Team Trivia Review

Exam 2

Round 1

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

The **Central Limit Theorem** states that sampling distributions generated from samples with an *N* of at least 30 will:

a) have small confidence intervals

b) have a standard deviation that is equal to the standard deviation in the population

c) have a mean that is equal to the mean in the population

d) all of the above are true

e) both A and C are true

Select one answer.

Question 1

- **C** is the correct answer:
  - have a mean that is equal to the mean in the population

As a reminder, here is the CLT…

Assuming the sampling distribution of sample means is created from many large (N = 30+) samples, the following is likely to be true:

1. the sampling distribution is **normal**
2. the **mean** of the sampling distribution = the mean of the population
3. the **standard deviation** of the sampling distribution (aka the *standard error*) can be computed using the equation:

   $SE = s/\sqrt{N}$

Question 1 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

You've been hired by the local school system to determine whether there is a naturally-occurring relationship between being a bully and grades. For each student, you record whether or not they bullied another student during the semester and their final semester grade (on a 1 to 100% scale).

What will your null hypothesis be, in words?

Question 2

- There are no differences in the grades of bullies and non-bullies. OR
- OR
- The mean grades of bullies and non-bullies do not differ (or, are equal).

Question 2 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

If your sample size is 9, your mean is 10, and your variance (s^2) is 4, what is your standard error?

Question 3

- ***SE* = .67**
- First, take the square root of the variance (s^2) to calculate the standard deviation, s
  - $s = \sqrt{s^2} = \sqrt{4} = 2.00$
- Then use the formula for SE ($s/\sqrt{N}$), to calculate the SE, given that N is 9.
  - $SE = 2/\sqrt{9} = 2/3 = .666666\ldots$ but round to two decimal places to get .67

Question 3 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

You and several friends are training for a marathon. You're trying to see if you can improve your time by doing some track work, so you set up a track workout program over three weeks.

You all measure your performance on the 400 meter dash at the beginning of the three weeks, and then again at the end of the three weeks of track workouts.

What is the predictor variable in this study?

Question 4

- Predictors (also called independent variables) are variables that the researchers believe will cause the change in the outcome variable.
- The outcome variable is speed.
- The predictor is: **Having done vs. not having done the track workouts**

Question 4 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- Differences in the outcome variable created by unknown factors or “noise” is known as _____ variation.
- Do researchers want to **minimize** or **maximize** this type of variation?

(You must answer both parts correct to earn a point.)

Question 5

Question 5 - answer

- **Unsystematic variation**
- **Minimize**
  - Researchers want to reduce noise/error in the outcome variable, so that they can better see the influence of their predictor/IV on that outcome.

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- Kelvin has class at 8:00 am every morning. He wants to know whether the number of times he snoozes his alarm clock differs depending on whether he has PY 101 that morning, or EH 102.
- He owns a fancy alarm clock that can tell him (when he finally gets up) how many times he hit snooze. He collects data for the whole semester.
  - **What's an example of a factor that would produce systematic variation in the outcome variable?**

Question 6

- The outcome variable is the number of times he hits snooze.
- *Systematic variation* is defined as the variation in the outcome variable associated with the predictor variable.
- The predictor is the *class he has that morning*, or PY 101 or EH 102 (these are really the *levels*).
- Therefore, the factor that would produce systematic variation in the outcome variable is the ***class he has that morning*** (or PY 101 or EH 102)

Question 6 - answer

Round 2

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- Test statistics are ratios.
- **Write two different ratios that are equivalent to how we conceptually define ALL test statistics.**

(You must provide two correct answers to earn a point.)

Question 7

Question 7 - answer

- **Effect / Error**
- **Systematic variation / Unsystematic variation**
- These two ratios apply to all test statistics we'll cover.
  - For ANOVA we can use:
  - Between-groups variance / Within-groups variance

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- You are studying the impact of social interaction on mood in older adults. You manipulate social interaction by assigning people to either a high or a low interaction group, and encouraging them to interact a lot vs. very little, respectively. After a few hours, you measure mood using a scale from 1-*very sad* to 7-*very happy*.

Write the null hypothesis using symbols.

Question 8

$H_0: \mu_{hi\_interaction} = \mu_{low\_interaction}$

where μ represents the average happiness score.

Question 8 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

You are interested in whether PY 221 students who are interested in graduate school in psychology perform better in the course than PY 221 students who are not interested in graduate school in psychology.

You collect data for PY 221 classes for 5 years, measuring whether or not each student in the class is interested in graduate school in psychology (yes or no), and each student's final grade (1 to 100%).

What type of design – between-subjects or within-subjects – does this study have?

