AP® Statistics Syllabus

2016-2017

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COURSE DESCRIPTION:
According to the College Board, AP Statistics is designed to introduce students to four broad themes: 1) exploring data, 2) sampling and experimentation, 3) anticipating patterns, and 4) statistical inference. Throughout the course, students will develop strategies for collecting and analyzing data, they will be required to draw appropriate conclusions from their analyses, and to communicate those conclusions in context. Class will be structured in such a way as to facilitate this work. Students will design, administer, and tabulate results from surveys and experiments. Probability and simulations will aid students in constructing models for chance behavior. Sampling distributions provide the logical structure for confidence intervals and hypothesis tests. Our students will use a TI-83/84 graphing calculator, Microsoft Excel and Minitab statistical software, and Web-based java applets to investigate statistical concepts.

COURSE GOALS:
In AP Statistics, students are expected to learn

Skills

- To produce convincing oral and written statistical arguments, using appropriate terminology, in a variety of applied settings.
- When and how to use technology to aid them in solving statistical problems

Knowledge

- Essential techniques for producing data (surveys, experiments, observational studies), analyzing data (graphical & numerical summaries), modeling data (probability, random variables, sampling distributions), and drawing conclusions from data (inference procedures – confidence intervals and significance tests)

Habits of mind

- To become critical consumers of published statistical results by heightening their awareness of ways in which statistics can be improperly used to mislead, confuse, or distort the truth.

COURSE OUTLINE:
Text: The Practice of Statistics (5th edition), by Starnes, Tabor, Yates, and Moore, W. H. Freeman & Co., 2014.

Intro Unit A – Statistics, Data and The Normal Curve Overview

Days	**Topics**	**Learning Objectives** Students will be able to …	**Suggested assignment**
1 – 2	Chapter 1 Introduction	• Identify the individuals and variables in a set of data. • Classify variables as categorical or quantitative. • Compare and contrast descriptive statistics and inferential statistics	Pg 6-7 1, 3, 5, 7, 8 and *Beginning of year Survey*
3 – 4	Overview of measures of Center, Spread and Skewedness	• Identify and calculate arithmetic means, medians, modes, and identify unusual features (outliers) in data sets • Calculate and describe range and variability and basic standard deviation • Identify and discuss skewedness in a population	Measures of Center and Variability Worksheet
5 – 6	Overview of Populations vs. Samples, Parameters vs. Statistics, The Normal Curve and The Empirical Rule	• Describe the difference between population and sample, parameter and statistic, population mean and sample mean • Apply the Empirical Rule to simple problems with "perfect" standard deviations. • Identify the Central Limit Theorem, and how it applies to univariate data, bivariate data, categorical data and continuous data	Empirical Rule Worksheet
7	Unit A Review/First FRAPPY		Unit A Review Sheet
8	Unit A – Overview Test		Watch "Sampling" Video and fill in video notesheet

Chapter 4

Days	Topics	**Learning Objectives** Students will be able to…	Suggested assignment
1 – 2	4.1 Introduction, The Idea of a Sample Survey, How to Sample Badly, How to Sample Well: Simple Random Sampling	• Identify the population and sample in a statistical study. • Identify voluntary response samples and convenience samples. Explain how these sampling methods can lead to bias. • Describe how to obtain a random sample using slips of paper, technology, or a table of random digits.	1, 3, 5, 7, 9, 11
3	4.1 Other Random Sampling Methods	• Distinguish a simple random sample from a stratified random sample or cluster sample. Give the advantages and disadvantages of each sampling method.	13, 17, 19, 21, 23, 25
4	4.1 Inference for Sampling, Sample Surveys: What Can Go Wrong?	• Explain how undercoverage, nonresponse, question wording, and other aspects of a sample survey can lead to bias.	27, 29, 31, 33, 35
5 – 6	4.2 Observational Study versus Experiment, The Language of Experiments	• Distinguish between an observational study and an experiment. • Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions.	37–42, 45, 47, 49, 51, 53, 55
7	4.2 How to Experiment Badly, How to Experiment Well, Completely Randomized Designs	• Identify the experimental units, explanatory and response variables, and treatments. • Explain the purpose of comparison, random assignment, control, and replication in an experiment. • 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.	57, 59, 61, 63, 65
8- 9	4.2 Experiments: What Can Go Wrong? Inference for Experiments	• Describe the placebo effect and the purpose of blinding in an experiment. • Interpret the meaning of statistically significant in the context of an experiment.	67, 69, 71, 73
10-11	4.2 Blocking	• Explain the purpose of blocking in an experiment. • Describe a randomized block design or a matched pairs design for an experiment.	75, 77, 79, 81, 85
12	4.3 Scope of Inference, The Challenges of Establishing Causation	• Describe the scope of inference that is appropriate in a statistical study.	83, 87–94, 97–104
13-14	4.3 Data Ethics (optional topic)	• Evaluate whether a statistical study has been carried out in an ethical manner.	Chapter 4 Review Exercises
15	Chapter 4 Review/FRAPPY!		Chapter 4 AP® Practice Exam
16	Chapter 4 Test		Cumulative AP Practice Test 1

