

Orange Unified School District
INTRODUCTORY STATISTICS
Semester Course

GRADE LEVEL: 11-12

PREREQUISITES: Algebra II “C” grade or better

INTRODUCTION TO THE SUBJECT:

This course is designed to be a rigorous mathematical elective; the next course in the sequence for students who have completed Algebra II. It introduces students to the important concepts of Statistics and Probability. The major themes will be exploratory analysis, graphs, random variables and distributions (including the Normal Distribution), confidence intervals and inference about the mean and proportion.

PURPOSE OF THE COURSE:

This course is designed as a college prep course aimed at students who are not ready for the rigor of Pre-Calculus and yet desire to take a challenging math course their senior year. It is expected that students who are planning to attend college but perhaps not enter the field of math and engineering will benefit from the rigors of this class.

TEXT: Yates, Dan, David S. Moore, George P. McCabe. *The Practice of Statistics*. W. H. Freeman, 1999.

COURSE OBJECTIVES: By the end of the course the student will:

- Appreciate the usefulness of obtaining and analyzing data for making decisions and advancing knowledge.
- Understand the importance of data collection and be able to critique the quality of studies based upon issues of data collection.
- Apply basic data analytical techniques to uncover patterns and truths with data sets and understand the primary importance of graphing the data.
- Apply basic techniques of statistical inference to data, interpret the results of a statistical analysis using the concepts of confidence interval or tests of significance, and assess when particular inferential procedures are appropriate.
- Communicate the results of statistical analyses or quantitative findings in writing and speaking.

COURSE OVERVIEW AND APPROXIMATE UNIT TIME ALLOTMENTS:

Standard	Concept	Text	Assessment	Projects Key Assignments
Unit/ Standards 10,11,14 Exploring data	<ul style="list-style-type: none"> Students learn how to display data graphically, learn statistics vocabulary Students learn to calculate measures of central tendency: mean, median, mode. In addition they learn variation: range, variance, standard deviation and quartiles. Students discriminate graphical displays of univariate data; using box plots, stem and leaf plot, histograms, frequency tables, cumulative frequency tables and time plots. Students describe graphical displays using shape, center and spread criteria. Students compare distributions graphically; students use their graphic calculators to explore various characteristics of distributions. 	Ch. 1 Ch. 2 part 1	<p>Quizzes Test 1,2 part 1 Homework: Assessments: Quizzes & Tests: Students will demonstrate how to uncover patterns in data and understand the usefulness of such graphs and summary statistics.</p> <p>Written: Readings and Summaries:</p> <p>A: For today's graduate B: Wealth of Nations</p>	<ul style="list-style-type: none"> Deceptive Graphs: Students will collect an example from a newspaper or magazine in which a graph has been presented in a potentially deceptive manner. Identify the source from which the graph was taken; interpret the graph using appropriate statistical vocabulary. Explain how it was drawn deceptively, then fix it using statistical methods to show what the graph actually looks like. Activity 1: Students will interpret graphs: determining descriptive statistics. Also, they will graph data, using a graph of their choice and describe the distribution using shape, center and spread. Activity 2: Students compare distributions, find means and standard deviations and interpret the results.
Density Curves 7,8	<ul style="list-style-type: none"> Density curves; students will learn about the difference between discrete and continuous random variables and distributions. Changes in distributions due to changes in variation. Z scores and the standard normal distribution Normal probability plots Review of exponents and series notation. 	Ch. 2, part 2	<p>Quizzes Test 2 Homework Students will learn and show the usefulness of the normal curve in many real life situations. Students will organize and analyze normal data and be able to find probabilities from non-standard normal situations.</p> <p>Readings: A: Normal Curve B: Standard Deviation</p>	<ul style="list-style-type: none"> Activity 2B: Students will solve many normal problems, both standard normal and nonstandard by indicating mean, standard deviation and shading $P(x)$. Activity 2A: Students will solve problems using the graphic calculator, interpret and analyze the results.
Modeling (x,y) data	Mathematical Modeling: x,y data	Ch. 3	Quizzes Test 3	<ul style="list-style-type: none"> Activity 3A: Students will compare two plots

