AP Statistics

COURSE DESCRIPTION:
AP Statistics is the high school equivalent of a one semester, introductory college statistics course. In this course, students develop strategies for collecting, organizing, analyzing, and drawing conclusions from data. Students design, administer, and tabulate results from surveys and experiments. Probability and simulations aid students in constructing models for chance behavior. Sampling distributions provide the logical structure for confidence intervals and hypothesis tests. Students use a TI-83/84 graphing calculator, output from Fathom and Minitab statistical software, and Web-based java applets to investigate statistical concepts. To develop effective statistical communication skills, students are required to prepare frequent written and oral analyses of real data.

COURSE OUTLINE:
Chapter 1

Day	Topics	Objectives: Students will be able to…
1	Chapter 1 Introduction; Activity: *Hiring discrimination*: This activity models the components of the statistical problem solving process: research question, data analysis, probability model, and inference	• Identify the individuals and variables in a set of data. • Classify variables as categorical or quantitative. Identify units of measurement for a quantitative variable.
2	1.1 Bar Graphs and Pie Charts, Graphs: Good and Bad	• Make a bar graph of the distribution of a categorical variable or, in general, to compare related quantities. • Recognize when a pie chart can and cannot be used. • Identify what makes some graphs deceptive.
3	1.1 Two-Way Tables and Marginal Distributions, Relationships Between Categorical Variables: Conditional Distributions, Organizing a Statistical Problem	• From a two-way table of counts, answer questions involving marginal and conditional distributions. • Describe the relationship between two categorical variables in context by comparing the appropriate conditional distributions. • Construct bar graphs to display the relationship between two categorical variables.
4	1.2 Dotplots, Describing Shape, Comparing Distributions, Stemplots	• Make a dotplot or stemplot to display small sets of data. • Describe the overall pattern (shape, center, spread) of a distribution and identify any major departures from the pattern (like outliers). • Identify the shape of a distribution from a dotplot, stemplot, or histogram as roughly symmetric or skewed. Identify the number of modes.
5	1.2 Histograms, Using Histograms Wisely, *Technology: Making Histograms on the Calculator*	• Make a histogram with a reasonable choice of classes. • Identify the shape of a distribution from a dotplot, stemplot, or histogram as roughly symmetric or skewed. Identify the number of modes. • Interpret histograms.
6	1.3 Measuring Center: Mean and Median, Comparing Mean and Median, Measuring Spread: IQR, Identifying Outliers	• Calculate and interpret measures of center (mean, median) in context • Calculate and interpret measures of spread (*IQR*) in context

		• Identify outliers using the 1.5 × *IQR* rule.
7	1.3 Five Number Summary and Boxplots, Measuring Spread: Standard Deviation, Choosing Measures of Center and Spread, *Technology: Making Boxplots on the Calculator*, *Computing Numerical Summaries with the Calculator*	• Make a boxplot. • Calculate and interpret measures of spread (standard deviation) • Select appropriate measures of center and spread • Use appropriate graphs and numerical summaries to compare distributions of quantitative variables.
8	Chapter 1 Review	
9	Chapter 1 Test	

Chapter 2

Day	Topics	Objectives: Students will be able to…
1	2.1 Introduction, Measuring Position: Percentiles, Cumulative Relative Frequency Graphs, Measuring Position: z-scores	• Use percentiles to locate individual values within distributions of data. • Interpret a cumulative relative frequency graph. • Find the standardized value (*z*-score) of an observation. Interpret *z*-scores in context.
2	2.1 Transforming Data, Density Curves	• Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data. • Approximately locate the median (equal-areas point) and the mean (balance point) on a density curve.
3	2.2 Normal Distributions, The 68-95-99.7 Rule, The Standard Normal Distribution, *Technology: Standard Normal Curve Calculations with the Calculator and with an Applet*	• Use the 68–95–99.7 rule to estimate the percent of observations from a Normal distribution that fall in an interval involving points one, two, or three standard deviations on either side of the mean. • Use the standard Normal distribution to calculate the proportion of values in a specified interval. • Use the standard Normal distribution to determine a *z*-score from a percentile.
4	2.2 Normal Distribution Calculations, *Technology: Normal Curve Calculations with the Calculator and with an Applet*	• Use Table A to find the percentile of a value from any Normal distribution and the value that corresponds to a given percentile.
5	2.2 Assessing Normality, *Normal Probability Plots on the Calculator*	• Make an appropriate graph to determine if a distribution is bell-shaped. • Use the 68-95-99.7 rule to assess Normality of a data set. • Interpret a Normal probability plot
6	Chapter 2 Review	
7	Chapter 2 Test	