Chapter 4 Project: Students work in teams of 2 to design and carry out an experiment to investigate response bias, write a summary report, and give a 10 minute oral synopsis to their classmates. *See rubric on page 16.*

Chapter 1

Days	Topics	**Learning Objectives** Students will be able to …	Suggested assignment
1	Chapter 1 Introduction	• Identify the individuals and variables in a set of data. • Classify variables as categorical or quantitative.	1, 3, 5, 7, 8
2	1.1 Bar Graphs and Pie Charts, Graphs: Good and Bad	• Display categorical data with a bar graph. Decide if it would be appropriate to make a pie chart. • Identify what makes some graphs of categorical data deceptive.	11, 13, 15, 17
3 – 4	1.1 Two-Way Tables and Marginal Distributions, Relationships between Categorical Variables: Conditional Distributions	• Calculate and display the marginal distribution of a categorical variable from a two-way table. • Calculate and display the conditional distribution of a categorical variable for a particular value of the other categorical variable in a two-way table. • Describe the association between two categorical variables by comparing appropriate conditional distributions.	19, 21, 23, 25, 27–32
5	1.2 Dotplots, Describing Shape, Comparing Distributions, Stemplots	• Make and interpret dotplots and stemplots of quantitative data. • Describe the overall pattern (shape, center, and spread) of a distribution and identify any major departures from the pattern (outliers). • Identify the shape of a distribution from a graph as roughly symmetric or skewed. • Compare distributions of quantitative data using dotplots or stemplots.	37, 39, 41, 43, 45, 47
6 – 7	1.2 Histograms, Using Histograms Wisely	• Make and interpret histograms of quantitative data. • Compare distributions of quantitative data using histograms.	53, 55, 59, 60, 65, 69–74
8 – 9	1.3 Measuring Center: Mean and Median, Comparing the Mean and Median, Measuring Spread: Range and *IQR,* Identifying Outliers, Five-Number Summary and Boxplots	• Calculate measures of center (mean, median). • Calculate and interpret measures of spread (range, *IQR*). • Choose the most appropriate measure of center and spread in a given setting. • Identify outliers using the 1.5×*IQR* rule. • Make and interpret boxplots of quantitative data.	79, 81, 83, 87, 89, 91, 93
10	1.3 Measuring Spread: Standard Deviation, Choosing Measures of Center and Spread, Organizing a Statistics Problem	• Calculate and interpret measures of spread (standard deviation). • Choose the most appropriate measure of center and spread in a given setting. • Use appropriate graphs and numerical summaries to compare distributions of quantitative variables.	95, 97, 99, 103, 105, 107–110
11	Chapter 1 Review/FRAPPY!		Chapter 1 Review Exercises
12	Chapter 1 Test		

Chapter 1 Project: Students work individually to construct and assemble 9 different (separate) graphs (univariate histogram or bar graph, side-by-side bar graph, segmented bar graph, dotplot, pie chart/graph, stem-and-leaf plot, back-to-back stem and leaf plot, one variable box-and-whiskers plot, and two or more variable comparative box-and-whiskers plot) and 3 tables (frequency, relative frequency and two-way) to organize and display data that was collected, aggregated and tabulated from our "beginning of the year" survey in 2 AP® Stats sections and 8 different Guided Study sections. Each graph and table should be well-labeled and scaled. In addition to, and adjacent to each graph should be one sentence that explains under what conditions the given graph is most appropriately used, and one sentence that explains what he or she thinks the graph tells us (What's its story?). *See rubric on page 17.*

Chapter 2

Days	**Topics**	**Learning Objectives** Students will be able to…	**Suggested assignment**
1 – 2	2.1 Measuring Position: Percentiles; Cumulative Relative Frequency Graphs; Measuring Position: *z*-scores	• Find and interpret the percentile of an individual value within a distribution of data. • Estimate percentiles and individual values using a cumulative relative frequency graph. • Find and interpret the standardized score (*z*-score) of an individual value within a distribution of data.	1, 3, 5, 9, 11, 13, 15
3 – 4	2.1 Transforming Data	• Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data.	17, 19, 21, 23, 25–30
5	2.2 Density Curves, The 68–95–99.7 Rule; The Standard Normal Distribution	• Estimate the relative locations of the median and mean on a density curve. • Use the 68–95–99.7 rule to estimate areas (proportions of values) in a Normal distribution. • Use Table A or technology to find (i) the proportion of *z*-values in a specified interval, or (ii) a *z*-score from a percentile in the standard Normal distribution.	33, 35, 39, 41, 43, 45, 47, 49, 51
6 – 7	2.2 Normal Distribution Calculations	• Use Table A or technology to find (i) the proportion of values in a specified interval, or (ii) the value that corresponds to a given percentile in any Normal distribution.	53, 55, 57, 59
8	2.2 Assessing Normality	• Determine if a distribution of data is approximately Normal from graphical and numerical evidence.	54, 63, 65, 66, 67, 69–74
9	Chapter 2 Review/FRAPPY!		Chapter 2 Review Exercises
10	Chapter 2 Test		

