

# AP Statistics Course Syllabus

**Course Description:** Curriculum for this course follows the AP Statistics curriculum set by the College Board and is designed to prepare students for the AP Statistics exam in May. This syllabus is adapted from the course description given by the College Board. The full course description should be downloaded from [www.Collegeboard.com](http://www.Collegeboard.com) and read completely. A link can be found on the instructor's class website. 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. This course draws connections between all aspects of the statistical process, including design, analysis, and conclusions. Additionally, using the vocabulary of statistics this course will teach students how to communicate statistical methods, results and interpretations. Students will learn how to use graphing calculators and read computer output in an effort to enhance the development of statistical understanding.

**Prerequisite:** Algebra II or equivalent

**Performance Standards:** During this course, the student will be exposed to four broad conceptual themes and will be expected to demonstrate proficiency in:

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

## Technology

- It is strongly recommended that all students have the equivalent of a TI-83, TI-83+ or TI-84 graphing calculator for use in class, at home, and on the AP Exam.
- Students will use their graphing calculator extensively throughout the course. Most assignments, numerous in class activities and most test will require the use of a graphing calculator.
- Students that do not have access to a graphing calculator will have great difficulty with the class.
- The instructor has a limited number of TI-83-plus calculators for students with an acute need; however, students need to make arrangements for long-term calculator needs.
- The TI calculators are recommended. TI calculators are NOT required and neither the instructor, nor the school has any financial relationship with TI. However, the examples in class will be given using a TI-84 (which is very similar to the TI 83) and the instructor does not know how to instruct students in the use of calculators other than the TI 83/84. Please note that the keystrokes on the TI 86 & 89 are completely different than the keystrokes for the TI 83/84.
- Students will also occasionally go to the computer lab and utilize MS Excel as well as some Internet applets for enhancing the learning process.
- Students are not required to have access to any statistical computer software. However, numerous examples of MINITAB printouts will be reviewed in class and some homework and test problems will require understanding of MINITAB output to answer the questions.

**Instructional Materials:** Teaching materials for this course include, but are not limited too:

- Text Book (Peck, Olsen, Devore: An introduction to Statistics and Data Analysis 2nd Edition.), each student provided individual copy by JCPS. Needed daily in class.
- Lecture notes (taken from instructor lectures & also available class website).
- Formula sheet found on College Board website & provided to students by instructor. Needed daily in class.
- Daily access to a graphing calculator of some type is strongly suggested (see technology section above and students are encouraged to visit the College Board website for a list of graphing calculators that are approved for the AP exam)
- Access to a computer with a spreadsheet program is highly recommended. The computer lab at school will be used occasionally during class, however, home access can accentuate the learning process.

- 3 ring binder with loose leaf paper & writing utensil are needed daily in class.

**Reference Material:** Winer, 1971. Statistical principles in experimental design. McGraw-Hill, New York: Yates, Moore, Starnes: The Practice of Statistics 3rd Edition: Statistics Course Description. The College Board, May 2003: AP Statistics, 2005-2006 Professional Development Workshop Materials, The College Board, 2005: Texas Instruments TI-84 Graphing Calculator Manual: Kreith & Chakerian, Teaching Mathematics Using Technology – Graphing Calculator & Spreadsheet Activities, McDougal Littell, 2002.

To help in studying for the AP exam, all class notes, assignments, exams and quizzes should be kept in a neatly organized binder. Your notebook/binder for class should be organized into the following clearly labeled sections:

- Notes
- Homework/effortwork
- Exams/Quizzes
- Miscellaneous assignments
- AP prep materials

**Class Room Standards:** Students are to follow all school board, school rules & standards. One point will be deducted for each day homework/effortwork assignments are late beyond due date defined by the Red Book. The deducted points guidelines for late projects & take home test beyond due date defined by the Red Book is 10% deduction per day late. Please note, this is NOT class days late, it is days late includes weekends and any days students are away from school. The justification for this is that the student gained all these days extra to work on the project or take home test, so they are penalized for those days.

All students are to follow the Class Expectations that are given out with this syllabus and can be found on the class web site. Class Expectations will be gone over in class the first week of class.

