Course Title: AP Statistics **Board Approval Date:** 02/17/15 **Credit / Hours:** 1 credit **Reviewed Annually**

Course Description:

The purpose of the AP course in statistics is to introduce students to the major concepts and tools for collecting, analyzing and drawing conclusions from data. Students are exposed to four conceptual themes:

- 1) Exploring Data: Describing patterns and departures from patterns.
- 2) Sampling and Experimentation: Planning and conducting a study.
- 3) Anticipating Patterns: Exploring random phenomena using probability and simulation.
- 4) Statistical Inference: Estimating population parameters and testing hypotheses.

Learning Activities / Modes of Assessment:

Large Group Instruction Small Group Work Projects

Instructional Resources:

Starnes, Tabor, Yates, Moore. *The Practice of Statistics* 5th Edition Baron's. *AP Statistics* Amsco's. *AP Statistics* Other relevant study guides as appropriate.

	Length of Instruction
Unit #1 Sampling and Experimentation: Planning and Conducting a Study.	10 days
Unit #2 Exploring Data: Describing Patterns and Departures from Patterns	41 days
Unit #3 Anticipating Patterns: Exploring Random Phenomena using Probability and Simulation.	40 days
Unit #4 Statistical Inference: Estimating Population Parameters and Testing Hypotheses	<u>60 days</u>
l Days	151 days
	rse Unit (Topic) ys/Periods) Unit #1 Sampling and Experimentation: Planning and Conducting a Study. Unit #2 Exploring Data: Describing Patterns and Departures from Patterns Unit #3 Anticipating Patterns: Exploring Random Phenomena using Probability and Simulation. Unit #4 Statistical Inference: Estimating Population

Unit One KUD: Sampling and experimentation: Planning and conducting a Study

Teacher's Name: Kevin Morgan

By the end of this unit, students will be able to ...

Know:

- Overview of methods of data collection.

Census, Sample Survey, Experiment, and Observational Studies.

- Planning and Conducting Studies.

Characteristics of a welldesigned and wellconducted survey.

Populations, samples, and random samples.

Sources of bias in sampling and surveys

Sampling methods including simple random sampling, stratified random sampling, and cluster sampling.

- Planning and Conducting experiments.

Characteristics of welldesigned and wellconducted surveys. Understand:

Creating and implementing a well-designed study or experiment is very difficult, and if not done properly can lead to bias and unreliable data and conclusions. Do:

- Identify characteristics of a well-designed study.

- Understand and create a well-designed study.

- Identify different problems created by sample surveys that are created poorly.

- Identify characteristics of a well-designed experiment.

- Understand and create a well-designed experiment.

Know:

Treatments, control groups, experimental units, random assignments, and replication.

Sources of bias and confounding, including placebo effect and blinding.

Completely randomized design.

Randomized block design, including matched pairs design.

- Generalizability of results and types of conclusion that can be drawn from observational studies, experiments, and surveys. Understand:

Do:

Unit Two KUD: Exploring Data: Describing patterns and departures from patterns.

Teacher's Name: Kevin Morgan

By the end of this unit, students will be able to ...

Know:

- Constructing and interpreting graphical displays of distributions of univariate data.

Center, Spread, Clusters, Gaps, Outliers, and Shape

- Summarizing Distributions of univariate data.

Median, Mean, Range, IQR, Standard Deviation, Quartiles, percentiles, standardized scores.

Using Boxplots.

The effect of changing units on summary measures.

- Comparing distributions of univariate data.

Comparing clusters, gaps, outliers, center, spread, and shape between groups. Understand:

Graphs and Charts can give us much information about how the data is centered, spread out, distributed, and if there are any outliers. Do:

Describe SOCS for any graph that the students are given.

Use a two-way table to identify marginal and conditional probabilities.

Interpret Box-Plots for SOCS and find outliers.