Chapter 3

Days	Topics	**Learning Objectives** Students will be able to …	Suggested assignment
1	Chapter 3 Introduction 3.1 Explanatory and response variables, displaying relationships: scatterplots, describing scatterplots	• Identify explanatory and response variables in situations where one variable helps to explain or influences the other. • Make a scatterplot to display the relationship between two quantitative variables. • Describe the direction, form, and strength of a relationship displayed in a scatterplot and recognize outliers in a scatterplot.	1, 5, 7, 11, 13
2	3.1 Measuring linear association: correlation, facts about correlation	• Interpret the correlation. • Understand the basic properties of correlation, including how the correlation is influenced by outliers. • Use technology to calculate correlation. • Explain why association does not imply causation.	14–18, 21
3 – 4	3.2 Least-squares regression, interpreting a regression line, prediction, residuals	• Interpret the slope and *y* intercept of a least-squares regression line. • Use the least-squares regression line to predict *y* for a given *x*. Explain the dangers of extrapolation. • Calculate and interpret residuals.	27–32, 35, 37, 39, 41, 45
5 – 6	3.2 Calculating the equation of the least-squares regression line, determining whether a linear model is appropriate: residual plots	• Explain the concept of least squares. • Determine the equation of a least-squares regression line using technology. • Construct and interpret residual plots to assess if a linear model is appropriate.	43, 47, 49, 51
7	3.2 How well the line fits the data: the role of *s* and r^2 in regression	• Interpret the standard deviation of the residuals and r^2 and use these values to assess how well the least-squares regression line models the relationship between two variables.	48, 50, 55, 58
8 – 9	3.2 Interpreting computer regression output, regression to the mean, correlation and regression wisdom	• Determine the equation of a least-squares regression line using computer output. • Describe how the slope, *y* intercept, standard deviation of the residuals, and r^2 are influenced by outliers. • Find the slope and *y* intercept of the least-squares regression line from the means and standard deviations of *x* and *y* and their correlation.	59, 61, 63, 65, 69, 71–78
10	Chapter 3 Review/FRAPPY!		Chapter Review Exercises
11	Chapter 3 Test		

Chapter 3 Project: Students work individually to investigate which of two explanatory variables is a better predictor of a response variable by doing a thorough analysis and comparison of the relationships between each pair of variables. They will write a report complete with introduction and hypotheses, discuss method of collection, display results on well-labeled scatterplots and include residual plots, use appropriate numerical summaries (equations, s_x and r), and verbal analysis. *See rubric on page 18.*

Chapter 5

Days	Topics	**Learning Objectives** Students will be able to…	Suggested assignment
1	5.1 The Idea of Probability, Myths about Randomness	• Interpret probability as a long-run relative frequency.	1, 3, 7, 9, 11
2	5.1 Simulation	• Use simulation to model chance behavior.	15, 17, 19, 23, 25
3 – 4	5.2 Probability Models, Basic Rules of Probability	• Determine a probability model for a chance process. • Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.	27, 31, 32, 39, 41, 43, 45, 47
5 – 6	5.2 Two-Way Tables, Probability, and the General Addition Rule, Venn Diagrams and Probability	• Use a two-way table or Venn diagram to model a chance process and calculate probabilities involving two events. • Use the general addition rule to calculate probabilities.	29, 33–36, 49, 51, 53, 55
7 – 8	5.3 What Is Conditional Probability?, The General Multiplication Rule and Tree Diagrams,	• Calculate and interpret conditional probabilities. • Use the general multiplication rule to calculate probabilities. • Use tree diagrams to model a chance process and calculate probabilities involving two or more events.	57–60, 63, 65, 67, 71, 73, 77, 79
9	5.3 Conditional Probability and Independence: A Special Multiplication Rule	• Determine whether two events are independent. • When appropriate, use the multiplication rule for independent events to compute probabilities.	81, 83, 85, 89, 91, 93, 95, 97–99
10	Chapter 5 Review/FRAPPY!		Chapter 5 Review Exercises
11	Chapter 5 Test		

Chapter 6

Days	Topics	**Learning Objectives** Students will be able to…	Suggested assignment
1	Chapter 6 Introduction, 6.1 Discrete Random Variables, Mean (Expected Value) of a Discrete Random Variable	• Compute probabilities using the probability distribution of a discrete random variable. • Calculate and interpret the mean (expected value) of a discrete random variable.	1, 3, 5, 7, 9, 11, 13
2	6.1 Standard Deviation (and Variance) of a Discrete Random Variable, Continuous Random Variables	• Calculate and interpret the standard deviation of a discrete random variable. • Compute probabilities using the probability distribution of a continuous random variable.	14, 15, 17, 18, 21, 23, 25
3 – 4	6.2 Linear Transformations	• Describe the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant.	27–30, 35, 37, 39–41, 43, 45
5	6.2 Combining Random Variables, Combining Normal Random Variables	• Find the mean and standard deviation of the sum or difference of independent random variables. • Find probabilities involving the sum or difference of independent Normal random variables.	47, 49, 51, 53, 55, 57–59, 61
6 – 7	6.3 Binomial Settings and Binomial Random Variables, Binomial Probabilities	• Determine whether the conditions for using a binomial random variable are met. • Compute and interpret probabilities involving binomial distributions.	63, 65, 66, 69, 71, 73, 75, 77
8 – 9	6.3 Mean and Standard Deviation of a Binomial Distribution, Binomial Distributions in Statistical Sampling	• Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context.	79, 81, 83, 85, 87, 89
10	6.3 Geometric Random Variables	• Find probabilities involving geometric random variables.	93, 95, 97, 99, 101–104
11	Chapter 6 Review/FRAPPY!		Chapter 6 Review Exercises
12	Chapter 6 Test		

