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## **AP Statistics Syllabus**

### **Overview**

The usual sequence of courses leading to AP Statistics is:

Algebra I → Geometry → Algebra II

Some students take Precalculus or AP Calculus concurrently with AP Statistics. Students who have successfully completed Algebra II may take AP Statistics. The typical AP Statistics class has 20-25 students

Our high school is on a normal 7-period day. Classes meet for 48 minutes. School typically begins about August 28, leaving us about 140 days before AP exams and about 15 days after finishing two weeks of AP exams. Grade point average for AP classes is figured on a five-point scale while all other classes are graded on the four-point scale.

### **Teaching Strategies**

#### **Pedagogy**

YMM provides the general layout of the course as well as being the primary source of homework problems. Students are encouraged to read the chapters in the textbook before the topics are discussed in class so that class time can be devoted to more discussion, investigation, and activities with less time spent lecturing. To facilitate this, outline questions to accompany reading the text are assigned before actual classroom discussion of that section.

Most of the class time is utilized working on activities and investigations from a variety of sources. These activities and investigations come mainly from Fifty Fathoms, Activity-Based Statistics, and materials gathered from AP Summer Institutes, Statistics Workshops, activities from AP Statistics teachers' websites (used with permission), and ideas from contributors to the AP Statistics Electronic Discussion Group. Activities and investigations are used to introduce students to and give students practice with the course content.

Students, especially at the beginning of the year, are pushed to write complete responses in their homework, on write-ups from the activities and investigations, and especially on quizzes and exams. Key words such as: brief paragraph, discuss, compare, contrast, and interpret are fleshed out early in the year so students can practice communicating effectively throughout the year. Student responses are graded on statistical accuracy and communication of statistical concepts.

Students are exposed to released AP Statistics free response questions throughout the year. This exposure is mostly in-class, although some questions are assigned as homework. As the AP Statistics exam draws near, students are given examples of past Investigative Tasks. These are initially given as homework and as the AP Stat test draws near, done in class and timed at 25 minutes. During the second semester, students practice grading each other's responses using released rubrics to get a sense of what the readers will be looking for.

On assignments, quizzes, and exams, students are expected to use an appropriate graphing calculator. Each chapter includes homework assignments which walk students through the statistical functions available on

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their calculator. Some class time is also devoted to how to use these functions to check student work and how to correctly write and interpret the results from the calculator.

## **Assessment**

Students are assigned homework virtually every day. YMM provides the majority of practice problems, and other sources are used to provide extra practice or enrichment. Students are asked to plan on about an hour of work each night for this course. Each YMM assignment is due the following day; free response questions and write-ups from activities and investigations are collected a few days after they have been assigned. YMM assignments are graded based upon completion while all other forms of assessment are graded based upon accuracy.

Students complete quizzes after each section in the book. This provides them with feedback 2-3 times in each chapter before the chapter exam. Quizzes are usually taken (with some modification on occasion) from our text's Instructor's Resources Book. Students are generally given about 20 minutes of class time to finish these. A chapter exam is given for each chapter in the textbook. These are usually taken from the Instructor's Resources Book, other textbooks, and previously released AP Statistics exam questions. Each test consists of multiple choice questions at the beginning of the test and free response questions following. Students have 48 minutes to finish each exam. The final exam lasts 90 minutes and students are given 30 minutes to finish 15 to 20 multiple choice questions followed by 60 minutes to complete 5 or 6 free response questions.

Students complete special problems which allow students to practice writing statistical content. Special problems are assigned with almost every chapter. These special problems incorporate all of the previous chapters as much as possible. Students are provided with a rubric when the special problems are assigned so that expectations are clear.

## **Review for AP Exam**

From a strategic standpoint, our "review for the exam" consists of teaching the course consistent with the philosophy of AP Statistics as outlined in the Course Description and Teachers Guide. As we progress through each chapter, we revisit topics and ideas from past chapters and build upon them with the new content. We will complete a comprehensive review at the end of the year and I will also cover the expectations for the written responses on the AP exam. The released free response items and their associated rubrics are an excellent way to both review and understand free response expectations. Thus, these are used liberally as exemplars of student responses.