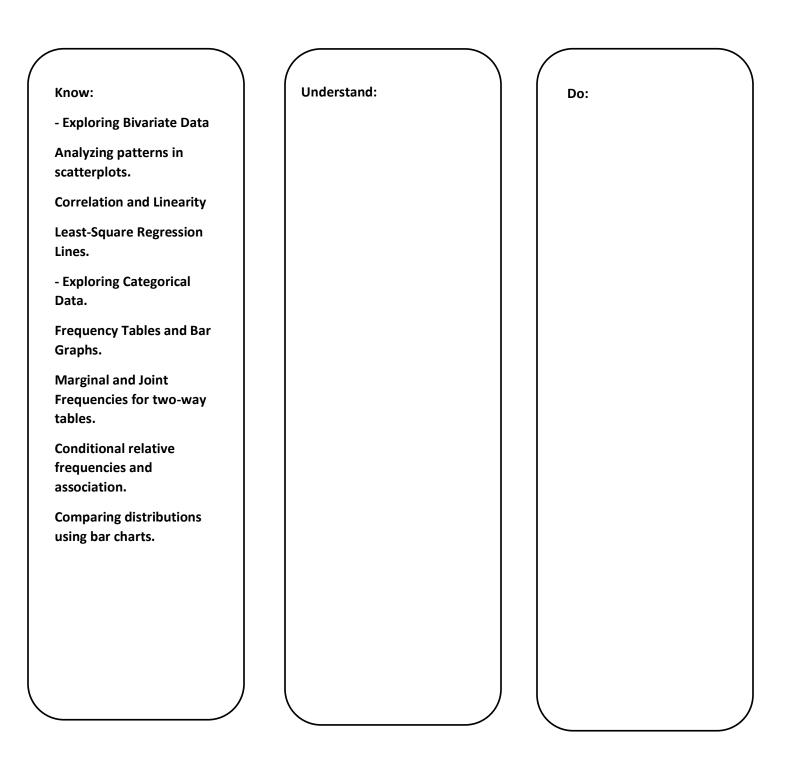
Understand the relationship between percentiles and z-scores.

Use the Empirical Rule to identify standard deviations of data.

Describe DOFS for any scatterplot.

Understand how correlation describes bivariate data.

Calculate and interpret Standard Deviation.



Subject: AP Statistics

Grade: 10,11,12

Unit Three KUD: Anticipating Patterns: Exploring random phenomena using probability and simulation.

Teacher's Name: Kevin Morgan

By the end of this unit, students will be able to ...

Know:

- Probability

Interpreting probability, including long-run relative frequency interpretation.

Law of Large Numbers

Addition and Multiplication Rule, Conditional Probability and independence.

Discrete Random Variables and their probability distributions, and including binomial and geometric.

Simulation of random behavior and probability distributions.

Mean (expected Value) and standard deviation of a random variable, and linear transformation of a random variable.

Understand:

Use Normal Distributions, T-Distributions, and Chi-Square Distributions to interpret Data. Do:

Understand the concept of Law of Large Numbers.

Set-up and Run a Simulation.

Identify if two events are Independent, Dependent, and/or mutually exclusive.