Chapter 3

Day	Topics	Objectives: Students will be able to …
1	Chapter 3 Introduction, Activity: CSI Stats, 3.1 Explanatory and response variables, 3.1 Displaying relationships: scatterplots, 3.1 Interpreting scatterplots, *Technology: Scatterplots on the Calculator*	• Describe why it is important to investigate relationships between variables. • 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 the overall pattern of a scatterplot. • Recognize outliers in a scatterplot.
2	3.1 Measuring linear association: correlation, 3.1 Facts about correlation, *Technology: Correlation and Regression Applet*	• Know the basic properties of correlation. • Calculate and interpret correlation in context. • Explain how the correlation r is influenced by extreme observations.
3	3.2 Least-squares regression, 3.2 Interpreting a regression line, 3.2 Prediction, *Technology: Least-Squares Regression Lines on the Calculator*	• Interpret the slope and y intercept of a least-squares regression line in context. • Use the least-squares regression line to predict y for a given x. • Explain the dangers of extrapolation.
4	3.2 Residuals and the least-squares regression line, 3.2 Calculating the equation of the least-squares regression line, *Technology: Residual Plots and s on the Calculator*	• Calculate and interpret residuals in context. • Explain the concept of least squares. • Use technology to find a least-squares regression line. • Find the slope and intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation.
5	3.2 How well the line fits the data: residual plots, 3.2 How well the line fits the data: the role of r^2 in regression	• Construct and interpret residual plots to assess if a linear model is appropriate. • Use the standard deviation of the residuals to assess how well the line fits the data. • Use r^2 to assess how well the line fits the data. • Interpret the standard deviation of the residuals and r^2 in context.
6	3.2 Interpreting computer regression output, 3.2 Correlation and regression wisdom	• Identify the equation of a least-squares regression line from computer output. • Explain why association doesn't imply causation. • Recognize how the slope, y intercept, standard deviation of the residuals, and r^2 are influenced by extreme observations.
7	Chapter 3 Review	
8	Chapter 3 Test	

Chapter 4

Day	Topics	Objectives: Students will be able to…
1	4.1 Introduction, Sampling and Surveys, How to Sample Badly, How to Sample Well: Random Samples, *Technology: Choosing an SRS using an Applet or Calculator*	• Identify the population and sample in a sample survey. • Identify voluntary response samples and convenience samples. Explain how these bad sampling methods can lead to bias. • Describe how to use Table D to select a simple random sample (SRS).
2	4.1 Other Sampling Methods	• Distinguish a simple random sample from a stratified random sample or cluster sample. Give advantages and disadvantages of each sampling method.
3	4.1 Inference for Sampling, Sample Surveys: What Can Go Wrong?	• Explain how undercoverage, nonresponse, and question wording can lead to bias in a sample survey.
4	4.2 Observational Studies vs. Experiments, The Language of Experiments, How to Experiment Badly	• Distinguish between an observational study and an experiment. • Explain how a lurking variable in an observational study can lead to confounding. • Identify the experimental units or subjects, explanatory variables (factors), treatments, and response variables in an experiment.
5	4.2 How to Experiment Well, Three Principles of Experimental Design	• Describe a completely randomized design for an experiment. • Explain why random assignment is an important experimental design principle.
6	4.2 Experiments: What Can Go Wrong? Inference for Experiments	• Describe how to avoid the placebo effect in an experiment. • Explain the meaning and the purpose of blinding in an experiment. • Explain in context what “statistically significant” means.
7	4.2 Blocking, Matched Pairs Design	• Distinguish between a completely randomized design and a randomized block design. • Know when a matched pairs experimental design is appropriate and how to implement such a design.
8	4.3 Scope of Inference, the Challenges of Establishing Causation	• Determine the scope of inference for a statistical study.
9	4.2 Class Experiments or 4.3 Data Ethics* (*optional topic)	• Evaluate whether a statistical study has been carried out in an ethical manner.
10	Chapter 4 Review	
11	Chapter 4 Test	