EXAM REVIEW: 3 DAYS

SEMESTER 1 EXAM: Simulated AP format with Multiple Choice, Free Response

Chapter 7

Days	Topics	**Learning Objectives** Students will be able to…	Suggested assignment
1	Introduction: German Tank Problem, 7.1 Parameters and Statistics	• Distinguish between a parameter and a statistic.	1, 3, 5
2	7.1 Sampling Variability, Describing Sampling Distributions	• Distinguish among the distribution of a population, the distribution of a sample, and the sampling distribution of a statistic. • Use the sampling distribution of a statistic to evaluate a claim about a parameter. • Determine whether or not a statistic is an unbiased estimator of a population parameter. • Describe the relationship between sample size and the variability of a statistic.	7, 9, 11, 13, 15, 17, 19
3 - 4	7.2 The Sampling Distribution of $\hat{p}$, Using the Normal Approximation for $\hat{p}$.	• Find the mean and standard deviation of the sampling distribution of a sample proportion $\hat{p}$. Check the 10% condition before calculating $\sigma_{\hat{p}}$. • Determine if the sampling distribution of $\hat{p}$ is approximately Normal. • If appropriate, use a Normal distribution to calculate probabilities involving $\hat{p}$.	21–24, 27, 29, 33, 35, 37, 39
5 - 6	7.3 The Sampling Distribution of $\bar{x}$: Mean and Standard Deviation, Sampling from a Normal Population	• Find the mean and standard deviation of the sampling distribution of a sample mean $\bar{x}$. Check the 10% condition before calculating $\sigma_{\bar{x}}$. • If appropriate, use a Normal distribution to calculate probabilities involving $\bar{x}$.	43–46, 49, 51, 53, 55
7 - 8	7.3 The Central Limit Theorem	• Explain how the shape of the sampling distribution of $\bar{x}$ is affected by the shape of the population distribution and the sample size. • If appropriate, use a Normal distribution to calculate probabilities involving $\bar{x}$.	57, 59, 61, 63, 65–68
9	Chapter 7 Review/FRAPPY!		Chapter 7 Review Exercises
10	Chapter 7 Test		Cumulative AP® Practice Exam 2

Chapter 8

Days	Topics	**Learning objectives** Students will be able to…	Suggested assignment
1	Chapter 8 Introduction; 8.1 The Idea of a Confidence Interval, Interpreting Confidence Intervals and Confidence Levels	• Interpret a confidence interval in context. • Interpret a confidence level in context.	1, 3, 5, 7, 9
2 - 3	8.1 Constructing a Confidence Interval; Using Confidence Intervals Wisely	• Determine the point estimate and margin of error from a confidence interval. • Describe how the sample size and confidence level affect the length of a confidence interval. • Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.	10, 11, 13, 15, 17, 19
4 - 5	8.2 Conditions for Estimating *p*, Constructing a Confidence Interval for *p*, Putting It All Together: The Four-Step Process	• State and check the Random, 10%, and Large Counts conditions for constructing a confidence interval for a population proportion. • Determine critical values for calculating a *C%* confidence interval for a population proportion using a table or technology. • Construct and interpret a confidence interval for a population proportion.	20–24, 31, 33, 35, 37
6	8.2 Choosing the Sample Size	• Determine the sample size required to obtain a *C%* confidence interval for a population proportion with a specified margin of error.	39, 41, 43, 45, 47
7 - 8	8.3 The Problem of unknown σ, When σ Is Unknown: The *t* Distributions, Conditions for Estimating μ	• 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. • Determine critical values for calculating a *C%* confidence interval for a population mean using a table or technology. • State and check the Random, 10%, and Normal/Large Sample conditions for constructing a confidence interval for a population mean.	49–52, 55, 57, 59
9 -10	8.3 Constructing a Confidence Interval for μ, Choosing a Sample Size	• Construct and interpret a confidence interval for a population mean. • Determine the sample size required to obtain a *C%* confidence interval for a population mean with a specified margin of error.	61, 65, 69, 71, 73, 75–78
11	Chapter 8 Review/FRAPPY!		Chapter 8 Review Exercises
12	Chapter 8 Test		

Chapter 8 Project: Students work individually to investigate the average word length used in 4 different novels (3 from their English class, and their personal favorite). They will take a SRS of 100 words from each book and write a report complete with introduction and hypotheses, discuss method of collection, display results on 4 different dotplots or bar graphs, use appropriate numerical summaries using two different methods: sampling distribution of $\bar{x}$ and sample proportion of words 7 or more letters long (confidence intervals, sample means $\bar{x}$, sample standard deviation s_x, sample proportions $\hat{p}$), and verbal analysis. *See rubric on page 19.*