**Academic Dishonesty:** Cheating of any kind will not be tolerated. All involved parties will earn zeros on the assignment or assessment and a disciplinary referral will be sent to the office. The following are examples of cheating; however, this list is not all-inclusive:

- Representing the work of others as your own (copying homework, letting someone copy your work etc.)
- Looking at another student's paper during an exam or quiz.
- Using prohibited materials (notes, etc.) on exams or quizzes.
- Sharing calculators during exams or quizzes
- Discussing exams or quizzes with students in other sections of the class who have not yet taken them.

**Forms of Assessment & Grading Scale:** Exams, quizzes, class participation, homework/ effortwork, class work, projects & content writing are used to assess the students' performance. The school board grading scale for AP classes will be used in this class.

#### **GRADING SCALE**

A 90%-100%  
 B 80% - 89%  
 C 70% - 79%  
 D 60% - 69%  
 U 0% - 59%

#### **GRADING STANDARDS**

40% Tests  
 20% Quizzes  
 20% Class work/Homework/Effortwork  
 15% Projects/Group Work/Writing  
 5% Group Participation Quizzes

The instructor reserves the right to change the grading standards percentages as long as they stay within school board or the schools Site Based Decision Making (SBDM) committee guidelines & they are changed at the beginning of the school year.

**Project:** Each student will have an individual and/or group project each semester. As an example, previously students have designed a simple survey and collected data on school athletic ticket sales at school events to obtain specific information needed by the schools athletic department and drawn conclusions in written form on the data collected to give the athletic department insight into possible price changes, been assigned specific pairs of physical attributes to measure on individuals ( $n = 50$ ) to create a scatter plot and assess in written form the strength & type (linear, quadratic, log, etc) of the relationship, required to individually develop questions & answers of which their groups develop a Jeopardy style game to be used in class for AP test review, etc. The instructor will give project assignments each semester & reserves the right to change projects to fit the needs of the school and/or the class.

**Writing:** During the academic year, each student will have to complete an individual portfolio writing assignment. The instructor reserves the right to change the writing prompt from year to year, but examples of previous topics include writing a letter to the county's superintendent of schools expressing how their math education stacks up against other top tiered countries and writing a letter to the schools site based decision board expressing their opinion on a hypothetical change in the grading standard which would allow for teachers of AP classes to be allowed to count test for more than a maximum of 40% of the students test grade.

**Makeup Work/Absences:** If you are absent for any reason, it is your responsibility to obtain all materials missed, including notes, homework solutions, assignments, etc. Since we use a block schedule & meet every other day, it is imperative that students keep up. It is a good idea to choose someone in class that you can call or email if you are absent. Alternatively, you may also look on the class website, which always has an up to date schedule of all the class assignments (HW, class activities, tests, projects, writing, etc). The timeline for turning in makeup work is outlined in your student planner. If you miss an exam or quiz, you will take an alternate version of the assessment immediately upon your return. Any assignments due on the day you miss must be handed in immediately upon your return. Since exams are announced well in advance, missing the class period before an exam does not get you out of taking the exam on the scheduled date. If you are in class on the scheduled date of an exam or quiz, you will take the exam or quiz.

**The AP Exam:** It is assumed that all students are in this class with the intention of taking the AP exam in May. If you are a senior and already know the schools you are applying to for next fall, you should contact them to find out their policy for accepting AP credit. If, for any reason, you decide not to take the AP exam, you are still required to complete all work and participate in all review activities in class with respect to the AP exam.