Chapter 5

Day	Topics	Objectives: Students will be able to…
1	5.1 Introduction, The Idea of Probability, Myths about Randomness	• Interpret probability as a long-run relative frequency in context.
2	5.1 Simulation, *Technology: Random Numbers with Calculators*	• Use simulation to model chance behavior.
3	5.2 Probability Models, Basic Rules of Probability	• Describe a probability model for a chance process. • Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.
4	5.2 Two-Way Tables and Probability, Venn Diagrams and Probability	• Use a Venn diagram to model a chance process involving two events. • Use the general addition rule to calculate P(A ∪ B)
5	5.3 What is Conditional Probability?, Conditional Probability and Independence, Tree Diagrams and the General Multiplication Rule	• When appropriate, use a tree diagram to describe chance behavior. • Use the general multiplication rule to solve probability questions. • Determine whether two events are independent. • Find the probability that an event occurs using a two-way table.
6	5.3 Independence: A Special Multiplication Rule, Calculating Conditional Probabilities	• When appropriate, use the multiplication rule for independent events to compute probabilities. • Compute conditional probabilities.
7	Review	
8	Chapter 5 Test	

Chapter 6

Day	Topics	Objectives: Students will be able to…
1	Chapter 6 Introduction, 6.1 Discrete random Variables, Mean (Expected Value) of a Discrete Random Variable	• Use a probability distribution to answer questions about possible values of a random variable. • Calculate the mean of a discrete random variable. • Interpret the mean of a random variable in context.
2	6.1 Standard Deviation (and Variance) of a Discrete Random Variable, Continuous Random Variables, *Technology: Analyzing Random Variables on the Calculator*	• Calculate the standard deviation of a discrete random variable. • Interpret the standard deviation of a random variable in context.
3	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.
4	6.2 Combining Random Variables, Combining Normal Random Variables	• Find the mean and standard deviation of the sum or difference of independent random variables. • Determine whether two random variables are independent. • Find probabilities involving the sum or difference of independent Normal random variables.
5	6.3 Binomial Settings and Binomial Random Variables, Binomial Probabilities, *Technology: Binomial Probabilities on the Calculator*	• Determine whether the conditions for a binomial random variable are met. • Compute and interpret probabilities involving binomial distributions.
6	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.
7	6.3 Geometric Random Variables, *Technology: Geometric Probabilities on the Calculator*	• Find probabilities involving geometric random variables.
8	Chapter 6 Review	
9	Chapter 6 Test	

EXAM REVIEW: 3 DAYS

MIDTERM EXAM: Simulated AP format with Multiple Choice, Free Response

Chapter 7

Day	Topics	Objectives: Students will be able to…
1	Introduction: German Tank Problem, 7.1 Parameters and Statistics, *Technology: Using Fathom to Simulate Sampling Distributions*	• Distinguish between a parameter and a statistic.
2	7.1 Sampling Variability, Describing Sampling Distributions	• Understand the definition of a sampling distribution. • Distinguish between population distribution, sampling distribution, and the distribution of sample data. • Determine whether a statistic is an unbiased estimator of a population parameter. • Understand the relationship between sample size and the variability of an estimator.
3	7.2 The Sampling Distribution of $\hat{p}$, Using the Normal Approximation for $\hat{p}$, *Technology: Using an Applet to Simulate the distribution of* $\hat{p}$.	• Find the mean and standard deviation of the sampling distribution of a sample proportion $\hat{p}$ for an SRS of size *n* from a population having proportion *p* of successes. • Check whether the 10% and Normal conditions are met in a given setting. • Use Normal approximation to calculate probabilities involving $\hat{p}$. • Use the sampling distribution of $\hat{p}$ to evaluate a claim about a population proportion.
4	7.3 The Sampling Distribution of $\overline{x}$: Mean and Standard Deviation, Sampling from a Normal Population, *Technology: Using an Applet to Simulate the distribution of* $\overline{x}$.	• Find the mean and standard deviation of the sampling distribution of a sample mean $\overline{x}$ from an SRS of size *n*. • Calculate probabilities involving a sample mean $\overline{x}$ when the population distribution is Normal.
5	7.3 The Central Limit Theorem	• Explain how the shape of the sampling distribution of $\overline{x}$ is related to the shape of the population distribution. • Use the central limit theorem to help find probabilities involving a sample mean $\overline{x}$.
6	Chapter 7 Review	
7	Chapter 7 Test	