Question 9

Question 9 - answer

- **Between-subjects design**
  - Students are *either* interested in graduate school *or* not interested in graduate school. There are *different students at each level* of our predictor.

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- A cognitive psychologist is interested in how proximity to smart phones influences attention. She measures attention using a cognitive task completed on a computer. (The task measures reaction time in milliseconds.) Before starting the task, Ps are randomly assigned to place their phones face down on the desk, in their book bag a few feet away, *or* in their book bag stored in the next room.
- **What is the dependent variable in this study?**

Question 10

- **Attention** (measured in how many milliseconds it takes to complete a cognitive task)
  - The psychologist *measures attention* after manipulating phone location, and hypothesizes that phone location (the IV) will have an effect on attention (the DV).

Question 10 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- A professor gives half the students cookies at the beginning of class, and half the students no cookies. Then she gives a lecture. She measures enjoyment of the lecture at the end of class. Her t-test results reveal a p-value of $p = .20$, so she concludes that cookies do not influence lecture enjoyment.
- If, in reality (in the population), cookies *do* influence lecture enjoyment, **what type of error would we say that the professor has made?**

Question 11

Question 11 - answer

- **Type II**
  - This error occurs when our data suggest that there's *no* effect/relationship/difference, when in fact (in reality, in the population) there *is* one.

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

A track coach wanted to know whether her 400 meter runners had better times in morning practices or evening practices. For an entire week, she measured runners' times for the 400m in the morning and in the evening. (Athletes were required to attend both practices.) She predicted that, on average, runners would have faster times in the morning than evening.

What type of statistical test should the researcher use to analyze her data?
(Be specific ☺)

Question 12

Question 12 - answer

- **Paired-samples t-test**
  - The study contains a within-subjects design, which always requires a paired-samples t-test
  - Pairs of scores (times) are obtained for each runner – one score for the morning and one for the evening – and are being compared.

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- You have a Fitbit, which records how many steps you take each day, and you record your daily step data for a year. You then randomly sample 40 of those days and wish to calculate an interval that allows you to say with 95% confidence that you've captured the true mean # of steps per day in your population of steps.
- You have already calculated the mean and standard deviation in your sample of 40. And you know the critical value is 1.96.
- **What <u>two</u> values do you <u>calculate</u> next, in order to begin to calculate the interval referenced above?**
- You do not need to perform the calculations for this question. You don't actually have enough information to do so. Just indicate which two values you would calculate next. Both answers must be correct to earn a point.

Question 13

- **The standard error** [$SE = s/\sqrt{(N)}$]
- **The margin of error** [M.O.E. = *SE* x critical value]

  After calculating these two values, you'll calculate the upper and lower boundaries of the confidence interval.

  Lower = point estimate – margin of error

  Upper = point estimate + margin of error

Question 13 - answer

Round 3

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- Student evaluation scores are measured on a 5-point scale and averaged for each course. A university administrator is interested in whether 100-level, 200-level, 300-level, or 400-level courses tend to receive better student evaluation scores at their university.
- He samples 150 courses, and records the mean evaluation score (across students) and the level of the course.
- **What kind of statistical test should the administrator use here to see whether average evaluation scores differ across course levels?**

Question 14

Question 14 - answer

- **ANOVA**
  - Predictor:
    - Level of course (100, 200, 300, or 400) – a 4-level qualitative variable
  - Outcome:
    - Average evaluation score for the course, a quantitative variable

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- You have a Fitbit, which records how many steps you take each day, and you record your daily step data for a year. You then randomly sample 40 of those days and wish to calculate an interval that allows you to say with 95% confidence that you've captured the true mean # of steps per day in your population of steps. Your mean for the sample of 40 days is 10,000, and the standard error is 1000. And you know the critical value is 1.96.
- **What are the lower and upper bounds of your 95% CI?**

(Both answers must be correct to earn a point.)

Question 15

- **Lower Bound: 8,040**
- **Upper Bound: 11,960**
  - Your point estimate is the mean of 10,000 (given)
  - Calculate your margin of error
    - MOE = *SE* x critical value
    - MOE = 1,000 x 1.96 = **1,960**
  - For the lower bound, subtract the MOE from the mean.
  - For the upper bound, add the MOE to the mean.

Question 15 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

If a researcher sets their significance level to .05, it means that:

A. there is a 95% chance of the population mean falling outside the computed intervals.
B. any sample data with an effect size of .05 or higher, will be labeled as “not significant”.
C. this is the threshold for deciding whether or not the sample data are so unlikely to have come from the distribution described by the null hypothesis, that you must reject the null hypothesis.
D. if the null hypothesis is true, there is a 95% chance your data will produce a significant result.