**Course Outline (organized by chapters in primary textbook):**

Welcome, Review Syllabus & Class Expectations (1 day)

Chapter 1: The Role of Statistics (1.5 days)

1.1 Three Reasons to Study Statistics

1.2 The Nature & Role of Variability

1.3 Statistics & Data Analysis

1.4 Types of Data & Some Simple Graphical Displays

Activity 1.1 Head Sizes, Understanding Variability

Chapter 3: Graphical Methods for describing Data (Graphical displays include, but are not limited to using boxplots, dotplots, stemplots, back-to-back stemplots, histograms, frequency plots, parallel boxplots, and bar charts. (2 days)

3.1 Displaying Categorical Data: Bar Charts, Pie Charts, Frequency Tables

3.2 Displaying Numerical Data: Stem & Leaf Displays

3.3 Displaying Numerical Data: Frequency Distributions & Histograms

3.4 Displaying Bivariate Numerical data: Scatter Plots (includes outliers & other unusual features)

3.5 Interpreting Results, Chapter Review & Wrap up

Activity 3.1: Locating States, Sampling Methodology

Chapter 1 & 3 Test (3/4 day)

Chapter 4: Numerical Methods for Describing Data (3.5 days)

4.1 Numerical Summaries (Mean, median, proportion, trimmed mean)

4.2 Variance, SD, Quartiles & IQR

4.3 Box Plots (outliers & other unusual features)

4.4 Empirical Rule, Chebyshev's Rule, z-scores

4.5 Interpreting Results, Chapter Review & Wrap up

Activity 4.1 Collecting & Summarizing Numerical Data.

Activity 4.2 Boxplot Shapes

Graphing Calculator Exploration

Chapter 5: Summarizing Bivariate Data (5.5 days)

5.1 Correlation (Linearity & properties of  $r$ )

5.2 Least Squares Linear Regression

5.3 Residual Plots (outliers & influential points)

5.4 Non-linear data (transforming to achieve linearity: power, log, inverse, etc.)

5.5 Interpreting Results, Chapter Review & Wrap up

Activity 5.1 Exploring Correlation & Regression Technology – Computer applets

Chapter 4 & 5 Test (3/4 day)

Chapter 6: Probability (6.5 days)

6.1 Chance experiments & sample space

6.2 Definitions of Probability (relative frequency & law of large numbers)

6.3 Basic Properties of Probability (Addition Rule)

6.4 Conditional Probability

6.5 Independent & dependent events (Multiplication Rule, sampling with & without replacement)

6.6 General Probability Rules (General Addition Rule, General Multiplication Rule, Law of Total Probability, Bayes' Rule)

6.7 Estimating  $p$  Empirically & with Simulation

Activity 6.1 Hershey Kiss, Estimating probability empirically.

Activity 6.2 Euro Coin Dilemma, Estimating probability empirically & with calculator simulation

Graphing Calculator Exploration: Probabilities as long run relative frequencies.

Chapter 6 test (1 day)

Chapter 7: Random Variables & Probability Distribution (10 days)

7.1 Random Variables (discrete & continuous)

7.2 Probability Dist for Discrete Random Variables (Properties of Discrete Probability Distributions)

7.3 Probability Dist for Continuous Random Variable (density function, density curve)

7.4 Mean & SD of random variable, Mean & SD of discrete random variable, Mean & SD of Linear Function, Mean & SD of Linear Combination.

7.5 Binomial & Geometric Random Variable (Properties of Binomial Experiment, Binomial Distributions, Mean & SD of Binomial Random variables, Geometric Probability Distribution)

7.6 Normal Distribution (Standard Normal Distribution, Using Standard Normal Curve Areas, Finding Probabilities)

7.7 Checking for Normality & Normalizing Transformations (Normal Probability plots, Distribution

Graphing Calculator Exploration: Discrete & Continuous Probability Distributions

Chapter 7 test (1 day)

Chapter 2: The Data Analysis Process & Collecting Data Sensibility (4 days)

2.1 The data analysis process (What & how to measure)

2.2 Sampling (Selection, measurement & non-response bias, simple random sample, sampling with & without replacement, other sampling methods)

2.3 Stat studies: Observational & Experimental (confounding variables)

2.4 Simple comparative experiments (extraneous factor, direct control, blocking, randomization, replication, control & randomization)

2.5 More Experimental Designs (control group, placebo, blind, experimental units)

2.6 More Observational Designs (surveys: phone, in-person, mail)

2.7 Interpreting Results, Chapter Review & Wrap up

1st Semester Final (1 day)

Chapter 8: Sampling Variability and Sampling Distributions (3 days)