Chapter 8

Day	Topics	Objectives: Students will be able to:
1	8.1 The Idea of a Confidence Interval, Interpreting Confidence Levels and Confidence Intervals, Constructing a Confidence Interval, *Technology: Simulating Confidence Intervals with the Confidence Interval Applet*	• Interpret a confidence level in context. • Interpret a confidence interval in context. • Understand that a confidence interval gives a range of plausible values for the parameter.
2	8.1 Using Confidence Intervals Wisely, 8.2 Conditions for Estimating *p*, Constructing a Confidence Interval for *p*	• Understand why each of the three inference conditions—Random, Normal, and Independent—is important. • Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval. • Construct and interpret a confidence interval for a population proportion. • Determine critical values for calculating a confidence interval using a table or your calculator.
3	8.2 Putting It All Together: The Four-Step Process, Choosing the Sample Size, *Technology: Confidence Intervals for p on the Calculator*	• Carry out the steps in constructing a confidence interval for a population proportion: define the parameter; check conditions; perform calculations; interpret results in context. • Determine the sample size required to obtain a level *C* confidence interval for a population proportion with a specified margin of error. • Understand how the margin of error of a confidence interval changes with the sample size and the level of confidence *C*. • Understand why each of the three inference conditions—Random, Normal, and Independent—is important.
4	8.3 When σ Is Known: The One-Sample *z* Interval for a Population Mean, When σ Is Unknown: The *t* Distributions, Constructing a Confidence Interval for μ, *Technology: Inverse t on the Calculator*	• Construct and interpret a confidence interval for a population mean. • Determine the sample size required to obtain a level *C* confidence interval for a population mean with a specified margin of error. • Carry out the steps in constructing a confidence interval for a population mean: define the parameter; check conditions; perform calculations; interpret results in context.
5	8.3 Using *t* Procedures Wisely, *Technology: Confidence Intervals for μ on the Calculator*	• Understand why each of the three inference conditions—Random, Normal, and Independent—is important.
6	Chapter 8 Review	• Determine sample statistics from a confidence interval.
7	Chapter 8 Test	

Chapter 9

Day	Topics	Objectives: Students will be able to:
1	9.1 The Reasoning of Significance Tests, Stating Hypotheses, Interpreting *P*-values, Statistical Significance	• State correct hypotheses for a significance test about a population proportion or mean. • Interpret *P*-values in context.
2	9.1 Type I and Type II Errors, Planning Studies: The Power of a Statistical Test, *Technology: Investigating Power with an Applet*	• Interpret a Type I error and a Type II error in context, and give the consequences of each. • Understand the relationship between the significance level of a test, *P*(Type II error), and power.
3	9.2 Carrying Out a Significance Test, The One-Sample *z* Test for a Proportion, *Technology: One-Proportion z Test on the Calculator*	• Check conditions for carrying out a test about a population proportion. • If conditions are met, conduct a significance test about a population proportion.
4	9.2 Two-Sided Tests, Why Confidence Intervals Give More Information, *Technology: Tests and Confidence Intervals using Minitab*	• Use a confidence interval to draw a conclusion for a two-sided test about a population proportion.
5	9.3 Carrying Out a Significance Test for μ, The One Sample *t* Test, Two-Sided Tests and Confidence Intervals, *Technology: Computing P-values from t Distributions on the Calculator, One Sample t Test on the Calculator*	• Check conditions for carrying out a test about a population mean. • If conditions are met, conduct a one-sample *t* test about a population mean μ. • Use a confidence interval to draw a conclusion for a two-sided test about a population mean.
6	9.3 Inference for Means: Paired Data, Using Tests Wisely	• Recognize paired data and use one-sample *t* procedures to perform significance tests for such data.
7	Chapter 9 Review	
8	Chapter 9 Test	

Chapter 10

Day	Topics	Objectives: Students will be able to…
1	Activity: Is Yawning Contagious?, 10.1 The Sampling Distribution of a Difference Between Two Proportions	• Describe the characteristics of the sampling distribution of $\hat{p}_1 - \hat{p}_2$ • Calculate probabilities using the sampling distribution of $\hat{p}_1 - \hat{p}_2$
2	10.1 Confidence Intervals for $p_1 - p_2$, *Technology: Confidence Intervals for a Difference in Proportions on the Calculator*	• Determine whether the conditions for performing inference are met. • Construct and interpret a confidence interval to compare two proportions.
3	10.1 Significance Tests for $p_1 - p_2$, Inference for Experiments, *Technology: Significance Tests for a Difference in Proportions on the Calculator*	• Perform a significance test to compare two proportions. • Interpret the results of inference procedures in a randomized experiment.
4	10.2 Activity: Does Polyester Decay?, The Sampling Distribution of a Difference Between Two Means	• Describe the characteristics of the sampling distribution of $\overline{x}_1 - \overline{x}_2$ • Calculate probabilities using the sampling distribution of $\overline{x}_1 - \overline{x}_2$
5	10.2 The Two-Sample *t*-Statistic, Confidence Intervals for $\mu_1 - \mu_2$, *Technology: Confidence Intervals for a Difference in Means on the Calculator*	• Determine whether the conditions for performing inference are met. • Use two-sample *t* procedures to compare two means based on summary statistics. • Use two-sample *t* procedures to compare two means from raw data. • Interpret standard computer output for two-sample *t* procedures.
6	10.2 Significance Tests for $\mu_1 - \mu_2$, Using Two-Sample *t* Procedures Wisely, *Technology: Two Sample t Tests with Computer Software and Calculators*	• Perform a significance test to compare two means. • Check conditions for using two-sample *t* procedures in a randomized experiment. • Interpret the results of inference procedures in a randomized experiment.
7	Chapter 10 Review	• Determine the proper inference procedure to use in a given setting.
8	Chapter 10 Test	