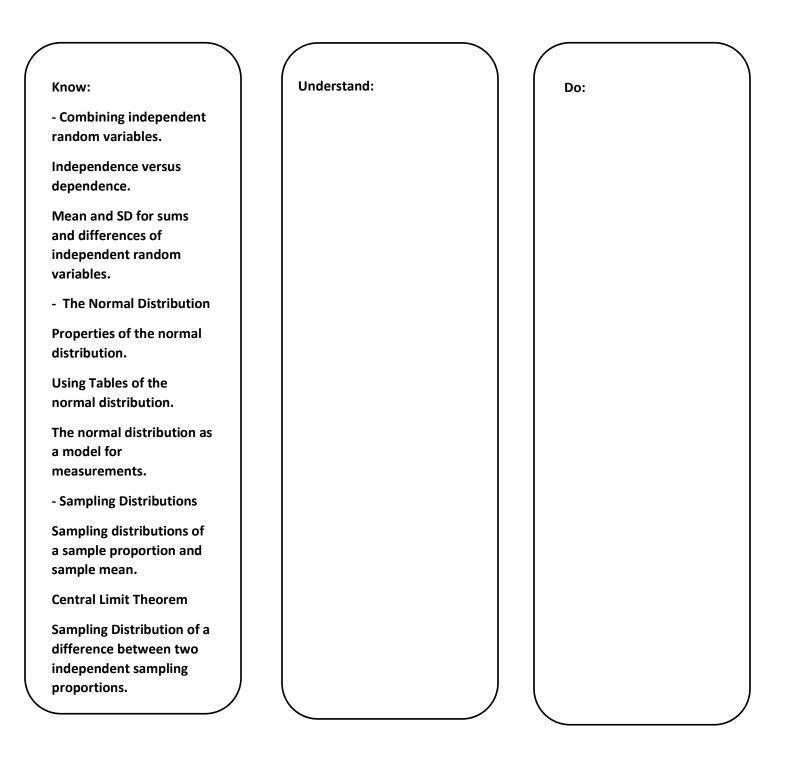
Identify the difference between Discrete and Continuous Random Variables.

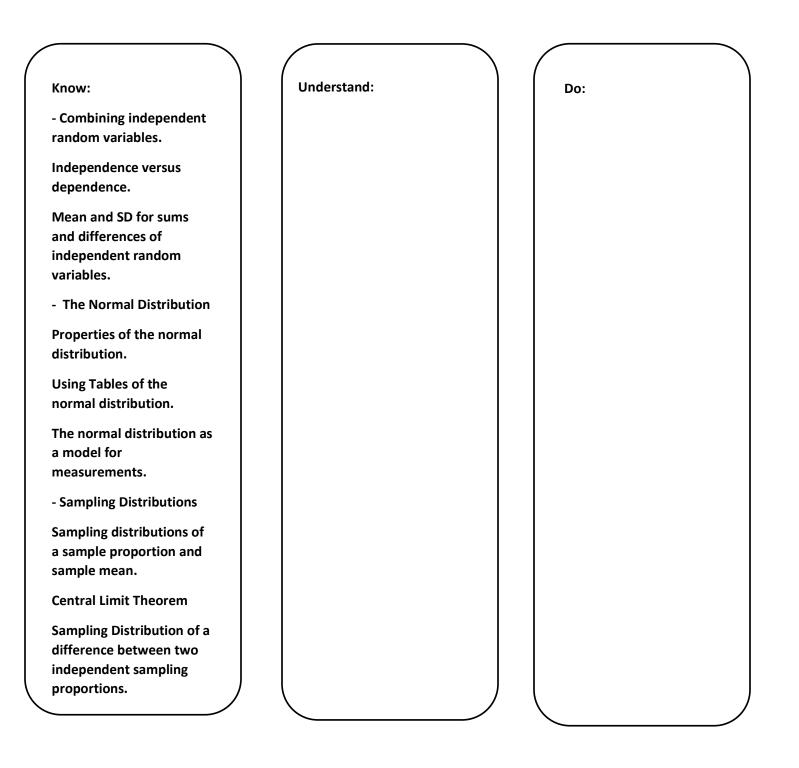
Find the mean and SD of Discrete and Continuous Random Variables.

Understand what changes are made to SOCS when a linear transformation occurs to a Discrete Random Variable.

Interpret Binomial and Geometric Random Variables and their characteristics.

Understand the difference between biased and unbiased estimators.





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Unit Four KUD: Statistical Inference: Estimating population parameters and testing hypotheses.

Teacher's Name: Kevin Morgan

By the end of this unit, students will be able to ...

Know:

- Estimation

Estimating population parameters and margins of error.

Properties of point estimators, including unbiasedness and variability

Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals.

Large sample confidence interval for a proportion.

Large sample confidence interval for aa difference between two proportions.

Confidence interval for a mean and difference between two means.

Confidence interval for the slope of a LSR.

Understand:

To be able to identify and utilize the correct test for a given situation. Do:

Interpret Confidence Levels and Intervals.