Chapter 9

Days	Topics	**Learning Objectives** Students will be able to…	**Suggested assignment**
1 - 2	9.1 Stating Hypotheses, The Reasoning of Significance Tests, Interpreting *P*-values, Statistical Significance	• State the null and alternative hypotheses for a significance test about a population parameter. • Interpret a *P*-value in context. • Determine if the results of a study are statistically significant and draw an appropriate conclusion using a significance level.	1, 3, 5, 7, 9, 11, 15
3	9.1 Type I and Type II Errors	• Interpret a Type I and a Type II error in context, and give a consequence of each.	13, 17, 19, 21, 23
4 - 5	9.2 Carrying Out a Significance Test, The One-Sample *z* Test for a Proportion	• State and check the Random, 10%, and Large Counts conditions for performing a significance test about a population proportion. • Perform a significance test about a population proportion.	25–28, 31, 35, 39, 41
6 - 7	9.2 Two-Sided Tests, Why Confidence Intervals Give More Information, Type II Error and the Power of a Test	• Use a confidence interval to draw a conclusion for a two-sided test about a population parameter. • Interpret the power of a test and describe what factors affect the power of a test. • Describe the relationship among the probability of a Type I error (significance level), the probability of a Type II error, and the power of a test.	43, 45, 47, 51, 53, 55, 57
8 - 9	9.3 Carrying Out a Significance Test for μ, The One Sample *t* Test, Two-Sided Tests and Confidence Intervals	• State and check the Random, 10%, and Normal/Large Sample conditions for performing a significance test about a population mean. • Perform a significance test about a population mean. • Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.	59–62, 65, 69, 73, 77, 79
10-11	9.3 Inference for Means: Paired Data, Using Tests Wisely	• Perform a significance test about a mean difference using paired data.	83, 85, 87, 89–91, 93, 95–102
12	Chapter 9 Review/FRAPPY!		Chapter 9 Review Exercises
13	Chapter 9 Test		

Chapter 10

Days	Topics	**Learning Objectives** Students will be able to…	Suggested assignment
1 - 2	"Is Yawning Contagious?" Activity, 10.1 The Sampling Distribution of a Difference between Two Proportions	• Describe the shape, center, and spread of the sampling distribution of $\hat{p}_1 - \hat{p}_2$.	1, 3
3 - 4	10.1 Confidence Intervals for $p_1 - p_2$	• Determine whether the conditions are met for doing inference about $p_1 - p_2$. • Construct and interpret a confidence interval to compare two proportions.	5, 7, 9, 11
5 – 6	10.1 Significance Tests for $p_1 - p_2$, Inference for Experiments	• Perform a significance test to compare two proportions.	13, 15, 17, 21, 23
7 - 8	10.2 "Does Polyester Decay?" Activity, The Sampling Distribution of a Difference between Two Means	• Describe the shape, center, and spread of the sampling distribution of $\overline{x}_1 - \overline{x}_2$. • Determine whether the conditions are met for doing inference about $\mu_1 - \mu_2$.	31, 33, 35, 51
9	10.2 The Two-Sample *t* Statistic, Confidence Intervals for $\mu_1 - \mu_2$	• Construct and interpret a confidence interval to compare two means.	25–28, 37, 39
10-11	10.2 Significance Tests for $\mu_1 - \mu_2$, Using Two-Sample *t* Procedures Wisely	• Perform a significance test to compare two means. • Determine when it is appropriate to use two-sample *t* procedures versus paired *t* procedures.	41, 43, 45, 47, 53, 57–60
12	Chapter 10 Review/ FRAPPY!		Chapter 10 Review Exercises
13	Chapter 10 Test		Cumulative AP® Practice Exam 3

Chapter 11

Days	Topics	**Learning objectives** Students will be able to…	Suggested assignment
1	Activity: The Candy Man Can; 11.1 Comparing Observed and Expected Counts: The Chi-Square Statistic; The Chi-Square Distributions and *P*-values	• State appropriate hypotheses and compute expected counts for a chi-square test for goodness of fit. • Calculate the chi-square statistic, degrees of freedom, and *P*-value for a chi-square test for goodness of fit.	1, 3, 5
2	11.1 Carrying Out a Test; Follow-Up Analysis	• Perform a chi-square test for goodness of fit. • Conduct a follow-up analysis when the results of a chi-square test are statistically significant.	7, 9, 11, 15, 17
3 – 4	11.2 Comparing Distributions of a Categorical Variable; Expected Counts and the Chi-Square Statistic; The Chi-Square Test for Homogeneity	• Compare conditional distributions for data in a two-way table. • State appropriate hypotheses and compute expected counts for a chi-square test based on data in a two-way table. • Calculate the chi-square statistic, degrees of freedom, and *P*-value for a chi-square test based on data in a two-way table. • Perform a chi-square test for homogeneity.	19–22, 27, 29, 31, 33, 35, 37, 39
5 - 6	11.2 Relationships between Two Categorical Variables; the Chi-Square Test for Independence; Using Chi-Square Tests Wisely	• Perform a chi-square test for independence. • Choose the appropriate chi-square test.	41, 43, 45, 47, 49, 51–55
7	Chapter 11 Review/ FRAPPY!		Chapter 11 Review Exercises
8	Chapter 11 Test		

