

AP STATISTICS Course Outline

NUMBER: 314
LEVEL: Honors
TEXTBOOK: Stats – Modeling the World, Pearson Education Inc., Bock, Velleman and DeVeaux, 2004.
The Practice of Statistics, W. H. Freeman and Company, Yates, Moore, McCabe, 1999
CREDITS: 5 Credits
REVISED: August 2008

PREREQUISITE:

Students enrolling in this course must have completed Algebra 2 Academic with at least a “B” average, or Algebra 2 Honors with at least a “C” average.

COURSE DESCRIPTION:

Statistics is an elective for students who have successfully completed Algebra 1, Geometry, and Algebra 2. It may be taken in addition to Pre-Calculus (A or H) or in addition to AP Calculus. In some cases, it may be taken instead of Pre-Calculus (A). However, any student who anticipates taking Calculus in college should take this course only in addition to Pre-Calculus.

Statistics is the science of collecting and analyzing data and is a required course for many college majors. Many decisions in life must be made from incomplete information. Statistics provides methods for making reliable conclusions when faced with uncertainties.

The main topics in this course are methods of organizing and presenting data, measures of central tendency, probability, the binomial and normal distributions, sampling distributions, estimation, hypothesis testing, regression and correlation.

All students enrolled in this Advanced Placement course are required to take The Advanced Placement test in May.

COURSE OBJECTIVES:

Students will be able to:

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1. Display and describe categorical and quantitative data, and numerical distributions.
2. Display, describe, and analyze relationships between two variables.
3. Gather data by conducting surveys and experiments, and running simulations.
4. Calculate probabilities.
5. Calculate confidence intervals and do hypothesis testing to make decisions about sampling distributions.

DESCRIPTION OF INSTRUCTION:

Students are expected to be active participants in the learning process. The teacher will involve them in the introduction and development of material through questioning and class discussion. This course will include extensive use of the graphing calculator, ActivStats computer program, and hands on activities.

Homework will be given almost every day and is an important part of the course, providing students the opportunity to apply skills learned in class, strengthen their understanding of the concepts and identify areas they don't understand. Reading assignments will be given frequently so that students will be prepared in class to discuss case studies and other problems. It is imperative that students do homework regularly and conscientiously. Homework will be reviewed in class and it is the student's responsibility during that time to ask questions about problems he/she doesn't understand, to identify specific mistakes and to take notes on any further explanations concerning these problems.

CORE CONTENT CURRICULUM STANDARDS:

Since this is a college level course, the content is beyond the Core Content Curriculum Standards (CCCS); however, this course will address the methods described in CCCS 4.5.

CCCS 4.5

All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas.

STUDENT EVALUATION:

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One to three quizzes, based on the course proficiencies, will be given during a unit and a unit test will be given at the end of each unit. There may also be group and/or individual graded assignments or projects throughout the year. An exam will be given at the end of each semester, covering all the work of that semester.

Homework will be checked on a regular basis. It will not usually be graded, but will be considered satisfactory if the work shown indicates the student has made a conscientious effort to complete the assignment. All work must be shown neatly to receive credit. Sometimes an assignment given for homework may be collected and graded as a quiz. This will only be done when the concepts have been thoroughly reviewed.

Grades will be calculated according to the school grading policy and the following guidelines.

A. Marking Period

1. Tests and quizzes	90 – 95%
2. Homework (Each teacher will explain his/her homework policy to the class.)	5 – 10%
3. Class Participation	0 – 5%

B. Final Grade

1. Each Marking Period	20%
2. Midterm Exam	10%
3. Final Exam	10%

District Policy: ACADEMIC INTEGRITY

Pupils are expected to be honest in all of their academic work. This means that the students in this course will not engage in any of the following acts:

- Cheating on examinations or other school assignments, including but not limited to, the non-authorized use of books or notes, the use of crib sheets, copying from other students' papers, exchanging information with other students orally, in writing, or by signals, obtaining copies of the examination illegally and other similar activities. Cheating through the use of technology to exchange information on any school assignment, examination, etc. is prohibited. Technology is defined as, but not limited to, computers, telephones, text messaging, palm pilots, calculators, cameras or any other hand held device.
- Plagiarism is not permitted in term papers, themes, essays, reports, images, take-home examinations, and other academic work. Plagiarism is defined as stealing or use without acknowledgment of the ideas, words, formulas, textual materials, on-line services, computer programs, etc. of another person, or in any way presenting the work of another person as one's own.

