does not provide convincing evidence (at 5% significance level) of a difference between the average birth weight from smoking mothers and non-smoking mothers.
- The study's authors are 95% confident that babies born to non-smoking mothers are on average 0.2 to 0.9 pounds lighter than babies born to smoking mothers.

This should not be selected

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.

Note the order in which the subtraction is being done.

- The study's authors are 95% confident that babies born to non-smoking mothers are on average 0.2 to 0.9

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5.

When doing inference on a single mean, which of the following is the **correct** justification for using the t-distribution rather than the normal distribution?

- Because the standard error estimate may not be accurate.

Correct

With a small sample size our estimate of the standard error as $\frac{s}{\sqrt{n}}$ is not reliable, since the sample standard deviation, s, may not be a reliable estimate for the population standard deviation σ when the sample size is low. We make up for this by using the t instead of the normal distribution.

- Because the t-distribution is not symmetric.
- All of the above.
- None of the above.

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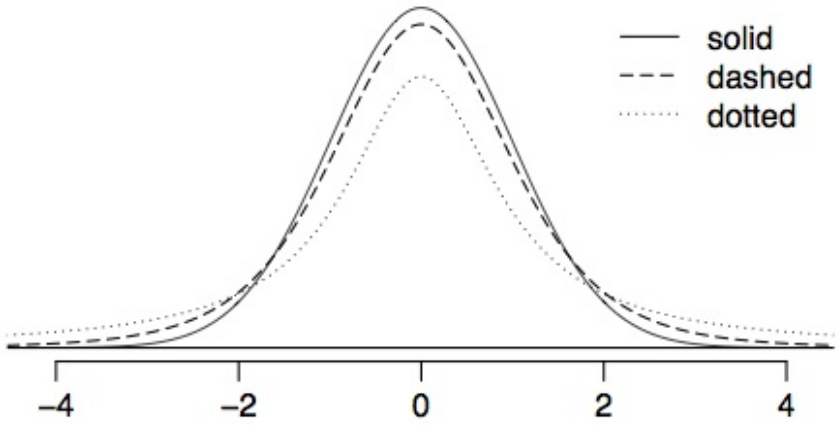
6.

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.

Air quality measurements were collected in a random sample of 25 country capitals in 2013, and then again in the same cities in 2014. We would like to use these data to compare average air quality between the two years. Which of the following tests is the **most** appropriate?

- independent samples t-test with two-sided alternative hypothesis
- paired t-test with one-sided alternative hypothesis
- independent samples t-test with one-sided alternative hypothesis
- paired t-test with two-sided alternative hypothesis

Correct

We're looking for a difference between the two years' averages, and the data are collected in the same cities in both years, creating dependency requiring paired analysis.

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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.

- $T > 1.71$

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.

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

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9.

We would like to test if students who are in the social sciences, natural sciences, arts \& humanities, and other fields spend the same amount of time studying for this course. What type of test should we use?

- z-test
- t-test for two independent groups
- F-test (ANOVA)

Correct

There are many groups, and we're comparing averages.

- t-test for two dependent groups

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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 that the means of each group are roughly equal.
- Histograms suggesting nearly normal distributions of data in 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 roughly equal ranges for 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
- 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
- 0.54
- 27.00

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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.

The p-value of the test is 0.0168. What is the conclusion of the test?

- Only two group means are significantly different from each other.
- At least two group means are significantly different from each other.

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

The p-value is low so we reject the null hypothesis.

- At most two group means are significantly different from each other.
- All five group means are equal to each other.
- All five group means are significantly different from each other.

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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.

- 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 $H_0 : \mu_{diff} = 0$

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

- 0.801
- 0.724
- 1.047

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0 / 1 points

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.

How many pairwise tests would we need to do in order to compare all pairs of means to each other?

- 4
- 20
- 5

This should not be selected

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.

- 3
- 10

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