STAT 3011 (006) Fall 2022 Exam 2 Information

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1 General Information About the Exam

1. **Exam 2 will be held on Thursday, November 17th, 5:00 pm - 6:30 pm, at Anderson Hall 310 (West Bank).**

2. Exam 2 has 10 to 13 multiple choice questions, (worth 30%-40% of the exam score), (including one question asking "did you circle your multiple-choice answers on the last page of the exam?" See item 9) and 3 short answers questions with sub-questions (worth 60% - 70% of the exam score). Exam 2 will be based on Chapter 8, 9, 10 that we learned in class, lab, and homework.

3. You can bring one letter-sized (8.5" by 11") cheat sheet either typed or hand-written to Exam 2. You may use both sides of your cheat sheet. You can use any content from Canvas/homework/lecture, etc. **Please write your name on both sides of your cheat sheet. Please note that your cheat sheet will be collected with your exam and will not be returned. If you want to keep your cheat sheet, please make a photocopy of it before the exam.**

4. Bring a scientific or graphic calculator. Phone/computer calculators are NOT allowed. If you have a graphing calculator with a color screen, please plan to seat in the front. I do not want to wrongly accuse you of using a cell phone during the exam and it is hard to tell from far away. **If you use a graphic calculator, please only use the basic algebraic functions and do not use the fancy functions that a scientific calculator does not provide.**

5. Bring your U-card or photo ID. Please have your ID out while taking the exam.

6. I will provide scratch paper if needed. Do not bring your own.

7. When you finish your exam :

   - Hand in your exam & cheat sheet to the teaching staff (instructor/TAs).
   - Show your ID.
   - Find your name on the class roster and write your initial.
   - Please DO NOT discuss the exam with other students when you are in line waiting to hand in your exam.

8. Sharing cheat sheets and/or sharing a calculator during the exam is NOT allowed.

9. Please circle your multiple choice answer on the last page of the exam. Failing to do so will result 0 for your multiple choice part.

10. All necessary R command results will be provided. But not all are useful.

2 Topics Covered

1. Chapter 8 Confidence Intervals

   - Understand the definitions/notations/meaning of the point estimate vs. interval estimate.
   - Understand the definition of standard error of a sample statistic and how to calculate.
   - Understand properties of t-distribution.
   - Know the assumptions of the confidence interval and determine whether they are met or not based on information such as summary statistic(s) or graphs.
   - Obtain correct z-multiplier (`qnorm(1 - `α`/2)`) and t-multiplier (`qt(1 - `α`/2, df = n-1)`) values using R to construct a confidence interval for p (population proportion) or μ (population mean).

- Know how margin of error (MOE) changes depending on sample size (n), error probability (α), sample proportion ($\hat{p}$), sample standard deviation (s), and etc.
- Interpret the confidence interval in the context of the problem.
- Calculate the minimum sample size (n) required given a confidence level ($1 - \alpha$) and a desired margin of error (m) to construct confidence intervals for μ and p.

2. Chapter 9 Hypothesis Tests

- Conduct a five-step hypothesis test.
  - Understand the nature of null and alternative hypothesis.
  - Know the formula of test statistic and its distribution under the null hypothesis.
  - Calculate and interpret z-test statistic for proportion, t-test statistic for mean.
  - Calculate p-value correctly based on alternative hypothesis using R and interpret in context.
    * If alternative hypothesis is $H_a : p < p_0$, then p-value is $P(Z < z^*) = \texttt{pnorm}(z^*)$.
    * If alternative hypothesis is $H_a : p > p_0$, then p-value is $P(Z > z^*) = \texttt{1 - pnorm}(z^*)$.
    * If alternative hypothesis is $H_a : p \neq p_0$, then p-value is $2P(Z > |z^*|)$.
      · If the test statistic is posivie (+), then use p-value = twice the upper tailed area = $\texttt{2 * (1 - pnorm}(z^*)\texttt{)}$.
      · If the test statistic is negative (-) then use p-value = twice the lower tailed area = $\texttt{2 * pnorm}(z^*)$.
    * In testing population mean(μ), use t-distribution and $\texttt{pt()}$ R command with correct degrees of freedom.
  - Draw conclusion in the context of the problem.
- Understand the equivalence between two-sided hypothesis tests and confidence interval for μ (and for $\mu_1 - \mu_2$ in Chapter 10).
- Understand Type 1 error and Type 2 error in different scenarios and know the type of possible error you could have made after drawing a conclusion.
- Understand how P(Type 1 error) and P(Type 2 error) change (increase/decrease) with different α values.
- Understand the difference between statistical significance (small p-value) and practical significance (the magnitude of the difference is large enough to have practical meaning).

3. Chapter 10 Comparing Two Groups

- Find the point estimate of $\mu_1 - \mu_2$.
- Calculate and interpret the confidence interval for $\mu_1 - \mu_2$ in context (when the CI contains 0 vs does not contain 0).
- Determine whether two samples are matched pairs or independent and obtain correct degrees of freedom in each case.
- Conduct a five-step hypothesis test for difference between two population means, which includes check assumptions, state null and alternative hypothesis using correct statistical notations, calculate test statistic and p-value, interpret and draw conclusions in context.
- Apply equivalence of CI for $\mu_1 - \mu_2$ and two-sided hypothesis test.