- Falsifications, including forging signatures, altering answers after they have been graded, inserting answers after the fact, erasing of grader's markings, and other acts that allow for falsely taking credit.

A pupil found guilty of academic dishonesty may be subjected to a full range of penalties including, but not limited to reprimand and loss of credit for all of the work that is plagiarized. Disciplinary action may also be a consequence of such behavior. Additional consequences may apply as defined in specific department policies and guidelines.

A teacher who believes that a pupil has been academically dishonest in his/her class should resolve the matter in the following manner:

- Reprimand the student orally and/or in writing. The teacher is also authorized to withhold credit in the work due to academic dishonesty.
- If warranted, the teacher shall file a written complaint against the student with the Administration, requesting a more stringent form of discipline. The complaint must describe in detail the academic dishonesty that is alleged to have taken place, and must request that the matter be reviewed by the Administration.
- The Administration will determine if further discipline of the pupil is appropriate, and will determine the nature of the discipline on a case-by-case basis.
- If the pupil is not in agreement with the disciplinary action of the Administration, he/she may appeal the action first to the Principal and secondly to the Superintendent. If the pupil is dissatisfied with the Superintendent's disposition of the case, he/she may grieve the action in accordance with Policy No. 5710, Pupil Grievance.

District Policy: Equal Opportunity

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socio-economic status.

COURSE PROFICIENCIES:

Unit 1: Exploring and Understanding Data

23 days

Goals: Students will use statistical vocabulary correctly and see applications of statistics in everyday life. They will be able to describe and analyze categorical and quantitative data, uncovering the story behind the data.

Objectives: Students will be able to:

I. Describe categorical data by:

1. Drawing bar graphs and using them to compare counts in categories.
2. Summarizing distributions with a table of counts or relative frequencies (percents) in each category.
3. Drawing and using pie charts and segmented bar charts to display and interpret data.
4. Comparing distributions with plots side-by-side.
5. Looking for associations between variables by comparing marginal and conditional distributions.

II. Describe quantitative data by:

1. Drawing and interpreting histograms, boxplots, stem-and-leaf, or dotplots.
2. Describing distributions in terms of their shape, center, and spread, and noting any unusual features such as gap or outliers.
3. Describing its modality, and recognizing data that is symmetric or skewed.
4. Computing a five number summary and using it to describe, compare, and contrast data sets.
5. Using the mean and standard deviation of a data set to describe its center.
6. Using the standard deviation as a ruler to tell how unusual an observed value may be, or to compare or combine measurements made on different scales.
7. Using the 68-95-99 Rule when a distribution is roughly unimodal and symmetric.
8. Using Normal percentile tables or functions when the Normal model fits well (Check by graphing).

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, pages 2-113

Activity Based Statistics; Schaeffer; Springer, 1996, Page 3, 9, 12, & 17.

”AP Statistics Activities MathBox;” Peterson and Duering; William K. Bradford Publishing Company, 1999, page 1.

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Unit 2: Exploring Relationships Between Variables

20 days

Goals: Students will describe the association of quantitative variables in terms of direction, form and scatter, and find lines of best fit. They will be able to model curved relationships between two variables.

Objectives: Students will be able to:

1. Place the explanatory variable on the x-axis and the response variable on the y-axis of a scatterplot, and describe the association in terms of direction, form and scatter.
2. Calculate a correlation to determine the strength of a linear association and do a regression analysis to model it.
3. Recognize when associations exist between data which are other than linear, continually remembering that association does not imply causation.
4. Calculate the least squares regression line and use it to estimate values of the response variable from values of the explanatory variable and to calculate the residuals.
5. Calculate the r-squared value and use it to determine the percentage of the variation in the response variable that is accounted for by the model.
6. Recognize outliers and influential points, know what effect they have on the results of their analysis, and make decisions about whether to include them, exclude them, or explain them.
7. Recognize a pattern (or curve) in a residual plot, know this indicates that the linear model is not appropriate and use a different model.
8. Straighten bent relationships, re-expressing the data using logarithms or a power.

