AP Statistics

COURSE OUTLINE		
Unit One	*Exploring Data*	*12 days*
Unit Two	*Modeling Distributions of Data*	10 days
Unit Three	*Describing Relationships*	11 days
Unit Four	*Designing Studies*	14 days
Unit Five	*Probability*	11 days
Unit Six	*Random Variables*	12 days
Unit Seven	*Sampling Distributions*	10 days
Unit Eight	*Estimating with Confidence*	11 days
Unit Nine	*Testing a Claim*	11 days
Unit Ten	*Comparing Two Populations or Groups*	11 days
Unit Eleven	*Inference for Distributions of Categorical Data*	9 days
Unit Twelve	*More about Regressions*	10 days

School-wide Academic Expectations Taught In This Course

- Communication
- Collaboration
- Analysis
- Literacy

School-wide Social and Civic Expectations Taught in This Course

- Demonstrate Resiliency
- Demonstrate Responsibility
- Demonstrate Respect

Major Themes

I. Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. In examining distributions of data, students should be able to detect important characteristics, such as shape, location, variability and unusual values. From careful observations of patterns in data, students can generate conjectures about relationships among variables. The notion of how one variable may be associated with another permeates almost all of statistics, from simple comparisons of proportions through linear regression. The difference between association and causation must accompany this conceptual development throughout.

II. Data must be collected according to a well-developed plan if valid information is to be obtained. If data are to be collected to provide an answer to a question of interest, a careful plan must be developed. Both the type of analysis that is appropriate and the nature of conclusions that can be drawn from that analysis depend in a critical way on how the data was collected. Collecting data in a reasonable way, through either sampling or experimentation, is an essential step in the data analysis process.

III. Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.

IV. Statistical inference guides the selection of appropriate models. Models and data interact in statistical work: models are used to draw conclusions from data, while the data are allowed to criticize and even falsify the model through inferential and diagnostic methods. Inference from data can be thought of as the process of selecting a reasonable model, including a statement in probability language, of how confident one can be about the selection.

Unit 1

Introduction and Established Goals: In chapter 1 we introduce categorical and quantitative variables and the idea of a distribution. We show how to describe the distribution of a categorical variable and the relationship between two categorical variables. We also focus on graphing and summarizing distributions of a single quantitative variable.

Desired Outcome(s):

- Students will be able to independently use their learning of graphical and numerical analysis of data distributions to determine if discrimination exists in hiring practices.

Standard(s)/Theme:

- Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. In examining distributions of data, students should be able to detect important characteristics, such as shape, location, variability and unusual values. From careful observations of patterns in data, students can generate conjectures about relationships among variables. The notion of how one variable may be associated with another permeates almost all of statistics, from simple comparisons of proportions through linear regression. The difference between association and causation must accompany this conceptual development throughout.

Essential Question(s):

- What is data?
- How do we communicate and understand data?
- Can you lie with statistics? How and to what extent?
- How can data analysis be used to predict future happenings?
- Does the data always lead to the truth?
- Is all data "created equal"?

Key Terms/Concepts:

- Distribution of a variable tells the values a variable attained and how often.
- Describe a distribution of a quantitative variable by describing shape, center, and spread
- Describe symmetry distributions using mean and standard deviation; use 5-number summary for skewed distributions
- Mean is not resistant and is always pulled toward the tail
- Standard deviation is always positive and equals zero only when all observations are identical
- Five number summary: Min, Q1, Median, Q3, Max. Q1 is the 25th percentile which means that 25% of observations are at or below that value. Q3 is the 75th percentile which means that 75% of observations are at or below that value. Median is 50th percentile.
- Frequency histogram has values of quantitative variable on one axis and frequency on other axis. *Relative* frequency histogram has values of quantitative variable on one axis and *proportion or percent* of observations on other axis.
- Cumulative frequency histogram or ogive gives the percent or frequency of observations *at or below* each value. Cumulative relative frequency histogram or ogive displays percentiles on one axis.
- Outliers may be identified using $1.5\times$ *IQR* rule, or by using a modified box plot on calculator.

- Mean and standard deviation are NOT resistant. Median and quartiles are resistant.
- Use median and IQR as measures of center and spread (respectively) if data is strongly skewed or has outliers.
- Graphs to display univariate, quantitative data: boxplot, stemplot, histogram, dotplot. (Note: box plot does not give information about individual observations.)

LEARNING PLAN

STANDARD(s)/ THEME	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme I	1. Identify individuals and variables for set of data 2. Classify variables as categorical/quantitative	○ Class lecture and notes ○ Practice Problems Hiring discrimination Activity	Graded homework Chapter test Multiple Choice questions
	3. Display categorical data with a bar graph or pie chart. 4. Identify what makes graphs of categorical data deceptive	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Calculate and display the marginal distribution of a categorical variable from a two-way table 6. Calculate and display the conditional distribution of a categorical variable for a particular value of the other categorical variable in a two-way table. 7. Describe the association between two categorical variables by comparing appropriate conditional distributions.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	8. Make and interpret dotplots and stemplots of quantitative data. 9. Describe the overall pattern of a distribution and identify any major departures from the pattern 10. Identify the shape of a distribution from a graph as roughly symmetric or skewed 11. Compare distributions of quantitative data using dotplots or stemplots.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	12. Make and interpret histograms of quantitative data 13. Compare distributions of quantitative data using histograms	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	14. Calculate measures of center 15. Calculate and interpret measures of spread	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test

