# STAT 109 Statistics
# Final Exam Review

**Notes and Reminders:**

You may use an approved calculator on this exam. Refer to the course syllabus for the official calculator policy.

A normal table and formula sheet will be provided for your reference. Both are available on the course website if you would like to use them while you study.

The exam will be held on Tuesday, August 9 from 5:30-7:30PM in our normal classroom.

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- Chapter 1: Classifying and Collecting Data (Sections 1-3)

  1. Identify the difference between a population and a sample and the difference between a parameter and a statistic
  2. Identify the difference between qualitative and quantitative data
  3. Identify the difference between an observational study and an experiment
  4. Principles of experimental design (blinding, randomization, blocking, replication)
  5. Sampling methods (What are they? Which ones are random?)
  6. In an observational study or experiment, identify the explanatory variable and the response variable

- Chapter 2: Descriptive Statistics (Sections 1-5)

  1. Graphs, tables, and charts (how to make them and how to read/interpret them)
     - For quantitative variables: frequency distributions, relative frequency distributions, cumulative frequency distributions, frequency histograms, relative frequency histograms, frequency polygons, ogive (cumulative frequency graphs), stem-and-leaf plots, dot plots, scatterplots, time series charts, boxplots
     - For qualitative variables: bar charts, pie charts, Pareto charts
  2. Describing the shape of the distribution of a quantitative variable: modes, skewness, outliers and gaps
  3. Measures of central tendency (how to compute them, when to use them)
     - For quantitative variables: mean, median, mode
     - For qualitative variables: mode
  4. Measures of variation (how to compute them, when to use them)
     - For quantitative variables: range, variance, standard deviation, IQR
  5. Other descriptive statistics for quantitative variables: weighted mean, mean from a frequency distribution, standard deviation from a frequency distribution, fractiles and percentiles, the Five Number Summary, $z$-scores
  6. The Empirical Rule (What is it and when does it apply?)

- Chapter 5: The Normal Model (Sections 1-4)

  1. The Standard Normal Model $N(0, 1)$ and the normal model $N(\mu, \sigma)$
  2. Finding area under a normal curve
  3. Finding probabilities associated with a normally distributed random variable
  4. Finding a $z$-score associated with the area of a region under the normal curve

5. Sampling distributions (What are they? When do we use them? How do we compute probabilities associated to a sampling distribution?)

- Chapter 3: Basic Probability (Sections 1-3)

  1. Identifying the sample space of a random event
  2. Using the Fundamental Counting Principle to answer questions about "How many"
  3. Using the definition of theoretical probability to compute probabilities
  4. Using the definition of empirical probability to compute probabilities
  5. Using basic rules to compute probabilities:
     - Use Complement Rule to compute the probability of the complement of an event
     - Use the Basic Addition Rule to compute the probability of the "OR" or "UNION" of two **DISJOINT** events
     - Use the Basic Multiplication Rule to compute the probability of the "AND" or "INTERSECTION" of two **INDEPENDENT** events
  6. Using other rules to compute probabilities:
     - Use conditional probability formula to compute conditional probabilities
     - Use the General Addition Rule to compute the probability of the "OR" or "UNION" of any two events (not necessarily disjoint)
     - Use the General Multiplication Rule to compute the probability of the "AND" or "INTERSECTION" of any two events (not necessarily independent)
  7. Using Venn Diagrams to model sets
  8. Using Venn Diagrams to model probability spaces

- Chapter 6: Confidence Intervals (Sections 1 and 3)

  1. Identify the point estimate from a sample
  2. Given a confidence level, find the critical value for a confidence interval
  3. Given a point estimate and confidence level, find the standard error and the margin of error
  4. Given a point estimate and a confidence level, find a confidence interval and be able to interpret this interval using a complete sentence
  5. Given a desired margin of error and confidence level, determine the minimum sample size needed
  6. All of the above for estimating either a population proportion ($p$) or a population mean ($\mu$) with known population standard deviation ($\sigma$)

- Chapter 7: Hypothesis Testing (Sections 1, 2, and 4)

  1. Identify the hypotheses $H_0$ and $H_a$ for a hypothesis test
  2. Identify the type of test (one-tailed left, one-tailed right, or two-tailed) based on the hypotheses
  3. Given a $P$ value and $\alpha$ level, determine the conclusion of the hypothesis test ("reject $H_0$" or "fail to reject $H_0$") and write a complete sentence interpreting this conclusion
  4. All of the above for testing statements about either a population proportion ($p$) or a population mean ($\mu$) with known population standard deviation ($\sigma$)
  5. Compute the $P$-value for the hypothesis tests described above

- Chapter 9: Linear Regression (Sections 1-2)

  1. Describing the association of a scatterplot (strength, direction, form)
  2. When analyzing a paired data set made up of two (paired) quantitative variables, identify the explanatory variable and the response variable
  3. Compute and interpret the correlation coefficient for two quantitative variables
  4. Compute the equation of the regression line for two quantiative variables
  5. Use the equation of the regression line to predict values of the response variable
  6. Compute the residual for a data point $(x, y)$