Chapter 11

Day	Topics	Objectives: Students will be able to…
1	Activity: The Candy Man Can, 11.1 Comparing Observed and Expected Counts: The Chi-Square Statistic, The Chi-Square Distributions and *P*-values, *Technology: Finding P-values for Chi-Square Tests on the Calculator*	• Know how to compute expected counts, conditional distributions, and contributions to the chi-square statistic.
2	11.1 The Chi-Square Goodness-of-Fit Test, Follow-Up Analysis, *Technology: Chi-Square Goodness-of-Fit Tests on the Calculator*	• Check the Random, Large sample size, and Independent conditions before performing a chi-square test. • Use a chi-square goodness-of-fit test to determine whether sample data are consistent with a specified distribution of a categorical variable. • Examine individual components of the chi-square statistic as part of a follow-up analysis.
3	11.2 Comparing Distributions of a Categorical Variable, Expected Counts and the Chi-Square Statistic, The Chi-Square Test for Homogeneity, Follow-Up Analysis, Comparing Several Proportions, *Technology: Chi-Square Tests for Two-Way Tables with Computer Software and Calculators*	• Check the Random, Large sample size, and Independent conditions before performing a chi-square test. • Use a chi-square test for homogeneity to determine whether the distribution of a categorical variable differs for several populations or treatments. • Interpret computer output for a chi-square test based on a two-way table. • Examine individual components of the chi-square statistic as part of a follow-up analysis. • Show that the two-sample *z* test for comparing two proportions and the chi-square test for a 2-by-2 two-way table give equivalent results.
4	11.2 The Chi-Square Test of Association/Independence, Using Chi-Square Tests Wisely	• Check the Random, Large sample size, and Independent conditions before performing a chi-square test. • Use a chi-square test of association/independence to determine whether there is convincing evidence of an association between two categorical variables. • Interpret computer output for a chi-square test based on a two-way table. • Examine individual components of the chi-square statistic as part of a follow-up analysis.
5	Chapter 11 Review	• Distinguish between the three types of chi-square tests.
6	Chapter 11 Test	

Chapter 12

Day	Topics	Objectives: Students will be able to…
1	Activity: The Helicopter Experiment, 12.1 The Sampling Distribution of *b*, Conditions for Regression Inference	• Check conditions for performing inference about the slope β of the population regression line.
2	12.1 Estimating Parameters, Constructing a Confidence Interval for the Slope, *Technology: Regression Inference using Calculators*	• Interpret computer output from a least-squares regression analysis. • Construct and interpret a confidence interval for the slope β of the population regression line.
3	12.1 Performing a Significance Test for the Slope	• Perform a significance test about the slope β of a population regression line.
4	12.2 Transforming with Powers and Roots, *Technology: Transforming to Achieve Linearity on the Calculator*	• Use transformations involving powers and roots to achieve linearity for a relationship between two variables. • Make predictions from a least-squares regression line involving transformed data.
5	12.2 Transforming with Logarithms	• Use transformations involving logarithms to achieve linearity for a relationship between two variables. • Make predictions from a least-squares regression line involving transformed data. • Determine which of several transformations does a better job of producing a linear relationship.
6	Chapter 12 Review	
7	Chapter 12 Test	

AP EXAM REVIEW (10 days)

- Practice AP Free Response Questions
- Choosing the Correct Inference Procedure
- Mock Grading Sessions
- Practice Multiple Choice Questions

AP STATISTICS EXAM (1 DAY)