	16. Choose the most appropriate measure of center and spread in a given setting 17. Identify outliers using the 1.5 x IQR 18. Make and interpret boxplots of quantitative data		Multiple Choice questions
	19. Calculate and interpret measures of spread 20. Choose the most appropriate measure of center and spread in a given setting 21. Use appropriate graphs and numerical summaries to compare distributions of quantitative variables	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 2

Introduction and Established Goals: In chapter 2 we continue exploring distributions of quantitative variables. This chapter focuses on ways to measure an individual's position within a distribution. There are two different ways to measure an individual's location in a distribution: percentiles and standardized scores (z-score).

Desired Outcome(s):

- Students will be able to independently use their learning and knowledge of the mean, standard deviation and normal distributions to analyze standardized test results.

Standard(s)/Themes:

- Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. In examining distributions of data, students should be able to detect important characteristics, such as shape, location, variability and unusual values. From careful observations of patterns in data, students can generate conjectures about relationships among variables. The notion of how one variable may be associated with another permeates almost all of statistics, from simple comparisons of proportions through linear regression. The difference between association and causation must accompany this conceptual development throughout.
- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.

Essential Question(s):

- How does one assess normality?
- Why is the normal distribution essential to the study of statistics?
- How does the normal distribution apply to the real world?
- How do density curves relate to probability?

Key Terms/Concepts:

- Density curve has area of 1 and is always on or above the x-axis
- Area under curve in a certain range is the same as the proportion of observations in that range. (Use area formulas for geometric density curves such as rectangles, triangles, and trapezoids.)
- Normal density curve is mound-shaped (or bell-shaped); mean=median; area can be found converting the observations to observation on the standard normal curve statistic – parameter
- Empirical rule applies to all normal density curves.
- Use InvNorm to find the standardized observation associated with a certain percentile ranking: InvNorm(%rank (as proportion)) = z-statistic. Then use z-formula to convert from the z-value to the observation value.
- Use normal probability plot to determine if data can be modeled by a normal curve. The plot looks kind of like a scatterplot (last type of graph in the STAT PLOT menu) and if plot looks linear, then data can be modeled by a normal density curve. If plot shows definite curve, then data is skewed. If one observation is set apart from others on left or right, then the observation is possibly an outlier.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme I, III	1. Find and interpret the percentile of an individual value within a distribution of data 2. Estimate percentiles and individual values using a cumulative relative frequency graph 3. Find and interpret the standardized score of an individual value within a distribution of data	○ Class lecture and notes ○ Practice Problems ○ Where do I stand activity	Graded homework Chapter test Multiple Choice questions
	4. Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Estimate the relative locations of the median and mean on a density curve 6. Use the 68-95-99.7 rule to estimate areas in a Normal distribution 7. Use table A or technology to find the proportion of z-values in a specified interval, or the value that corresponds to a given percentile in any Normal distribution	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	8. Determine if a distribution of data is approximately Normal from graphical and numerical evidence	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 3

Introduction and Established Goals: In this chapter we consider relationships between two quantitative variables. We will use a scatterplot to display the relationship between two variables, correlation to measure the strength and direction of a linear association, and a least-squares regression line to model a linear relationship.

Desired Outcome(s):

- Students will be able to independently use their learning and knowledge of scatterplots, correlations, and least squares regressions to determine the relationship between endangered species and modern technology.

CT State Standard(s):

- Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. In examining distributions of data, students should be able to detect important characteristics, such as shape, location, variability and unusual values. From careful observations of patterns in data, students can generate conjectures about relationships among variables. The notion of how one variable may be associated with another permeates almost all of statistics, from simple comparisons of proportions through linear regression. The difference between association and causation must accompany this conceptual development throughout.

Essential Question(s):

- What does it mean to regress?
- What is association? What is correlation? How are they connected?
- Does association imply causation?
- How can modeling data help us to understand patterns?
- Can we use extrapolation to predict the future?
- Is it possible to test for lack of correlation?

Key Terms/Concepts:

- Bivariate data: Two measures recorded on each individual.
- Use a *scatterplot* to determine if there is a relationship between two quantitative variables.
- Positive association means positive slope; as values of explanatory variable increase, values of response variable increase. Or, above average values of one variable are associated with above average values of the other variable.
- To describe a plot give strength, form, and direction of relationship.
- *Correlation* is a measure of the strength of a *linear* relationship. Also gives direction (sign).
- Correlation coefficient has values: $-1 \le r \le 1$ where $r = 1$ is a perfect line with positive slope and $r = -1$ is a perfect line with negative slope.
- Correlation of $r = 0$ or r close to zero could mean no association at all (randomly scattered points) or a *non-linear* association, such as a quadratic.
- *Least squares regression line* means that the line produces the smallest sum of squared residuals possible for the data.
- Least squares line always passes through $(\bar{x}, \bar{y})$
- Least squares regression line can be obtained using LinReg on calculator or using means and standard deviations of the two data sets. (See formula on formula sheet.)