12,13	<ul style="list-style-type: none"> • Exploring (x,y) data as explanatory and response variables • Scatterplots • Time series • Correlation • Regression and Line of Best Fit • Residual plots • Influential points and outliers 		<p>Homework Assessments: Students will be able to graph and interpret (x,y) data. They will uncover patterns and understand the importance of correlation and association of (x,y) data.</p> <p>Readings: A: Correlation B: Scatterplots: outliers and influential points.</p>	<p>comparing the strength of a medicine. Students will write up a comparison using appropriate statistical analysis.</p> <ul style="list-style-type: none"> • Q3B: Students will write a research paper about a sports event using (x,y) data. They will use the computer to research and then interpret their results.
Patterns, Random Variables and Probability 1,2,3	<ul style="list-style-type: none"> • Basic Rules of Probability • Random Variables • Binomial and geometric distributions • Sampling distributions of \bar{x}. • Simulation as an attempt to explain experimental situations. • Sampling techniques 	Ch. 6	<p>Quizzes Test 6 Homework Assessments: Students will find probabilities and understand their usefulness in finding models of real life situations. In addition, students will see the primary importance of finding probabilities using concise methods.</p> <p>Readings: A: Central Limit Theorem: History</p>	<ul style="list-style-type: none"> • Activity 6A-C: Students will determine and explain probabilities using addition rule, multiplication rule, and conditional probability rules. • Project: Students will create a survey, sample using random number generators and organize results. Students will use and explain graphs, tables and descriptive statistics.
Random Variables and Distributions	<ul style="list-style-type: none"> • Probability density $f(x)$ • Expected values and $\text{Var}(x)$ 	Ch. 7	<p>Quizzes Test 7 Homework Assessments: Students will utilize analytical techniques to find expected values and variances of probability models. Students will analyze their results and report them using appropriate vocabulary. plots, tables and interpreting results.</p> <p>Exam: Standard format.</p>	<p>Packet 7: Students will discover models using probability skills learned from chapter 6. They will determine the mean = $E(x)$ and $\text{var}(x)$ for each model and where appropriate find probabilities.</p>
Special Dis-	<ul style="list-style-type: none"> • Binomial and Geometric 	Ch. 8	Readings: Casualties-	Investigation 8: Students will work through an

tributions			<p>Probabilities and sampling. Quizzes, Test 8, Homework Assessment: Students will understand and show that some distributions have special formulas due to the fact that they are so commonly studied. Students will become aware of and appreciate the usefulness of the Binomial Distribution and how to utilize it's distribution to answer many binomial questions.</p>	<p>investigation using simulation of binomial variables. They will answer questions and explain the solution to problems that end with Normal approx. to the Binomial distribution.</p>
<p>Sampling Dis-tribution and Confidence Intervals</p>	<p>Distributions</p> <ul style="list-style-type: none"> • Normal approximation to Binomial P(x). • Sampling distributions of \bar{x} • Proportions • Means • Central limit Theorem • Confidence intervals 	Ch. 9-10	<p>Quizzes Test 9/10 Homework Assessments: Students will discover the distribution of \bar{x} and be able to find probabilities based on sample means. Students will use analytical techniques to find confidence intervals of means and interpret the results using statistics vocabulary.</p>	<ul style="list-style-type: none"> • Investigation 9: Students use the calculator to generate normal random variables. They table and graph the mean of the means and find and interpret conclusions. • Activity 10: Students find several confidence intervals for the mean. Sample is included.

** Tests: Tests include both a multiple choice section and a free response where students show their work and receive partial credit for correct work. All assessments include an open ended question that allows students to explain their understanding of a major (standard) concept. Students who do not pass with a 70% or better can retake for a max grade of 70%.

*** Assessment driven instruction: Each test is gone over with students; problems that many students missed are reviewed and placed on the next test. Students know this and prepare using chapter review suggested problems. This in turn makes possible 'spiraling' and make tests partly cumulative.

(1) Technology is used for computation.

(2) Projects: Students will compose a Review Study Guide for Algebra II. This is planned because many seniors will be taking ACT and SAT tests. In addition they will take placement test at Jr. College and the ELM and EPT.

DATE OF CONTENT REVISION: February 2009

DATE OF CURRENT CONTENT REVISION: January 2011

DATE OF BOARD APPROVAL:

February 12, 2009

PROBABILITY AND STATISTICS CONTENT STANDARDS

This discipline is a technical and in-depth extension of probability and statistics. In particular, mastery of academic content for advanced placement gives students the background to succeed in the Advanced Placement examination in the subject.

- 1.0** Students solve probability problems with finite sample spaces by using the rules for addition, multiplication, and complementation for probability distributions and understand the simplifications that arise with independent events.
- 2.0** Students know the definition of conditional probability and use it to solve for probabilities in finite sample spaces.
- 3.0** Students demonstrate an understanding of the notion of discrete random variables by using this concept to solve for the probabilities of outcomes, such as the probability of the occurrence of five or fewer heads in 14 coin tosses.
- 4.0** Students understand the notion of a continuous random variable and can interpret the probability of an outcome as the area of a region under the graph of the probability density function associated with the random variable.
- 5.0** Students know the definition of the mean of a discrete random variable and can determine the mean for a particular discrete random variable.
- 6.0** Students know the definition of the variance of a discrete random variable and can determine the variance for a particular discrete random variable.
- 7.0** Students demonstrate an understanding of the standard distributions (normal, binomial, and exponential) and can use the distributions to solve for events in problems in which the distribution belongs to those families.
- 8.0** Students determine the mean and the standard deviation of a normally distributed random variable.
- 9.0** Students know the central limit theorem and can use it to obtain approximations for probabilities in problems of finite sample spaces in which the probabilities are distributed binomially.
- 10.0** Students know the definitions of the mean, median, and mode of distribution of data and can compute each of them in particular situations.
- 11.0** Students compute the variance and the standard deviation of a distribution of data.
- 12.0** Students find the line of best fit to a given distribution of data by using least squares regression.
- 13.0** Students know what the correlation coefficient of two variables means and are familiar with the coefficient's properties.