Every chapter exam contains questions building on skills the students have gained from previous chapters as well as questions from the current chapter. A short review of chapters 1 through 8 (or as much of chapter 8 as we have gotten through) is held before the fall semester final exam. Another review of chapters 1 through 14 is held before the spring semester final exam, which is given prior to the AP exam. Class time before the exam is spent working through past free response questions, past multiple choice questions, and selected practice questions from the AP Statistics preparation guides. If there is enough time, a timed practice exam is offered.

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## **Course Materials**

### **Texts, Reference and Resource Materials:**

#### **Primary Textbook:**

Yates, Dan, David S. Moore, and George P. McCabe. *The Practice of Statistics*. New York, NY: W. H. Freeman and Company, 1999.

#### **Technology:**

- All students have a TI-83/TI-83+/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.
- Students are required to use Fathom and will be given class time to work with the software for their projects.
- Students will read and interpret Minitab output for homework, on quizzes and tests.
- Various applets on the Internet.

### **References and Resource Materials:**

*Against All Odds: Inside Statistics* video series. Annenberg/CPB, 1988.

Bock, Velleman, and De Veaux. *Teacher's Edition, Stats Modeling the World, Second Edition*. Boston, MA: Pearson Education, Inc., 2007. ISBN 0-1318-7623-6

Bock, David and William Craine III. *Printed Test Bank and Resource Guide: Stats Modeling the World, Second Edition*. Boston, MA: Pearson Education, Inc., 2007. ISBN 0-1319-5004-5

*Fathom, Release 2*. Key Curriculum Press, Berkeley, CA.

Heller, Lerer, Montgomery, and Picollino. *Multiple-Choice and Free-Response Questions in Preparation for the AP Statistics Examination*. Brooklyn, NY: D& S Marketing Systems, Inc., 2003. ISBN 1-8786-2178-5

Heller, Lerer, Montgomery, and Picollino. *Student's Solutions Manual to Accompany Multiple-Choice and Free-Response Questions in Preparation for the AP Statistics Examination*. Brooklyn, NY: D& S Marketing Systems, Inc., 2003. ISBN 1-8786-2179-3

Peck, Olsen, and Devore. *Introduction to Statistics and Data Analysis, Second Edition*. Belmont, CA: Brooks/Cole – Thomson Learning, 2007. ISBN 0-4951-0966-5

Peterson, Larry. *Prep for the AP Exam Guide for Yates, Moore, and Starnes's The Practice of Statistics, Second Edition*. New York, NY: W. H. Freeman and Company, 2003. ISBN 0-7167-9615-5

Scheaffer, Watkins, Witmer, and Gnanadesikan. *Activity-Based Statistics: Instructor Resources, Second Edition*. Emeryville, CA: Key College, 2004. ISBN 1-930190-73-5.

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Yates, Daniel. *Teacher's Resource Binder: The Practice of Statistics*. New York, NY: W. H. Freeman and Company, 1999. ISBN 0-7167-3415-X

Yates, Moore, and Starnes. *The Practice of Statistics, Second Edition*. New York, NY: W. H. Freeman and Company, 2002. ISBN: 0-7167-4773-1

Selected Advanced Placement Statistics Examination Free Response questions are used throughout the course.

Other resource materials used come from newspapers, select journals, and the World Wide Web (including NCSSM Statistics Leadership Institute material). Students often use data sets they have collected.

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

Graphical displays include, but are not limited to using box plots, dot plots, stem plots, back-to-back stem plots, histograms, frequency plots, cumulative frequency plot, parallel box plots, and bar charts.

Theme	Chapter and Topics	Approximate Time Frame
<b>Univariate Data</b>	<b>Chapter 1: Exploring Data</b> <ul style="list-style-type: none"><li>• Graphs: stemplots, dotplots, histograms, boxplots</li><li>• Constructing Graphs by hand, on a graphing calculator and using Fathom</li><li>• Numerical summaries: mean, variance, standard deviation, range, interquartile range, five number summary, effects of transformations</li><li>• Describing the shape of a distribution: shape, center, spread, outliers, unusual features</li><li>• Frequency and cumulative distributions and tables</li><li>• Activity: An Unusual Incident: What can data tell us?</li><li>• Activity: Comparing Pulse Rates: How can we compare data?</li><li>• Special Problem 1: Exploring Different Representations of Data</li></ul>	13 days
<b>Univariate Data</b>	<b>Chapter 2: The Normal Distributions</b> <ul style="list-style-type: none"><li>• Density Curves</li><li>• Standard normal distribution, z-scores</li><li>• Table and calculator computations</li><li>• Assessing normality</li><li>• Activity: Heights: Does our class data fit the normal model?</li></ul>	9 days
<b>Bivariate Data</b>	<b>Chapter 3: Examining Relationships</b> <ul style="list-style-type: none"><li>• Scatterplots</li><li>• Correlation</li><li>• Least-squares linear regression</li><li>• Residuals</li><li>• Influential Points</li><li>• Activity: SAT/ACT Scores: Graphing and analyzing the data, is there a correlation?</li><li>• Activity: Applet matching <math>r</math> with its scatterplot. <a href="http://www.stat.uiuc.edu/courses/stat100/cuwu/Games">http://www.stat.uiuc.edu/courses/stat100/cuwu/Games</a>.</li></ul>	12 days