- Slope of the least squares lines tells the amount that the y-variable changes for each unit of change in the x-variable.
- *Coefficient of determination*, $r2$, is the percent of the *variation* in the response variable that is explained by the model on the explanatory variable.
- *Residual* is *observed – predicted* or $y - \hat{y}$
- If residual plot has no pattern, then that is evidence that the model selected is a good fit for the data. (Residuals are plotted against x-values or against y-values.)
- *Influential point* sharply affects regression line if removed; points that are extreme in the x-direction can be influential; influential points may have small residuals.
- *Outliers* in a regression do not fit the pattern of the data; generally have large residuals
- *Correlation does not mean causation*!! Even if you have a perfect correlation, that does not mean that the x-variables causes changes in the y-variable. The correlation could be due to lurking variables.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme I	9. Identify explanatory and response variables in situations where one variable helps to explain or influences the other. 10. Make a scatterplot to display the relationship between two quantitative variables. 11. Describe the direction, form, and strength of a relationship displayed in a scatterplot and recognize outliers in a scatterplot.	○ Class lecture and notes ○ Practice Problems ○ The case of the missing cookies Activity	Graded homework Chapter test Multiple Choice questions
	12. Interpret the correlation. 13. Understand the basic properties of correlation, including how the correlation is influenced by outliers. 14. Use technology to calculate correlation. 15. Explain why association does not imply causation.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	16. Interpret the slope and y intercept of a least-squares regression line 17. Use the least-squares regression line to predict y for a given x. Explain the dangers of extrapolation. 18. Calculate and interpret residuals.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

	19. Explain the concept of least squares. 20. Determine the equation of a least-squares regression line using technology. 21. Construct and interpret residual plots to assess if a linear model is appropriate.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	22. Interpret the standard deviation of the residuals and r squared. 23. Use these values to assess how well the least-squares regression line models the relationship between two variables.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	24. Determine the equation of a least-squares regression line using computer output. 25. Describe how the slope, y intercept, standard deviation of the residuals, and r squared are influenced by outliers. 26. Find the slope and y intercept of the least-squares regression line from the mean and standard deviations of x and y and their correlation.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 4

Introduction and Established Goals: In this chapter we will cover methods of data collection, planning and conducting studies and experiments. We will then generalize results and types of conclusions that can be drawn from observational studies, experiments, and surveys.

Desired Outcome(s):

- Students will be able to independently use their learning of sample surveys, experiments, and observational studies to design a study to measure the effect of texting on high school class work.

CT State Standard(s):

- Data must be collected according to a well-developed plan if valid information is to be obtained. If data are to be collected to provide an answer to a question of interest, a careful plan must be developed. Both the type of analysis that is appropriate and the nature of conclusions that can be drawn from that analysis depend in a critical way on how the data was collected. Collecting data in a reasonable way, through either sampling or experimentation, is an essential step in the data analysis process.

Essential Question(s):

- What is an experiment?
- What is bias? How can it be identified? How can it be prevented?
- To what extent is data biased? To what extent can data be purposely biased?
- Does size matter?
- Is all data "created equal"?

Key Terms/Concepts:

- A *census* is when every individual in a population is used in a study; a *sample* is when only a portion of a population is used in a study.
- A study is *biased* if one outcome is systematically favored over other outcomes.
- *Sampling bias* may be due to: *voluntary response*, *undercoverage, convenience sampling*, Random sampling reduces the chance of bias.
- Sample size is NOT bias!! Yes, larger sample sizes are more accurate (less spread), but sample size does not result in one outcome being systematically favored over another.
- *Non-sampling bias* cannot be corrected by random sampling. Sources of nonsampling bias are *poor wording of questions*, or *nonresponse.*
- A sample is a *simple random sample (SRS)* if every group of *n* individuals has an equal chance of being selected.
- To create an SRS, number the individuals in the population from 1 to whatever and then using a random number table select individuals. Must use the same number of digits for each number, so made need to label individuals as 01, 02, etc, or 001, 002, etc.
- A *stratified sample* (which is NOT an SRS) is one in which individuals are first divided into separate groups, or strata, and then an SRS is selected from each stratum.
- An *observational study* occurs when the experimenter observes individuals and measures variables of interest but does not attempt to influence the responses.
- In an *experiment*, the researcher deliberately imposes a treatment on individuals in order to observe how they respond to the treatment.