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, Pages 115 – 214.

Activity Based Statistics; Schaeffer; Springer, 1996, pages 43 & 50.

”AP Statistics Activities MathBox;” Peterson and Duering; William K. Bradford Publishing Company, 1999, 8,10,15 & 29.

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Unit 3: Gathering data

28 days

Goals: Students will explore the concept of simulation models using the concept of randomness. Students will collect data from samples which represent a population. Students will analyze observational studies and experiments.

Objectives: Students will be able to:

- I. Run simulations using random numbers (both tables and computer generated) to get some insight into what might happen in a real situation.
- II. Answer questions about a target population; collect information from a sample with a survey or poll by:
 1. Running simulations using random numbers (both tables and computer generated) to gain insight into what might happen in a real situation.
 2. Collecting information from a sample with a survey or poll.
 3. Choosing a random sample and describing the process.
 4. Using other types of sampling when random sampling isn't possible and understanding their benefits and restrictions.
 5. Employing methods which will avoid bias in sampling, understanding that bias is sometimes intentional, but often unintentional or subconscious.
 6. Identifying sampling error, and understand that each sample only approximates the target population.
- III. Use observational studies to collect information from a sample drawn from a target population by:
 1. Examining existing data or by identifying subjects in advance, then following them to collect data as they are created.
 2. Spotting associations between variables in observational studies, remembering that this does not imply cause and effect.
 3. Continually being aware that it is impossible to eliminate the possibility of lurking or confounding variables, and taking this into account when drawing conclusions.
- IV. Design an experiment in which changes in the factors cause changes in the response variable by:
 1. Assigning subjects to treatments randomly so your experiment is likely to yield valid results.
 2. Controlling known sources of variation as much as possible, and reducing variation that cannot be controlled by using blocking if possible.
 3. Using replication, assigning several subjects to each treatment level.

4. Replicate (if possible) the entire experiment with an entirely different collection of subjects.

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, Pages 216 – 272.

Activity Based Statistics; Schaeffer; Springer, 1996, pages 5, 33, 99,105,109,112,131 &144.

”AP Statistics Activities MathBox;” Peterson and Duering; William K. Bradford Publishing Company, 1999, pages 30 & 55.

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Unit 4: Learning About the World.

15 days

Goals: Students will calculate and interpret probabilities. They will identify Bernoulli trials and interpret data using the Geometric and the Binomial Distributions.

Objectives: Students will be able to:

1. Find the probability that an event OR another event happens, whether or not they are mutually exclusive.
2. Find the probability that an event AND another event happens, whether they are independent or dependent.
3. Find conditional probabilities.
4. Find the probability of mutually exclusive events.
5. Calculate and interpret the mean and variance of a random variable.
6. Calculate and interpret the probability of a Binomial distribution.
7. Calculate and interpret the probability of a Geometric distribution.

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, pages 274-345.

Activity Based Statistics; Schaeffer; Springer, 1996, 59 & 62.

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Unit 5: From The Data At Hand To The World At Large

21 days

Goals: Students will use normal models to approximate sampling distributions. They will interpret confidence intervals, run hypothesis tests, and calculate Type I and Type II errors.

Objectives: Students will be able to:

1. Use knowledge of the Central Limit Theorem to make decisions on sampling distributions taken from a population.
2. Check assumptions for any distribution to make sure they are met, before the results are use for analysis.
3. Calculate and interpret Confidence Intervals (both statistically and in laymen terms) of sampling distributions.
4. Run a Hypothesis Test by:
 - a. Identifying which distribution is appropriate
 - b. Stating the Null and Alternate Hypothesis
 - c. Calculating the z-value, and comparing it to the critical z-value
 - d. Calculating the p-value and comparing it to the Confidence Level
 - e. Making a decision, based on all of the above, and stating the conclusion both statistically and in laymen terms.
5. Calculate and understand the meaning of, a Type I error, a Type II error, and the Power of a Test.