Identify the correct test to be used for a given problem.

Write a test claim, run the simulation, and draw correct conclusions from the data about your claim.

Create an inference of categorical data and use the appropriate test.

Know:

- Test of Significance.

Logic of significance testing, null and alternative hypotheses: pvalues, one and two-sided tests, concepts of Type I and Type II errors, concepts of Power.

Large Sample test for a proportion and difference between two proportions.

Test for a mean and difference between two means.

Chi-Square Test for GOF, Homogeneity of proportions, and independence.

Test for the slope of a LSR line.

Understand: Do:

Unit Essential Question:

How do we analyze 1-variable statistics?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Organizing Data	Displaying Data	Numerical Summaries for Quantitative Data
•	-	•
Lesson Essential Question/s:	Lesson Essential Question/s:	Lesson Essential Question/s:
How do we organize 1-variable data?	How do we display 1-variable data?	How do we calculate and interpret summary statistics?
-		
Vocabulary:	<u>Vocabulary:</u>	<u>Vocabulary:</u>
 Individuals Variable Categorical Variable Quantitative Variable Frequency Table Relative Frequency Table 	 Bar Graphs Dot plots Stem plots Histograms Box Plots SOCS 	 Median Mean Standard Deviation IQR Outlier Rule

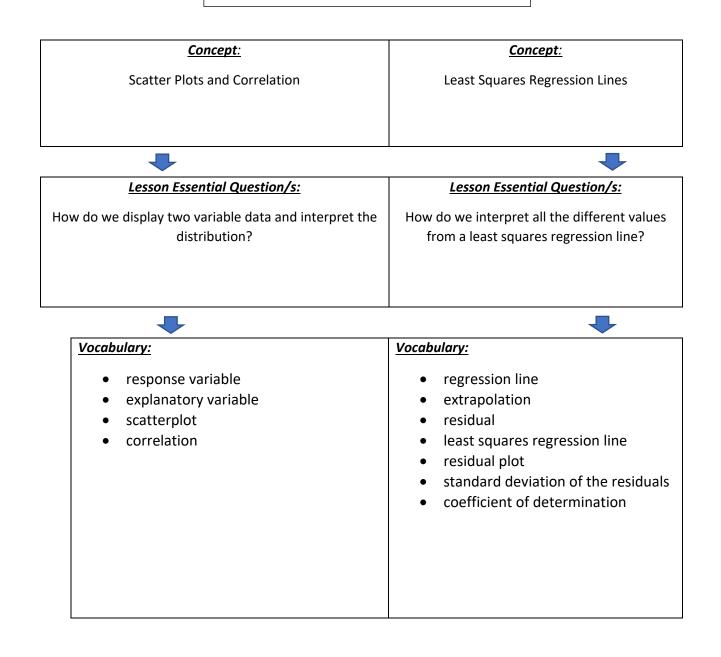
Unit Essential Question:

How do we model one-variable quantitative data?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Describing Location in a distribution	Transforming Data	Density Curves	Normal Distributions
	-	-	-
Lesson Essential	Lesson Essential	Lesson Essential	Lesson Essential
<u>Question/s:</u>	<u>Question/s:</u>	<u>Question/s:</u>	<u>Question/s:</u>
How do we calculate and	What happens to	What are the	How do we calculate and
interpret location in a	summery statistics	characteristics of a	interpret the probability of
distribution?	when we make	density curve?	an event occurring in a
	changes to all the		normal distribution?
	values in the data set?		
-	•	•	-
<u>Vocabulary:</u>	<u>Vocabulary:</u>	<u>Vocabulary:</u>	<u>Vocabulary:</u>
Percentile	•	•	Empirical Rule
Z-score			Standard
			Normal
			Distribution
			 normalcdf()
			 invnorm()

Unit Essential Question:

How do we model two-variable quantitative data?