- The basic principles of *experimental design* are: control – *control* the effects of lurking variables (done by comparison of groups like control group and treatment group, blindness); *randomization* – randomly assigning subjects to groups; *replication* – perform the experiment on many subjects to reduce chance variation in results.
- *Completely randomized experiment* is one in which all experimental units are assigned completely at random to groups. (This is the opposite of a block design!!)
- *Blind* experiment means that subject does not know whether he is receiving the real treatment or the individual interacting with the experimental unit does not know. *Double blind* experiment means that neither the subject nor the people in contact with the subject know which treatment the subject is receiving.
- Blindness and double-blindness are used to control the placebo effect. The placebo effect is the phenomenon that humans will always respond to a treatment.
- *Block design* is one in which experimental units that are similar are grouped together and assigned to treatment groups within the block. Only subjects within a block are compared. When blocking, put LIKE THINGS together so that the variable being controlled is constant within the block.
- *Blocking is used to reduce variation and to control lurking variables* by grouping subjects according to those lurking variables.
- *Matched pairs* is a special case of blocking in which each block consists of only two experimental units, or one experimental unit receiving two treatments. Order of treatments must be randomized since there is not randomization within groups. Either one subject receives both treatments (in random order) or two subjects that are alike in every important way are compared with one subject randomly receiving one treatment and the other randomly receiving a treatment.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme II	1. Identify the population and sample in a statistical study. 2. Identify voluntary response samples and convenience samples. Explain how these sampling methods can lead to bias. 3. Describe how to obtain a random sample using slips of paper, technology, or a table of random digits.	○ Class lecture and notes ○ Practice Problems See no evil, hear no evil Activity	Graded homework Chapter test Multiple Choice questions
	4. Distinguish a simple random sample from a stratified random sample or cluster sample. Give the advantages and disadvantages of each sampling method.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Explain how undercoverage, nonresponse, question wording, and other aspects of a sample survey can lead to bias.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

	6. Distinguish between an observational study and an experiment. 7. Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions. 8. Identify the experimental units, explanatory and response variables, and treatments.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	9. Explain the purpose of comparison, random assignment, control, and replication in an experiment. 10. Describe a completely randomized design for an experiment, including how to randomly assign treatments using slips of paper, technology, or a table of random digits	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	11. Describe the placebo effect and the purpose of blinding in an experiment. 12. Interpret the meaning of statistically significant in the context of an experiment.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	13. Explain the purpose of blocking in an experiment. Describe a randomized block design or a matched pairs design for an experiment.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	14. Describe the scope of inference that is appropriate in a statistical study.	Class lecture and notes Practice Problems	Graded homework Chapter test Multiple Choice questions
	15. Evaluate whether a statistical study has been carried out in an ethical manner.	Class lecture and notes Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 5

Introduction and Established Goals: In chapter 5 we begin a three-chapter section about probability. In section 5.1, we introduce simulation as a very useful way to estimate probabilities. In section 5.2, we introduce the idea of a probability model and some basic probability rules. In addition, we revisit two-way tables as a good way to investigate the relationship between two events. In section 5.3, we introduce two concepts that we will be using throughout the rest of the book: conditional probability and independence.

Desired Outcome(s):

- Students will be able to independently use their learning of randomness, probability and simulation to understand the operations of casinos.

CT State Standard(s):

- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.

Essential Question(s):

- What is the probability of understanding probability?
- How can we base decisions on chance?
- How can probability be used to simulate events and to predict future happenings?
- What are the benefits of simulating events as opposed to gathering real data?
- Is independence desirable?

Key Terms/Concepts:

- *Probability* is the proportion of times that a certain event occurs in a long series of repetitions.
- The *Law of Large Numbers* describes the phenomenon of the more trials we do, the closer the ratio of occurrences to trials becomes closer to the true probability.
- The *complement* of an event is $1-P(\text{event})$. Complement is denoted $P(\text{eventc})$
- *Two events are mutually* exclusive if they cannot occur simultaneously; that is, the joint probability is zero, $P(A \cap B) = 0$. (Two events that are mutually exclusive cannot be independent.)
- Two events, A and B, are independent if $P(A) = P(A|B)$. Events that can occur simultaneously may or may not be independent.
- The *joint probability* of two (or more) events is the probability that both occur simulataneously (AND). If two events are *independent*, then joint probability is:
  $P(A \cap B) = P(A)P(B)$
- The *union* or *probability that at least one event occurs* is (on formula sheet)
  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- *Conditional probability* of two events is the probability that one event occurs given that the other event has already occurred (on formula sheet). ($P(A|B)$ $P(A \cap B)$
  $P(B) = \cap$
- Probability of *at least one* is $1-P(\text{none})$

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme III	1. Interpret probability as a long-run relative frequency.	○ Class lecture and notes ○ Practice Problems ○ The "1 in 6 game" wins activity	Graded homework Chapter test Multiple Choice questions
	2. Use simulation to model chance behavior.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	3. Determine a probability model for a chance process. 4. Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Use a two-way table or Venn diagram to model a chance process and calculate probabilities involving two events. 6. Use the general addition rule to calculate probabilities.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	7. Calculate and interpret conditional probabilities. 8. Use the general multiplication rule to calculate probabilities. 9. Use tree diagrams to model a chance process and calculate probabilities involving two or more events.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	10. Determine whether two events are independent. 11. When appropriate, use the multiplication rule for independent events to compute probabilities	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 6

Introduction and Established Goals: In this chapter, we continue our study of probability with a focus on random variables. A random variable is a numerical outcome of a chance process. In addition to learning how to calculate probabilities of events involving random variables, we will also focus on identifying the shape, center, and spread of the probability distribution of a random variable.

Desired Outcome(s):

- Students will be able to independently use their learning of discrete and continuous random variables to be able to analyze medical test results to determine how often false positives occur.