Chapter 12

Days	Topics	**Learning Objectives** Students will be able to …	Suggested assignment
1	Activity: The Helicopter Experiment; 12.1 Sampling Distribution of *b*; Conditions for Regression Inference	• Check the conditions for performing inference about the slope β of the population (true) regression line.	1, 3
2	12.1 Estimating the Parameters; Constructing a Confidence Interval for the Slope	• Interpret the values of *a, b, s,* SE_b, and r^2 in context, and determine these values from computer output. • Construct and interpret a confidence interval for the slope β of the population (true) regression line.	5, 7, 9, 11
3 – 4	12.1 Performing a Significance Test for the Slope	• Perform a significance test about the slope β of the population (true) regression line.	13, 15, 17
5	12.2 Transforming with Powers and Roots	• Use transformations involving powers and roots to find a power model that describes the relationship between two variables, and use the model to make predictions.	19–24, 31, 33
6	12.2 Transforming with Logarithms; Putting it all Together: Which Transformation Should We Choose?	• Use transformations involving logarithms to find a power model or an exponential model that describes the relationship between two variables, and use the model to make predictions. • Determine which of several transformations does a better job of producing a linear relationship.	35, 37, 39, 41, 43, 45, 47–50
7	Chapter 12 Review/ FRAPPY!		Chapter 12 Review Exercises
8	Chapter 12 Test		Cumulative AP® Practice Test 4

AP EXAM REVIEW (10 days)

- Practice AP Free Response Questions
- Choosing the Correct Inference Procedure
- Flash cards
- Mock Grading Sessions
- Rubric development by student teams
- Practice Multiple Choice Questions

After the AP® Exam: Final Project *(See rubric on page 20)*

Purpose: The purpose of this project is for you to actually do statistics. You are to formulate a statistical question, design a study to answer the question, conduct the study, collect the data, analyze the data, and use statistical inference to answer the question. You are going to do it all!!

Topics: You may do your study on any topic, but you must be able to include all 6 steps listed above. Make it interesting and note that degree of difficulty is part of the grade.

Group Size: You may work alone or with a partner for this project.

Proposal (25 points): To get your project approved, you must be able to demonstrate how your study will meet the requirements of the project. In other words, you need to clearly and completely communicate your statistical question, your explanatory and response variables, the test/interval you will use to analyze the results, and how you will collect the data so the conditions for inference will be satisfied. You must also make sure that your study will be safe and ethical if you are using human subjects. The proposal should be typed. If your proposal isn't approved, you must resubmit the proposal for partial credit until it is approved.

Poster (75 points):
The key to a good statistical poster is communication and organization. Make sure all components of the poster are focused on answering the question of interest and that statistical vocabulary is used correctly. The poster should include:

- Title (in the form of a question).
- Introduction. In the introduction you should discuss what question you are trying to answer, why you chose this topic, what your hypotheses are, and how you will analyze your data.
- Data Collection. In this section you will describe how you obtained your data. Be specific.
- Graphs, Summary Statistics and the Raw Data (if numerical). Make sure the graphs are well labeled, easy to compare, and *help answer the question of interest.* You should include a brief discussion of the graphs and interpretations of the summary statistics.
- Analysis. In this section, identify the inference procedure you used along with the test statistic and *P*-value and/or confidence interval. Also, discuss how you know that your inference procedure is valid.
- Conclusion. In this section, you will state your conclusion. You should also discuss any possible errors or limitations to your conclusion, what you could do to improve the study next time, and any other critical reflections.
- Live action pictures of your data collection in progress.

Presentation: You will be required to give a 5 minute oral presentation to the class.

Rubric for Chapter 4 Project

Response Bias Project	4 = Complete	3 = Substantial	2 = Developing	1 = Minimal
Introduction	• Describes the context of the research • Has a clearly stated question of interest • Provides a hypothesis about the question of interest • Question of interest is of appropriate difficulty	• Introduces the context of the research and has a specific question of interest • Suggests hypothesis OR has appropriate difficulty	• Introduces the context of the research and question of interest OR has question of interest and a hypothesis	• Briefly describes the context of the research
Data Collection	• Method of data collection is clearly described • Includes appropriate randomization • Describes efforts to reduce bias, variability, confounding • Quantity of data collected is appropriate	• Method of data collection is clearly described • Some effort is made to incorporate principles of good data collection • Quantity of data collected is appropriate	• Method of data collection is described • Some effort is made to incorporate principles of good data collection	• Some evidence of data collection
Graphs and Summary Statistics	• Raw data is included in a two-way table (categorical) or in lists (quantitative) • Appropriate graphs are included • Graphs are neat, easy to compare, and clearly labeled, including clear identification of treatments • Appropriate summary statistics are included in discussion (e.g., percentages for categorical data, means for quantitative data)	• Appropriate graphs are included • Graphs are neat, clearly labeled, and easy to compare • Appropriate summary statistics or raw data are included	• Graphs and summary statistics are included	• Graphs or summary statistics are included
Conclusions	• Uses the results of the study to correctly answer question of interest • Discusses what inferences are appropriate based on study design • Shows good evidence of critical reflection (discusses possible errors, limitations.)	• Makes a correct conclusion • Discusses what inferences are appropriate or shows good evidence of critical reflection	• Makes a partially correct conclusion • Shows some evidence of critical reflection	• Makes a conclusion
Poster, Presentation, & Communication	• Has a clear, holistic understanding of the project • Poster is well organized, neat, and easy to read • Poster included pictures of data collection in progress and is visually appealing • Oral is well organized	• Has a clear, holistic understanding of the project, but poster is unorganized, lacks visual appeal, or oral presentation is not organized	• The poster and oral presentation have several problems	• Commun-ication and organizatio n are poor