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, pages 347 – 441.

Activity Based Statistics; Schaeffer; Springer, 1996, pages 65, 68, 74, 79, 85, 89, 109, 112, 116, & 134.

”AP Statistics Activities MathBox;” Peterson and Duering; William K. Bradford Publishing Company, 1999, pages 26, 29, 34, 46, 50 and 53.

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Unit 6: Learning About the World

15 days

Goals: Students will use t-models to solve problems in which we do not meet the conditions which allow us to use the z-models. They will continue to use confidence intervals and hypothesis testing to make decisions about data from different distributions.

Objectives: Students will be able to:

1. Calculate t-values using either a table or calculator.
2. Use t-values to make inferences about one mean, the difference of two independent means, or the mean of paired differences, always checking to make sure all conditions are met before proceeding with any analysis, as no inference procedure is valid unless the underlying assumptions are true.
3. Check that their data is at least nearly normal before using a t-model for analysis, as skewness and outliers are particularly problematic.
4. Check for independence before using a two-sample t- procedure. If two variables are not from independent groups the matched-pairs t-procedure must be used.

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, pages 443 – 516.

Activity Based Statistics; Schaeffer; Springer, 1996, page 159.

”AP Statistics Activities MathBox;” Peterson and Duering; Wiliam K. Bradford Publishing Company, 1999, pages 62, 63 & 64.

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Unit 7: Inference When Variables Are Related

13 days

Goals: Students will use the chi-square model to test for goodness of fit, homogeneity, and independence for distributions. They will make inferences for regression.

Objectives: Students will be able to:

1. Calculate and interpret a goodness-of-fit model, to determine if an observed distribution is consistent with a proposed model.
2. Calculate and interpret a test of homogeneity, to determine if two or more observed distributions could have arisen from populations with the same model.
3. Make inferences about a single proportion or the difference of two proportions using Normal models.
4. Make inferences about one mean, the difference of two independent means, or the mean of paired differences using t-models.
5. Make inferences about distributions using chi-squared models
6. Make inferences about association between categorical variables using chi-square models. Make inferences about linear association between quantitative variables using t-models.

Resources:

Stats – Modeling the World; Bock, Velleman & De Veaux; Pearson Education Inc., 2004, pages 518 – 582.

Activity Based Statistics; Schaeffer; Springer, 1996, page 163.

”AP Statistics Activities MathBox;” Peterson and Duering; William K. Bradford Publishing Company, 1999, page 65.

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Unit 8: Review All Topics for the Advanced Placement Exam 20 days

Goal: To obtain a grade of 3 (out of 5) or better on the AP Statistics Exam in order to receive college credits.

Objective: With the knowledge they’ve learned throughout the course students will be able to work through an AP Statistics workbook with confidence, and have the ability to use all available resources (textbook, notes, workbook, teacher, peers, etc.) to review any topic they may still feel unsure of.

How to Prepare for the AP Statistics Advanced Placement Examination; Martin Sternstein, Ph.D.; Baron’s Educational Services, Inc., 2000.

AP Statistics, Preparing for the advanced Placement Examination; James F. Bohan; AMSCO School Publications, Inc., 2000.

Unit 9: Applications: After the AP Test. 15 days

Goals: Students will use the topics learned throughout the course to complete projects which are based on statistical analysis.

Objectives: Students will incorporate all of the objectives addressed throughout the year to conduct experiments, simulations, and surveys.

Students will be able to:

1. Display and describe categorical and quantitative data, and numerical distributions.
2. Display, describe, and analyze relationships between two variables.
3. Gather data by conducting surveys and experiments, and running simulations.
4. Calculate probabilities.
5. Calculate confidence intervals and do hypothesis testing to make decisions about sampling distributions.

Resources:

Activity Based Statistics; Schaeffer; Springer, 1996, pages 175, 185, 190, 206, & 217 – 252.

”AP Statistics Activities MathBox;” Peterson and Duering; William K. Bradford Publishing Company, 1999, page 66.

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