CT State Standard(s):

- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.

Essential Question(s):

- What is randomness?
- How can modeling predict the future?
- To what extent does our world exhibit binomial and geometric phenomena?
- When is probability a sure thing?
- How can we base decisions on chance?
- Is anything in nature truly random?

Key Terms/Concepts:

- *A random* variable is a variable whose value is a numerical outcome of a random phenomenon.
- A *discrete random variable* is one in which there are a countable number of outcomes. The distribution of a discrete random variable is a table (or histogram) showing each possible outcome along with the probability of that outcome. To find the probability of a discrete random variable, add the probabilities of all of the outcomes in the range.
- A *continuous random variable* is one in which the variable takes on every possible value in an interval. The distribution of a continuous random variable is a density curve. To find the probability for a continuous random variable, find the area under the density curve.
- A normal distribution is a special distribution of a continuous random variable.
- The *mean* of a random variable or *expected value* is (on formula sheet)
  $i\ i\ E(X) = \sum x\ p$. (Multiply each outcome by its probability and add them all up.)
  This gives the average outcome per game if the phenomenon were repeated many times.
- The *variance* of a random variable is (on formula sheet) 2
  $i\ i\ VAR(X) = \sum (x - x)\ p$; to get standard deviation, you square root the variance.
- *Binomial distribution* is a special probability distribution in which: there are two outcomes for the event; there is a fixed number of observations; the observations are independent; probability of success is the same for each observation
- To find the probability of exactly *k* success in *n* trials of a binomial phenomenon either use the formula (on formula sheet): *n* 1 *n k*

$n\ k\ P(X = k) = C\ p\ (-p)$ – or use Binompdf on your calculator: Binompdf(num observations, probability of success, number of successes we want)

- Binomial distribution is symmetrical if p = 0.5; skewed right if p close to zero; skewed left if p close to 1.
- Mean of a binomial distribution is (on formula sheet) $X\ \mu\ np$ and standard deviation of binomial distribution is 1 $X\ \sigma = np(-p)$.
- *Geometric distribution* is a special probability distribution in which: there are two outcomes, success or fail, for the event; the observations are independent; the probability of success is the same for each observation; the variable of interest is the number of trials before we see the first success.
- To find the probability of the first success on the *kth* observation either use the formula: $P(X = k) = (1-p)n-1\ p$ Geometric distribution is always skewed right.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme III	1. Compute probabilities using the probability distribution of a discrete random variable. 2. Calculate and interpret the mean (expected value) of a discrete random variable.	o Class lecture and notes o Practice Problems o Bottled water vs tap water activity	Graded homework Chapter test Multiple Choice questions
	3. Calculate and interpret the standard deviation of a discrete random variable. 4. Compute probabilities using the probability distribution of a continuous random variable.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Describe the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	6. Find the mean and standard deviation of the sum or difference of independent random variables. 7. Find probabilities involving the sum or differences of independent Normal random variables.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	8. Determine whether the conditions for using a binomial random variable are met.	o Class lecture and notes o Practice Problems	Graded homework Chapter test

	9. Compute and interpret probabilities involving binomial distributions.		Multiple Choice questions
	10. Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions
	11. Find probabilities involving geometric random variables.	o Class lecture and notes o Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 7

Introduction and Established Goals: In this chapter we will develop the idea of a sampling distribution. A sampling distribution describes the possible values of a statistic and how often it takes those values. A statistic is any quantity that can be calculated from a sample, such as a sample mean or a sample proportion.

Desired Outcome(s):

- Students will be able to independently use their learning of data exploration, planning studies and probability to estimating endangered species populations from sample data.

CT State Standard(s):

- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.

Essential Question(s):

- How can modeling predict the future?
- How does the normal distribution apply to the real world?
- Does the Central Limit Theorem test one's limit?
- Is all data "created equal"?

Key Terms/Concepts:

- Larger sample sizes are more accurate; increasing sample size decreases sampling variability.
- The *sampling distribution of a statistic* is the distribution of the statistic in all possible samples of a certain size.
- The *distribution of the sample mean, x ,* has mean $= x\ \mu\ \mu$ (where μ is the mean of the population from with the sample is drawn) and standard deviation $x\ n\ \sigma = \sigma$.
- The *Central Limit Theorem* gives the mean and standard deviation of the sampling distribution of sample means as state above, and *more importantly* says that if the sample size is large ($n \geq 30$) the sampling distribution of sample means will be approximately normal regardless of the shape of the distribution of the population. (If $n < 30$, then the sampling distribution of sample means will mimic the shape of the population, and will be more like it the smaller the sample size is. The sampling distribution of sample means is normal if the distribution of the population is normal.)
- The sampling distribution of sample proportions, $p\hat{}$, has mean $\hat{}p\ \mu = p$ (where p is the population proportion) and standard deviation 1
- The sampling distribution of sample proportions will be approximately normal if $np \geq 10$ and $n(1- p\ ) \geq 1$