Rubric for Chapter 1 Project

Graphing Categorical Data Project	4 = Complete	3 = Substantial	2 = Developing	1 = Minimal
Accuracy of Graphs and Summary Statistics	• The student has used all required graphs and tables, and applied appropriate statistical techniques to them • All graphs and tables are scaled and labeled appropriately • The student has written a well-constructed, thorough explanation about appropriate uses of each given table or graph • The student has written a well-constructed, thorough description of what the student believes the graph tells us.	• The student generally used all required graphs and tables, and made minor omissions or errors on a small number of graphs • Student's labeling and scaling are mostly appropriate • Each graph has explanations about appropriate uses of each given table or graph. There may be a minor error or omission in these explanations. • Each graph has a description of what the student believes the graph tells us. There may be a minor error or omission in these descriptions.	• The student has used most but not all of the required graphs and tables, and applied some statistical techniques to them. • There are some explanations and descriptions about appropriate uses and meanings of each table, but there are errors in these.	• The student made some attempt to graph the correct data and tried to use statistical techniques. • The student attempted to write about each graph • Scaling and labeling is vague
Organization, Transition and Appearance	• The project shows evidence of careful organization, flows naturally from graph to analysis and to the next graph, and it is neat in appearance.	• There are minor flaws in one of the areas: Organization, Transition or Appearance.	• There are major flaws in one of areas of Organization, Transition or Appearance, OR minor flaws in two areas	• Completely inadequate in two of the areas of Organization, Transition or Appearance.
English Mechanics	• The student's writing is grammatically correct, is punctuated properly, and flows logically. It is well put together, being well structured, thorough and meaningful.	• The student's writing has a minor flaw in one of the areas: grammatically correct, punctuated properly, logical flow, spelling.	• The student has made significant errors in one of the areas: grammatically correct, punctuated properly, logical flow, spelling.	• The student's writing has major flaws in two or more of the areas: grammatically correct, punctuated properly, logical flow, spelling.

Rubric for Chapter 3 Project

Response Bias Project	4 = Complete	3 = Substantial	2 = Developing	1 = Minimal
Introduction and Data Collection	• Describes the context of the research • Clearly defines the variables and any preliminary hypotheses • Specifically describes how the data were collected, including source • Includes appropriate amount of data and displays data in a table	• Clearly introduces the context of the research and the variables being used • Describes how the data were collected or includes the data in a table	• Introduces the context of the research, but doesn't specifically define variables • Describes how the data were collected, but doesn't include the data in a table (or vice-versa)	• Briefly describes the context of the research or the method of data collection
Graphs	• Scatterplots are correctly drawn, clearly labeled and easy to compare (ex.: same vertical scale) • Important characteristics of the graph are described and compared • Residual Plots are correctly displayed and interpreted	• Includes three characteristics in "Complete" bullet one, but makes one of the following errors: -correctly drawn, labels missing -a segment of the comparisons and descriptions are weak or missing -residual plot included, but not interpreted correctly	• Includes scatterplots with appropriate descriptions and comparisons, but no residual plots, OR includes both scatterplots and residual plots with weak descriptions or no descriptions	• Only scatterplots are included with little or no descriptions or interpretations
Numerical Summaries	• Includes all of the numerical summaries (r, slope, y intercept, s, r^2) • All numerical summaries are interpreted correctly in context	• Includes all of the numerical summaries, but the interpretations are weak and/or lack context	• Includes most or all of the numerical summaries but several interpretations are missing or incorrect and not written in context	• Some numerical summaries are included
Conclusions	• Makes a reasonable conclusion about which explanatory variable is a better predictor • Decision is based on specific evidence from the graphs and numerical summaries • Discusses when making predictions is appropriate (i.e. discusses extrapolation) • Shows evidence of critical reflection (discusses possible errors, limitations, etc.)	• Makes a reasonable conclusion citing evidence from graphs and numerical summaries • Discusses when to make predictions or shows some other evidence of critical reflection	• Makes a reasonable conclusion based on evidence from graphs and numerical summaries	• Makes a reasonable conclusion with little or no reference to specific evidence
Overall Presentation, & Communication	• Has a clear, holistic understanding of the project • Project is well organized, neat, and easy to read • Ideas are well communicated, including appropriate transitions between sections	• Project is organized and easy to read, but lacks clear communication or a holistic picture of the project	• Project is not well organized, or communication is poor	• Commun-ication and organization are very poor