8.1 Stats & Sampling Variability (statistic, sampling variability, sampling distribution)

8.2 The sampling distribution of a sample mean (General properties, Central Limit Theorem)

8.3 The sampling distribution of the sample proportion (General properties)

Graphing Calculator Exploration: Sampling Dist of Mean & Proportion

Chapter 9: Estimation Using a Single Sample (4 days)

9.1 Point Estimation (unbiased statistic, confidence intervals, confidence level)

9.2 Large sample CI for pop prop (standard error, bound on error of estimation B)

9.3 CI for a pop mean (One sample z CI for  $\mu$ , t distribution, one sample t CI for  $\mu$ )

9.4 Interpreting Results, Chapter Review & Wrap up

Activity 9.1 Getting a feel for CI

Activity 9.2 An alternative CI for Pop Proportion

Graphing Calculator Exploration: CI for  $p$  &  $\mu$

Chapter 8 & 9 test (1 day)

Chapter 10: Hypothesis Testing Using a Single Sample (5 days)

10.1 Hypo & test procedures (null & alternative hypothesis)

10.2 Errors in Hypo testing (type I & type II error, level of significance)

10.3 Large sample Hypo test for pop prop (test statistic, finding P-Value for z, observed sig. level, large sample z for  $p$ , steps in hypothesis testing)

10.4 Hypo test for pop mean (finding P-Value for z, one sample t test for  $\mu$ , statistical vs practical significance)

10.5 Power & the Probability of Type II Error (effects of various factors on Power)

10.6 Interpreting Results, Chapter Review & Wrap up

Graphing Calculator Exploration: Hypothesis test for  $p$  &  $\mu$

Chapter 11: Comparing Two Populations or Treatments (4 days)

11.1 Inferences between 2 pop/treat mean using Independent samples (2 sample ind t test & CI)

11.2 Inferences between 2 pop/treat mean using paired samples (paired t test & CI)

11.3 Large sample Infer between 2 pop/treat prop (2 sample prop z test & CI)

11.5 Interpreting Results, Chapter Review & Wrap up

Graphing Calculator Exploration: Testing hypothesis  $p$  &  $\mu$  & CI for  $p$  &  $\mu$

Chapter 10 & 11 test (3/4 day)

Chapter 12: The Analysis of Categorical Data & Goodness of Fit Tests (3 days)

12.1 Chi-sq for univariate categorical data (one-way frequency table, goodness-of-fit test, Chi squared distribution, observed & expected cell counts)

12.2 Test for homogeneous & Independent in a 2way table (two-way frequency table, observed & expected cell counts, marginal & grand totals)

12.3 Interpreting Results, Chapter Review & Wrap up

Activity 12.1 Pick a number - any number, One-way Frequency Table

Graphing Calculator Exploration: Goodness of fit test, Homogeneity & Independence test)

Chapter 13: Simple Linear Regression & Correlation: Inferential Methods (1 day)

13.5 Infer about pop Correlation Coefficient (Test for Independence in bivariate normal population)

13.6 Interpreting Results, Chapter Review & Wrap up

Chapter 12 & 13 test (3/4 day)

Review for AP test (18 days)

AP Test (1 day)

Post AP test:

Continue with Chapter 13 & possibly Chapter 14 if time permits

13.1 Simple Linear Regression (basic assumptions of the simple regression model, estimate of SD)

13.2 Inferences about slope of pop regression line (Properties of the  $b$  distribution, SD for  $b$ , CI for  $\beta$ , hypothesis test for  $\beta$ ).

13.3 Checking Model Adequacy (standardized residuals, residual plots)

## Chapter 14: Multiple Regression Analysis

14.1 Multiple Regression models (general additive regression model, population regression coefficients & function, quadratic regression, interaction)

14.2 Fitting a model & assessing utility (least squares est, residual SS, SSR<sub>resid</sub>, SST<sub>o</sub>, regression SS, the F test,

14.3 Infer based on an Estimated model

14.4 Other issues in Multiple Regression

14.5 Interpreting Results, Chapter Review & Wrap up

2nd Semester Final (1 day)