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme III	12. Distinguish between a parameter and a statistic.	○ Class lecture and notes ○ Practice Problems ○ The German tank problem activity	Graded homework Chapter test Multiple Choice questions
	13. Distinguish among the distribution of a population and a sample, and the sampling distribution of a statistic. 14. Use the sampling distribution of a statistic to evaluate a claim about a parameter 15. Determine whether or not a statistic is an unbiased estimator of a population parameter. 16. Describe the relationship between sample size and the variability of a statistic	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	17. Find the mean and standard deviation of the sampling distribution of a sample proportion. Check the 10% condition before calculating the standard deviation. 18. Determine if the sampling distribution of the sample proportion is approximately Normal. 19. Use a Normal distribution to calculate probabilities involving the sample proportion.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	20. Find the mean and standard deviation of the sampling distribution of a	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test

	sample mean. Check the 10% condition before calculating the standard deviation. 21. Use a Normal distribution to calculate probabilities involving the sample mean.		Multiple Choice questions
	22. Explain how the shape of the sampling distribution of the sample mean is affected by the shape of the population distribution and the sample size. 23. Use a Normal distribution to calculate probabilities involving the sample mean.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 8

Introduction and Established Goals: In this chapter we will introduce the idea of a confidence interval – an interval of plausible values for a parameter. We will also provide the specific details for constructing confidence intervals for a population proportion and confidence intervals for a population mean.

Desired Outcome(s):

- Students will be able to independently use their learning of data exploration, design of experiments, probability and sampling distributions to analyze 911 call response times in a major United States city.

CT State Standard(s):

- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.
- Statistical inference guides the selection of appropriate models. Models and data interact in statistical work: models are used to draw conclusions from data, while the data are allowed to criticize and even falsify the model through inferential and diagnostic methods. Inference from data can be thought of as the process of selecting a reasonable model, including a statement in probability language, of how confident one can be about the selection.

Essential Question(s):

- How much evidence do you need before you are able to make a reasonable conjecture?
- Is it reasonable to think that different people require different amounts of convincing?
- How is statistical inference used to draw conclusions from data?
- How is probability used to express the strength of our conclusions?
- What is inference?
- To what extent should decisions be made based on chance?

Key Terms/Concepts:

- A *confidence interval* is used to estimate a population parameter.
- *An N% confidence interval is interpreted as follows*: N% of all intervals that could be obtained contain the population parameter, so we're fairly confident that our interval contains the population parameter.
- Increasing the confidence level will increase the margin of error. Decreasing confidence and/or increasing sample size will decrease the margin of error.
- The *P-value* of a statistic is the probability of obtaining a statistic as extreme as the one you got, if the null hypothesis is true.
- A *statistic is significant* if it is unlikely to occur by random chance; the statistic (or sample) is unusual or rare. The smaller the P-value (closer to zero) the more significant the statistic and the stronger the evidence against the null hypothesis.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme III, IV	1. Interpret a confidence interval in context. 2. Interpret a confidence level in context.	○ Class lecture and notes ○ Practice Problems ○ Do "The Mystery Mean" activity	Graded homework Chapter test Multiple Choice questions
	3. Determine the point estimate and margin of error from a confidence interval. 4. Describe how the sample size and confidence level affect the length of a confidence interval. 5. Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	6. State and check the Random, 10%, and Large Counts conditions for constructing a confidence interval for a population proportion 7. Determine critical values for calculating a C% confidence interval for a population proportion using a table or technology. 8. Construct and interpret a confidence interval for a population proportion.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	9. Determine the sample size required to obtain a C% confidence interval for a population proportion with a specific margin of error.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

	10. Explain how the t distributions are different from the standard Normal distribution, and why it is necessary to use a t distribution when calculating a confidence interval for a population mean. 11. Determine critical values for calculating a C% confidence interval for a population mean using a table or technology. 12. State and check the Random, 10%, and Normal/Large Sample conditions for constructing a confidence interval for a population mean.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	13. Construct and Interpret a confidence interval for a population mean. 14. Determine the sample size required to obtain a C% confidence interval for a population mean with a specified margin of error.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 9

Introduction and Established Goals: In this chapter we will use data from random samples and randomized experiments to test claims about a population parameter. This type of inference is called a significance test. Students will learn how to make these decisions using a more formal, four-step process. We introduce the basics of significance testing. Then we focus on one-sample tests for a population proportion. Lastly, we focus on one-sample tests for a population mean.

Desired Outcome(s):

- Students will be able to independently use their learning of data exploration and experimental design to determine the effect of steroids on baseball records.

CT State Standard(s):

- Statistical inference guides the selection of appropriate models. Models and data interact in statistical work: models are used to draw conclusions from data, while the data are allowed to criticize and even falsify the model through inferential and diagnostic methods. Inference from data can be thought of as the process of selecting a reasonable model, including a statement in probability language, of how confident one can be about the selection.

Essential Question(s):

- To what extent are significance tests reliable?
- How can one prepare for errors from significance tests?
- Is all data "created equal"?
- What makes an argument statistically convincing?
- What is significant about significance?