Rubric for Chapter 8 Project

Response Bias Project	4 = Complete	3 = Substantial	2 = Developing	1 = Minimal
Introduction and Data Collection	• Describes the context of the research • Clearly defines the variables and any preliminary hypotheses • Specifically describes how the data were collected, including specific sources (include page numbers!) • Includes appropriate amount of data and displays data in a table	• Clearly introduces the context of the research and the variables being used • Describes how the data were collected or includes the data in a table	• Introduces the context of the research, but doesn't specifically define variables • Describes how the data were collected, but doesn't include the data in a table (or vice-versa)	• Briefly describes the context of the research or the method of data collection
Graphs	• Dotplots / Bar Graphs are correctly drawn, clearly labeled and easy to compare (ex.: same vertical scale) • Important characteristics of the graphs are described and compared	• Dotplots / Bar Graphs are correctly drawn, but not clearly labeled OR not easy to compare • Important characteristics of the graphs are sometimes described or sometimes compared	• Includes all Dotplots / Bar graphs , but very little detail	• Includes all Dotplots / Bar graphs , with no detail or incorrect calculations or methods
Numerical Summaries	• Includes all of the numerical summaries for two different types of tests • All numerical summaries are interpreted correctly in context • Confidence intervals are clearly stated and interpreted correctly	• Includes all of the numerical summaries for both tests, but the interpretations are weak and/or lack context • Confidence intervals may have a small error	• Includes most or all of the numerical summaries and confidence intervals, but several interpretations are missing or incorrect and not written in context	• Some numerical summaries and confidence intervals are included
Conclusions	• Makes a reasonable conclusion about confidence intervals and logically compares and contrasts the two different tests • An argument about "easiest to read" is based on specific evidence from the graphs and numerical summaries • Shows evidence of critical reflection (discusses possible errors, limitations, etc.)	• Makes a reasonable conclusion citing evidence from graphs and numerical summaries • Discusses some other evidence of critical reflection referencing which books are "easiest to read."	• Makes a reasonable conclusion based on evidence from graphs and numerical summaries	• Makes a reasonable conclusion with little or no reference to specific evidence
Overall Presentation, & Communication	• Has a clear, holistic understanding of the project • Project is well organized, neat, and easy to read • Ideas are well communicated, including appropriate transitions between sections	• Project is organized and easy to read, but lacks clear communication or a holistic picture of the project	• Project is not well organized, or communication is poor	• Commun-ication and organization are very poor

Rubric for Final Project

Final Project	4 = Complete	3 = Substantial	2 = Developing	1 = Minimal
Introduction	• Describes the context of the research • Has a clearly stated question of interest • Clearly defines the parameter of interest and states correct hypotheses (for tests) • Question of interest is of appropriate difficulty	• Introduces the context of the research and has a specific question of interest • Has correct parameter/ hypotheses OR has appropriate difficulty	• Introduces the context of the research and has a specific question of interest OR has question of interest and parameter/ hypotheses	• Briefly describes the context of the research
Data Collection	• Method of data collection is clearly described • Includes appropriate randomization • Describes efforts to reduce bias, variability, confounding • Quantity of data collected is appropriate	• Method of data collection is clearly described • Some effort is made to incorporate principles of good data collection • Quantity of data is appropriate	• Method of data collection is described • Some effort is made to incorporate principles of good data collection	• Some evidence of data collection
Graphs and Summary Statistics	• Appropriate graphs are included • Graphs are neat, clearly labeled, and easy to compare • Appropriate summary statistics are included • Summary statistics are discussed and correctly interpreted	• Appropriate graphs are included • Graphs are neat, clearly labeled, and easy to compare • Appropriate summary statistics are included	• Graphs and summary statistics are included	• Graphs or summary statistics are included
Analysis	• Correct inference procedure is chosen • Use of inference procedure is justified • Test statistic/*P*-value or confidence interval is calculated correctly • *P*-value or confidence interval is interpreted correctly	• Correct inference procedure is chosen • Lacks justification, lacks interpretation, or makes a calculation error	• Correct inference procedure is chosen • Test statistic/*P*-value or confidence interval is calculated correctly	• Inference procedure is attempted
Conclusions	• Uses *P*-value/confidence interval to correctly answer question of interest • Discusses what inferences are appropriate based on study design • Shows good evidence of critical reflection (discusses possible errors, limitations, alternate explanations, etc.)	• Makes a correct conclusion • Discusses what inferences are appropriate • Shows some evidence of critical reflection	• Makes a partially correct conclusion (such as accepting null). • Shows some evidence of critical reflection	• Makes a conclusion
Overall Presentation/ Communication	• Clear, holistic understanding of the project • Poster is well organized, neat and easy to read • Statistical vocabulary is used correctly • Poster is visually appealing	• Clear, holistic understanding of the project • Statistical vocabulary is used correctly • Poster is unorganized or isn't visually appealing,	• Poster is not well done or communication is poor	• Communication and organization are very poor