Unit Essential Question:

How do we construct a good survey or experiment?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Sampling Surveys	Experiments	Inferences from studies
-		-
Lesson Essential Question/s:	Lesson Essential Question/s:	Lesson Essential Question/s:
What are the different types of	What are the different types of	What inference can we make
surveys and what are the advantages of each?	experiments and what are the advantages of each?	with how we set up the study?
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	-	-
Vocabulary:	<u>Vocabulary:</u>	<u>Vocabulary:</u>
convenience sample	 observational studies 	
• bias	• experimental studies	
voluntary response samplerandom sampling	 confounding treatment 	
 simple random sample 	 experimental unit 	
stratified random sample	 subjects 	
cluster sample	 random assignment 	
undercoveragenonresponse	 completely randomized design 	
	 double blind 	
	statistically significant	
	 randomized block design 	
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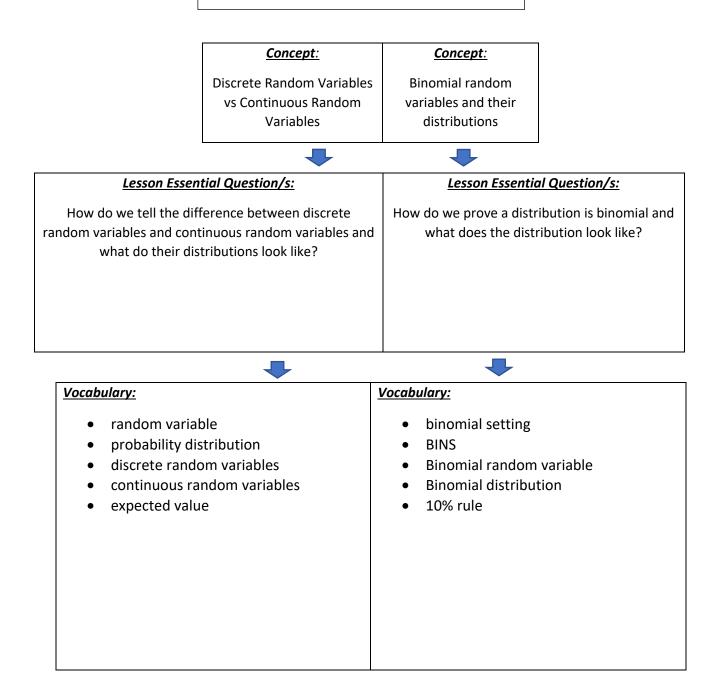
Unit Essential Question:

What are the basic rules of probability and how do we use them to solve real world problems?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Randomness, Probability, and Simulation	Probability Models and Probability Rules	Conditional Probability, Multiplication Rules and Independence
-	•	-
Lesson Essential Question/s: How do we use simulations and the Law of Large numbers to help us make predictions?	Lesson Essential Question/s: How do we use two-way tables to help us find the probability of 2 events occurring?	Lesson Essential Question/s: How do we find the probability of 2 events occurring when they are not independent?
•	-	•
 Vocabulary: probability law of large numbers simulation 	 Vocabulary: probability model event complement rule general addition rule mutually exclusive events two-way table Venn-diagrams 	 Vocabulary: conditional probability general multiplication rule tree diagram independent events

Unit Essential Question:

How can we tell the difference between the different types of random variables?



Unit Essential Question:

What is a sampling distribution and how do we describe it?

Concept:	<u>Concept:</u>	<u>Concept:</u>
The idea of a sampling distribution	Sample proportions	Sample Means
-	-	
Lesson Essential Question/s:	Lesson Essential Question/s:	Lesson Essential Question/s:
What is a sampling distribution and wh do we use them?	How do we find the shape, center, and spread of a samplin distribution of a sample proportion?	How do we find the shape, center, g and spread of a sampling distribution of a sample mean?
-	-	-
Vocabulary:	Vocabulary:	Vocabulary:
 Parameter Statistic Sampling distribution Unbiased estimator 	 Sampling distribution of a sample proportion Shape – Large Counts Center – p Spread – standard deviation of the sample proportion 	 Sampling distribution of a sample mean Shape – CLT or graphs Center – sample mean Spread – standard deviation of the sample mean

