# Exam 3 study guide - Fall 2022

## Question break down (40 Questions total)

* 13 CI questions (Ch 13 & 14) (1 of them interpretation)
* 12 Chapter 15&16 Qs (1 of them interpretation)
* 6 Chapter 17 Qs (1 of them interpretation)
* 7 Chapter 19 Qs (1 of them interpretation)
* 2 "Choose the right tool" Qs

## 13 CI questions (Ch 13 & 14) (1 of them interpretation)

* Margin of Error
  + Formulas
    - Proportion:
    - Mean:
  + What factors affect the size of ME?
    - How does sample size affect ME? Larger sample size leads to (larger/smaller) ME?
    - How does the confidence and *critical value* affect ME? Larger confidence leads to (larger/smaller) ME? Larger critical value leads to (larger/smaller) ME?
  + How does ME affect a CI? Larger ME leads to (larger/smaller) CI?
  + Given a confidence interval, how could you find the ME?
* Confidence Intervals
  + CIs talk about capturing the ***population*** parameter based on our sample. We use CIs when we do NOT know info about the population
  + Inperpretation
    - We are \_\_\_% confident that the true population \_\_\_\_\_\_\_\_ (mean/proportion) is captured in the range \_\_\_ to \_\_\_
    - ^general form, make sure to give some context (ie "the true proportion of manufacturing defects")
  + Know CI conditions!! (mean and proportion)
    - Shared conditions
      * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - 3rd condition for proportion CIs: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - 3rd condition for mean CIs: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Formulas
    - Proportion:
      * Aka
    - Mean:
      * Aka
  + Bigger confidence bigger interval
  + "Critical values" ( & ) are looked up based on level of confidence
    - We just need the level of confidence to look up
    - We need "degress of freedom" and level of confidence to look up
      * comes from the -distribution. This has fatter tails and leads to wider, more realistic confidence intervals for smaller sample sizes.
* Estimate of the SD of a sampling dist is the SE

## 11 Chapter 15&16 Qs (1 of them interpretation)

* UNLESS YOU DESIGNED AN EXPERIMENT AND COLLECTED THE DATA YOU CAN'T SAY ANYTHING ABOUT CAUSATION
* Hypothesis testing steps
  + Hypotheses - State null () and alternative hypotheses ()
    - Null hypotheses examples: &
    - Alternative hypotheses examples: & &
  + Model - Check assumptions of test (same as CIs)
  + Mechanics - Calculate test statistic and convert to a p-value
  + Conclusion - Interpret p-value and state conclusions of test
    - When interpreting include: statement about , level of significance, & p-value
    - p > - **Fail to reject the null hypothesis**, there is not evidence to support the alternative hyothesis
    - p < - **Reject null hypothesis**, there is evidence to support the alternative hypothesis
    - - aka "alpha" or "level of significance"- very common to use 0.05
      * Relates to confidence levels in CIs. A test with and a CI at 95% confidence will agree
* p-values
  + p - probability
  + "Assuming the null hypothesis to be true, what's the probability we'd see the data in our sample"
  + Examples:
    - Assuming heads should come up 50% of the time, what's the probability we'd see 20 heads in a row? This would be very unusual data to observe and have a low p-value. It might lead us to reject the assumption that it is a fair coin.
    - Assuming the average weight of a french bull dog is 24.3 pounds, what's the probability we'd see a french bull dog that weighs 40 pounds? This would be very unusual data to observe and have a low p-value. It might lead us to reject the assumption that the dog is a frenchie.
* Confidence intervals and hypothesis tests
  + If a 95% confidence includes the null hypothesized mean/proportion then a hypothesis test will result in p > 0.05 (ie fail to reject ).
    - Example: A 95% confidence interval of a population mean is [10, 15].
      * If we ran a hypothesis test with , we'd see a p-value greater than 0.05 and fail to reject the null hypothesis
      * If we ran a hypothesis test with , we'd see a p-value less than 0.05 and reject the null hypothesis
* Hypothesis testing errors
  + Type I error - [False Positive](https://i.imgur.com/AxubVWu.jpg) - rejecting the null hypothesis when it's true
    - The probability of making a Type I is denoted as (alpha)
    - We base p-values and our conclusions on how unusual events are. There's always a chance of just seeing some unsual things ([eg](https://content.time.com/time/nation/article/0,8599,1901663,00.html)). We often say if there's <5% chance of observing this data assuming the null then reject the null. We'd still see that happen ~5% of the time when the null is true.
  + Type II error - [False Negative](https://i.imgur.com/n0FOqJZ.jpg) - failing to reject the null hypothesis when it's false
  + If you decrease chance of making a Type I error you increase chances of Type II error
  + If you decrease chance of making a Type II error you increase chances of Type I error

## 6 Chapter 17 Qs (1 of them interpretation)

## 7 Chapter 19 Qs (1 of them interpretation)

## 2 "Choose the right tool" Qs