Key Terms/Concepts:

- A *Type I error* is the probability that we incorrectly reject the null hypothesis when it is really true. The probability of a Type I error is α (significance level). A Type I error will occur α of the time by random chance.
- A *Type II error* is the probability that we incorrectly accept the null hypothesis when the alternate is really true. The probability of a Type II error is called β and is the area under the "true" distribution that falls in the acceptance region of the hypothesized distribution.
- The *power of a test* is the probability that the test will reject the null if the alternate is really true. $(1-\beta)$; power is the complement of Type II error.
- If sample size is increased, the probability of a Type II error decreases and power increases. (Probability of Type I error is still alpha.)
- If significance level (alpha) is made smaller (from 0.05 to 0.01) then probability of Type II error is increased and power decreased.
- A *t-distribution* is used when we don't know the population standard deviation and we want to estimate a population mean. Mean of the distribution is always zero.
- A t-distribution is bell-shaped, but is more variable (wider and flatter) than a standard normal curve for small sample sizes. It is more variable because the standard deviation is calculated from the sample so varies with each sample. As sample size increases without bound, the t-distribution becomes closer to a normal distribution.

- For dependent samples (Matched Pairs) do a one-sample t-test on the list of differences. The null hypothesis would be 0 *diff* $\mu =$
- For two independent samples, use a two-sample t-test with null hypothesis 1 2 $\mu = \mu$
- For 2-sample t-test, the degrees of freedom is the smaller sample size minus 1.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme IV	1. State the null and alternative hypothesis for a significance test about a population parameter. 2. Interpret a P-value in context. 3. Determine if the results of a study are statistically significant and draw an appropriate conclusion using a significance level.	○ Class lecture and notes ○ Practice Problems ○ Do the "I'm a Great Free-Throw Shooter activity"	Graded homework Chapter test Multiple Choice questions
	4. Interpret a Type I and Type II error in context, and give a consequence of each.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. State and check the Random, 10%, and Large Counts conditions for performing a significance test about a population proportion 6. Perform a significance test about a population proportion.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	7. Use a confidence interval to draw a conclusion for a two-sided test about a population parameter. 8. Interpret the power of a test and describe what factors affect the power of a test. 9. Describe the relationship among the probability of a	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

	Type I error (significance level), the probability of a Type II error, and the power of a test.		
	10. State and check the Random, 10%, and Normal/Large Sample conditions for performing a significance test about a population mean. 11. Perform a significance test about a population mean. 12. Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	13. Perform a significance test about a mean difference using paired data.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 10

Introduction and Established Goals: In this chapter, we learn how to compare the proportion of successes for two populations or treatments using both confidence intervals and significance tests. We also learn how to use confidence intervals and significance tests to compare means for two populations or treatments. We start first with proportions (categorical data) and then move to means (quantitative data). Within each type of data we start with confidence intervals and then move to significance tests.

Desired Outcome(s):

- Students will be able to independently use their learning of population comparisons to determine the accuracy of fast food restaurant servers.

CT State Standard(s):

- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.
- Statistical inference guides the selection of appropriate models. Models and data interact in statistical work: models are used to draw conclusions from data, while the data are allowed to criticize and even falsify the model through inferential and diagnostic methods. Inference from data can be thought of as the process of selecting a reasonable model, including a statement in probability language, of how confident one can be about the selection.

Essential Question(s):

- What does it mean to be 95% confident?
- How do you determine if there is a statistical significance?
- What does it mean to make an inference?
- What is a confidence interval?
- What makes an argument statistically convincing?

Key Terms/Concepts:

- Sampling distribution of sample proportions is approximate normal if $np \geq 10$ and $n(1-p) \geq 10$. For a 1-prop z-test, use the "p" from the null hypothesis. For a confidence interval, use p-hat.
- Use a one-proportion z-test to compare an unknown population proportion to a known population proportion. You may use a 1-Prop Z test on calculator to test if a population proportion is equal to a given value, but you still must show all steps including the appropriate calculation for the z-statistic.
- The sampling distribution for the difference of two proportions is approximately normal if $n(\hat{p}) \geq 5$ and $n(1-\hat{p}) \geq 5$ for BOTH p-hats. If checking "nearly normal" for a two-proportion z-test, you may use the pooled $\hat{p}$ in the place of both p-hats when checking the nearly normal condition.
- Use 2-Prop Z-test on calculator to see if two population proportions are equally where you have two independent samples.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme III, IV	1. Describe the shape, center, and spread of the sampling distribution of a Difference between Two Proportions.	○ Class lecture and notes ○ Practice Problems ○ Do the "Is Yawning Contagious?" activity	Graded homework Chapter test Multiple Choice questions
	2. Determine whether the conditions are met for doing inference about p1 – p2. 3. Construct and interpret a confidence interval to compare two proportions.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	4. Perform a significance test to compare two proportions.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Describe the shape, center, and spread of the sampling distribution of a Difference between Two Sample Means. 6. Determine whether the conditions are met for doing inference about a Difference between Two Population Means.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	7. Construct and interpret a confidence interval to compare two means.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	8. Perform a significance test to compare two means. 9. Determine when it is appropriate to use two-sample t	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

	procedures versus paired t procedures.		

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 11

Introduction and Established Goals: In this chapter we will learn three different significant tests for distributions of categorical data. The chi-square test for goodness of fit is used to determine whether the distribution of a single categorical variable differs from a hypothesized distribution in some population. The chi-square test for homogeneity is used to compare the distribution of a single categorical variable for two or more populations or treatments. Finally, the chi-square test for independence is used to investigate the relationship between two categorical variables in a single population.

