MTH 3210
Supplemental Final Exam Study Guide

In addition to the topics covered on **Exams I** and **II** (listed in the **study guides** for those exams), the **Final Exam *also*** covers Slides 15-18 (we skipped 19), 20, 21, and 22 (but not R^2 – we didn't cover it), Homeworks 8-10, and Sections 7.1-7.3, 8.1-8.3, 9.1-9.2, 12.1-12.2, and 12.5 in the book. Exam problems will be similar to examples done in class and homework problems.

1. **Confidence intervals (CIs)**

   - Level of confidence: know how to interpret it (i.e. it's the degree to which we can be confident that the interval contains the unknown population parameter).
   - CI for a population mean μ:
     - Know how to compute a CI for μ under each of the two scenarios:
       - $X_1, X_2, \ldots, X_n$ is a random sample from *any* population and n is large.
       - $X_1, X_2, \ldots, X_n$ is a random sample from a $\mathrm{N}(\mu, \sigma)$ population.
     - Know how to interpret the CI (e.g. it gives a set of plausible values for the unknown population mean μ).
   - General properties of CIs:
     - Know how the sample size n influences the **width** of a CI.
     - Know how the level of confidence influences the **width** of a CI.
   - CI for a population proportion p:
     - Know how to compute the CI for p when n is large.
     - Know how to interpret the CI (e.g. it gives a set of plausible values for the unknown population proportion p).
   - Sample size determination.
     - Know how to determine the smallest sample size that will give a desired CI **width** in a CI for μ.
     - Know how to determine the smallest sample size that will give a desired CI **width** in a CI for p.

2. **Hypothesis tests**

   - Null and alternative hypotheses: know the difference, know how to decide what the hypotheses are for a given problem.
   - Test statistic: know what it's used for and how it's used to determine a p-value.
   - P-value:
     - Know how to determine the p-value for each of the tests listed below.
     - Know how to **interpret** a p-value.
   - Level of significance α: know how it's used with the p-value and the decision rule to draw the conclusion.
   - Statistical significance: know what it means for a result to be statistically significant.
   - **One-sample *z* test** for a population mean μ.
     - Know when it can be used: $X_1, X_2, \ldots, X_n$ is a random sample from *any* population and n is large. (**Note**: the one-sample t test can also be used under these circumstances, and will give the same results as the z test.)

  - Know how to compute the z test statistic.
  - Know how to use the computed test statistic to obtain p-values from the $\mathrm{N}(0,1)$ distribution.
- **One-sample *t* test** for a population mean μ.
  - Know when it can be used: $X_1, X_2, \ldots, X_n$ is a random sample from a $\mathrm{N}(\mu, \sigma)$ population.
  - Know how to compute the t test statistic.
  - Know how to use the computed test statistic to obtain p-values from the $t(n-1)$ distribution.
- **Two-sample *z* test** for the difference between two population means $\mu_1 - \mu_2$.
  - Know when it can be used: $X_1, X_2, \ldots, X_m$ and $Y_1, Y_2, \ldots, Y_n$ are random samples from *any* two populations and m and n are large. (**Note**: the two-sample t test can also be used under these circumstances, and will give the same results as the z test.)
  - Know how to compute the z test statistic.
  - Know how to use the computed test statistic to obtain p-values from the $\mathrm{N}(0,1)$ distribution.
- **Two-sample *t* test** for the difference between two population means $\mu_1 - \mu_2$.
  - Know when it can be used: $X_1, X_2, \ldots, X_m$ is a random sample from a $\mathrm{N}(\mu_1, \sigma_1)$ population, $Y_1, Y_2, \ldots, Y_n$ is a random sample from a $\mathrm{N}(\mu_2, \sigma_2)$ population.
  - Know how to compute the z test statistic.
  - Know how to use the computed test statistic to obtain p-values from the $t(\nu)$ distribution, where

$$\nu = \frac{\left(\frac{s_1^2}{m} + \frac{s_2^2}{n}\right)^2}{\frac{\left(\frac{s_1^2}{m}\right)^2}{m-1} + \frac{\left(\frac{s_2^2}{n}\right)^2}{n-1}}$$

You ***don't*** need to know this formula. The value of ν will be given on the exam.

3. **Correlation**

- Scatterplots (know how to make and interpret them)
- Know how to compute and **interpret** the correlation r.
- Know the **properties** of correlations.

4. **Linear Regression**

- Explanatory and response variables (know the difference)
- Principle of Least Squares (know what this is)
- Fitted regression line
  - Know how to the the slope b_1 and y-intercept b_0 are calculated.
  - Know how to use the fitted regression line to predict y from a given value of x.
  - Know how to use the fitted regression line to quantify a typical change in y for a given change in x.
- Cautions about using the fitted regression line.
  - Extrapolation (know what this means)
  - Influential points (know which outliers are particularly influential).
- THIS TOPIC WILL NOT BE ON THE EXAM: Coefficient of determination R^2 (know how to interpret it and how to use it to assess how well a regression line fits the data).