Unit Essential Question:

How do we use confidence intervals to estimate a population parameter?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Idea of a confidence interval	Confidence intervals for a sample proportion	Confidence intervals for a sample mean
-		
Lesson Essential Question/s:	Lesson Essential Question/s:	Lesson Essential Question/s:
What is a confidence interval and how can we change the margin of error?	How do we estimate and interpret the confidence interval for a sample proportion?	How do we estimate and interpret the confidence interval for a sample mean?
•	₽	-
Vocabulary:	<u>Vocabulary:</u>	<u>Vocabulary:</u>
 Confidence interval Confidence level Point estimate Margin of error 	 Conditions for a confidence interval for a sample proportion Critical value (z*) Standard error of sample proportion 1-prop-z-interval 	 Conditions for a confidence interval for a sample mean Critical value (t*) Standard error of sample mean 1-sample-t-interval or t-interval

Unit Essential Question:

How do we use hypothesis tests to test a claim?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Idea of a hypothesis test	Hypothesis test for a sample	Hypothesis test for a sample
	proportion	mean.
-	•	
Lesson Essential Question/s:	Lesson Essential Question/s:	Lesson Essential Question/s:
What is a hypothesis test and what	How do we preform and	How do we preform and
type of errors could we make?	interpret a hypothesis test for a sample proportion?	interpret a hypothesis test for a sample mean?
-	•	-
<u>Vocabulary:</u>	<u>Vocabulary:</u>	<u>Vocabulary:</u>
 Significance test Null hypothesis Alternate hypothesis One-sided test Two-sided test P-value Significance level Type I Error Type II Error 	 Conditions for a hypothesis test for a sample proportion 1-prop-z-test 	 Conditions for a hypothesis test for a sample mean. 1-sample-t-test or t-test

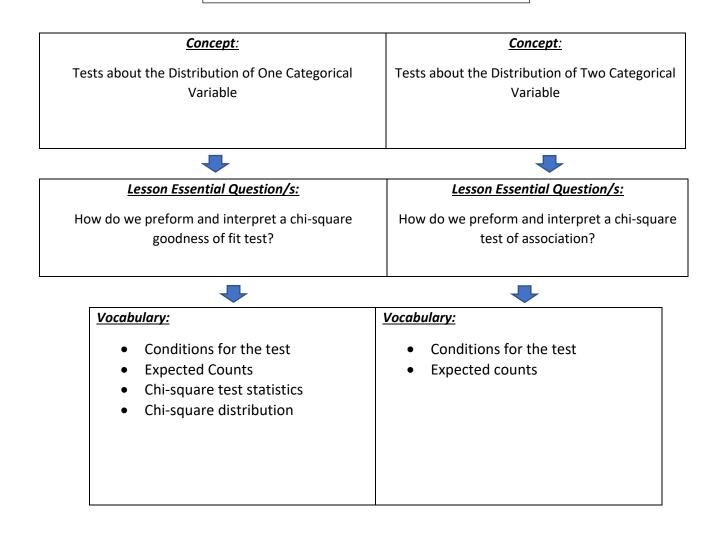
Unit Essential Question:

How do we compare two different populations with confidence intervals or hypothesis tests?

<u>Concept:</u>	<u>Concept:</u>	<u>Concept:</u>
Inference about two proportions	Inference about two means	Inference about a mean difference in Paired Data
	•	
Lesson Essential Question/s:	Lesson Essential Question/s:	Lesson Essential Question/s:
How do we make inferences about two proportions?	How do we make inferences about two means?	How do we make inferences in paired data?
•	-	-
<u>Vocabulary:</u>	<u>Vocabulary:</u>	<u>Vocabulary:</u>
 Conditions for the test Shape Center Spread 	Conditions for the testShapeCenterSpread	 Paired Data Conditions for the test Shape Center Spread

Unit Essential Question:

How do we make inferences about categorical data?



Unit Essential Question:

How do we make inferences about Linear Regressions?