Desired Outcome(s):

- Students will be able to independently use their learning and knowledge of chi-square tests and inference to determine if M&Ms contain the correct amount of each color.

CT State Standard(s):

- Probability is the tool used for anticipating what the distribution of data should look like under a given model. Random phenomena are not haphazard: they display an order that emerges only in the long run and is described by a distribution. The mathematical description of variation is central to statistics. The probability required for statistical inference is not primarily axiomatic or combinatorial but is oriented toward using probability distributions to describe data.
- Statistical inference guides the selection of appropriate models. Models and data interact in statistical work: models are used to draw conclusions from data, while the data are allowed to criticize and even falsify the model through inferential and diagnostic methods. Inference from data can be thought of as the process of selecting a reasonable model, including a statement in probability language, of how confident one can be about the selection.

Essential Question(s):

- How can we verify that two variables are independent?
- How does one distinguish among the various tests of significance?
- What does it mean to make an inference?
- How can decisions be based on chance?
- What makes an argument statistically convincing?
- How do we make a declaration of independence statistically?
- Is independence desirable?

Key Terms/Concepts:

- The *Chi-square distribution* is always skewed to the right. Also, the mean shifts to the right as the degrees of freedom increases.
- Use a Chi-square Goodness of Fit test if you want to see if the distribution of a single categorical variable "fits" some idealized distribution. Create the chi-sq statistic using lists. Remember to always use COUNTS not percents in your lists!
- Use a Chi-square Test of independence if you want to see if two variables measured on one set of individuals (sample or population) are independent---mainly a two-way table. Null hypothesis is that the variables are independent, or that there is no relationship between the variables.
- Use Chi-square test of homogeneity if you want to see if the values of a categorical variable are distributed the same way for two or more populations. The test works the same way as a test of independence except the null hypothesis is that the populations are homogeneous.
- Expected counts for two-way table: (row total x column total)/ grand total

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme III, IV	1. State appropriate hypothesis and compute expected counts for a chi-square test for goodness of fit 2. Calculate the chi-square statistic, degrees of freedom, and p-value for a chi-square test for goodness of fit	○ Class lecture and notes ○ Practice Problems ○ Do the "Candy Man Can" activity	Graded homework Chapter test Multiple Choice questions
	3. Perform a chi-square test for goodness of fit 4. Conduct a follow-up analysis when the results of a chi-square test are statistically significant	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	5. Compare conditional distributions for data in a two-way table 6. State appropriate hypothesis and compute expected counts for a chi-square test based on data in a two-way table. 7. Calculate the chi-square statistic, degrees of freedom, and p-value for a chi-square test based on data in a two-way table 8. Perform a chi-square test for homogeneity	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	9. Perform a chi-square test for independence 10. Choose the appropriate chi-square test	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Unit 12

Introduction and Established Goals: In this chapter, we learn how to perform inference about the slope of a least-squares regression line. We will need inference to create an interval estimate to make decisions about the true value of the slope.

Desired Outcome(s):

- Students will be able to independently use their learning and knowledge of linear regression to analyze the relationship between salaries and movie grosses for Hollywood stars.

CT State Standard(s):

- Statistical inference guides the selection of appropriate models. Models and data interact in statistical work: models are used to draw conclusions from data, while the data are allowed to criticize and even falsify the model through inferential and diagnostic methods. Inference from data can be thought of as the process of selecting a reasonable model, including a statement in probability language, of how confident one can be about the selection.

Essential Question(s):

- How can we test a series of proportions?
- How can we test the slope of a correlation?
- How do we use a model to make statistical inference?
- How can decisions be made based on chance?
- Is all data "created equal"?
- What makes an argument statistically convincing?

Key Terms/Concepts:

- To test to see if a linear model is appropriate, we make an inference about the parameter β where beta is the slope of the population line.
- Null: Assume there is no linear relationship, so beta is zero. Ho: $\beta = 0$
- Degrees of freedom is $n - 2$ where n is the number of observations.
- To make a decision, look at the t-statistic and p-value from the computer output.
- To create a confidence interval for the population slope, use the t-statistic with $n - 2$ degrees of freedom and use the SE from the computer output.

LEARNING PLAN

STANDARD(s)/ THEMES	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESMENT EVIDENCE
Major Theme IV	1. Check the conditions for performing inference about the slope of a population regression line.	○ Class lecture and notes ○ Practice Problems ○ Do the "Helicopter Experiment" activity	Graded homework Chapter test Multiple Choice questions

	2. Interpret the values of a, b, s, SE, and r squared in context, and determine these values from a computer output 3. Construct and interpret a confidence interval for the slope of the population regression line.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions
	4. Perform a significance test about the slope of the population regression line.	○ Class lecture and notes ○ Practice Problems	Graded homework Chapter test Multiple Choice questions

Suggested Resources and Texts: The Practice of Statistics (5th edition) – Josh Tabor

Suggested Technology: Graphing calculator

Information taken from: College Board on the Web: www.collegeboard.com