Select the correct answer.

Question 16

If a researcher sets their significance level to .05, it means:

C) this is the threshold for deciding whether or not the sample data are *so* unlikely to have come from the distribution described by the null hypothesis, that you must reject the null hypothesis.

If $\alpha = .05$, then we are using .05 as the cut off below which we will reject the null hypothesis. If, according to the p-value calculated using our sample data, our sample data have a ***less*** *than 5% probability of occurring given that the null is true, then this sheds doubt on the null's credibility.*

Question 16 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

A researcher was interested in examining which of two feelings - feeling anxious or feeling afraid - makes non-Southerners discriminate more against Southerners. She randomly assigned a group of non-Southerners to 1 of the 2 feelings conditions, and influenced their feelings by having them write about a time they felt anxious or a time they felt afraid. Then, she measured discrimination against Southerners with a commonly-used discrimination measure, involving a quantitative scale.

What are the predictor and outcome variables, and what type of statistical test should the researcher use to analyze her data?

Question 17

3-point question! (partial credit awarded)

- **Predictor: feeling (anxious or afraid).** This variable was manipulated. It is a binary IV.
- **Outcome: discrimination.** This variable was measured using a quantitative scale.
- **Independent samples t-test**
  - The study design was a between-subjects experimental design. Each participant was assigned to only one of the two conditions of the IV– anxious or afraid.
  - Between-subjects designs will always require an independent samples t-test.

Question 17 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

What is meant by a “p-value”?

A. the significance level, α, which researchers usually set at .01 or .05; this is the threshold for rejecting the null hyp.
B. the magnitude of the effect, its practical importance
C. the probability of the population parameter falling into the interval, which is typically 95% or 99%
D. the chance that the sample data that we have collected, or data even more extreme, came from the distribution described by the null hypothesis

Select the correct answer.

Question 18

D) a “p-value” is the chance (or probability or likelihood) that the sample data that we have collected, or data even more extreme, would have come from the distribution described by the null hypothesis.

If the p-value we calculate is below (<) the significance level (alpha) we have set, it means we should reject the null because our sample data are very unlikely to have come from the population described by the null hypothesis.

Question 18 - answer

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

If you know that your Cohen's *d* is equal to .27, what does this tell you?

A. The relationship between the predictor and outcome is statistically significant.
B. The 95% CI does not contain zero.
C. Both of the above.
D. The p-value is not significant.
E. None of the above.

Select one answer.

Question 19

Question 19 - answer

E) None of the above.

The measure of effect size (e.g., Cohen's *d*) tells us the *size of the effect*, which helps us understand how practically important the relationship is between our two variables.

Effect sizes do not tell us whether the statistical test we ran is significant, and do not tell us the upper and lower bounds of our confidence interval.

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

University XYZ uses online course evaluations and students have 1 week to complete the evaluation of the course, online. They can complete it any time during that week. Suppose a professor of a very large (*N*=1000) section of a PY 101 course wants to compare the evaluations from freshmen, sophomores, juniors, and seniors to see if students of different years liked the class more vs. less.

Provide an example of a factor that could produce unsystematic variation in outcome scores, that could be present in this study's data.

Question 20

There are many correct answers. The key is that you identify a factor that might be associated with differences in the course ratings that is NOT *a student's year in school*, which is the predictor variable.

Ex 1 - *When* the student completed evaluation

If the student completed the evaluation right after getting back a test, or on a Friday night after coming back from a party, they may rate the course differently than had they completed the course evaluation at another time.

Ex 2 - *Where* the student was when completing evaluation

If the student completed the evaluation in a noisy dorm room, vs. a quiet library, they may rate the course differently.

Ex 3 - The student's *grade* in the course

A student with a higher grade may rate the course differently than a student with a lower grade.

Question 20 - answer

Tiebreaker Question

2 mins | 90 secs | 60 secs | 30 secs | 15 secs | 5 secs

- You're interested in whether fall semester or spring semester, on average, contains more social events on campus. You count the # of social events for each semester, for the past 40 academic years.
- **What type of statistical test would you use to analyze these data?** (HINT: think of *each academic year* as a *participant*.)
- **State the null and alternative hypotheses in symbols, where μ means the average number of social events.**

FINAL Question

3-point question! (partial credit awarded)

FINAL Question - answer

- **Paired-samples t-test**
  - Each academic year has a score (# of social events) for both fall and spring, i.e., each year has a *pair* of scores that will be compared for whether they're the same or different.
- $\mathbf{H_0: \mu_{fall} = \mu_{spring}}$
- $\mathbf{H_1: \mu_{fall} \neq \mu_{spring}}$

(μ signifies the mean # of social events)