	<ul style="list-style-type: none"> <li>• Activity: Guessing their ages: How do we know who wins? Using the correlation coefficient.</li> <li>• Power point: Understanding slope</li> <li>• Power point: Understanding <math>r^2</math></li> <li>• Activity: Applets to demonstrate influential points:  <a href="http://www.mbhs.edu/~steind00/statistics.html">http://www.mbhs.edu/~steind00/statistics.html</a>  <a href="http://www.stat.sc.edu/~west/javahtml/Regression.html">http://www.stat.sc.edu/~west/javahtml/Regression.html</a>  <a href="http://www.ruf.rice.edu/~lane/stat_sim/index.html">http://www.ruf.rice.edu/~lane/stat_sim/index.html</a></li> <li>• Special Problem 3: Examining the Anscombe data: Always graph your data!</li> <li>• Special Problem 3B: Cautions when using least-squares regression lines to make predictions.</li> </ul>	
<b>Bivariate Data</b>	<p><b>Chapter 4: More on Two-Variable Data</b></p> <ul style="list-style-type: none"> <li>• Transformations for regression</li> <li>• Modeling Non-linear Data (exponential)</li> <li>• Power transformations</li> <li>• Interpreting Correlation and Regression</li> <li>• Relations in Categorical Data</li> <li>• Two way Tables</li> <li>• Simpson's Paradox</li> <li>• Ladder of Powers</li> <li>• Activity: Applying power to straighten the data</li> <li>• Special Problem 4: Length of Alligators: Modeling and analyzing non-linear data</li> </ul>	10 days
<b>Planning a Study</b>	<p><b>Chapter 5: Producing Data</b></p> <ul style="list-style-type: none"> <li>• Observational study, census, survey</li> <li>• Simple, systematic, stratified, and probability random samples</li> <li>• Experimental design</li> <li>• Simulations</li> <li>• Activity: The River Sampling: SRS vs. Stratified</li> <li>• Activity: Gummy Bears in Space: Factorial Designs and Interaction</li> <li>• Special Problem 5A: Designing a Survey</li> <li>• Special Problem 5B: Designing an Experiment</li> </ul>	15days
<b>Probability</b>	<p><b>Chapter 6: Probability: The Study of Randomness</b></p> <ul style="list-style-type: none"> <li>• Sample spaces, events, outcomes</li> <li>• Probability Rules</li> <li>• Complements</li> <li>• Disjoint and independent events</li> <li>• Union and Intersection</li> <li>• All Probability Models</li> <li>• Tree Diagrams</li> <li>• Venn Diagrams</li> <li>• Conditional Probability</li> <li>• Activity: Drawing cards: When can we "know" the probability of an outcome?</li> <li>• Activity: Greedy Pig: Discovering Expected Values</li> </ul>	12 days
<b>Probability</b>	<p><b>Chapter 7: Random Variables</b></p> <ul style="list-style-type: none"> <li>• Discrete random variables</li> </ul>	9 days

	<ul style="list-style-type: none"> <li>• Continuous random variables</li> <li>• Mean and variance</li> <li>• Mean and variance for transformations, sums, and differences</li> <li>• Activity: Constructing a game: Creating, finding expected value, mean and standard deviation of a game.</li> </ul>	
<b>Probability</b>	<b>Chapter 8: The Binomial and Geometric Distributions</b> <ul style="list-style-type: none"> <li>• Geometric distribution</li> <li>• Binomial distribution</li> <li>• Means and variances for binomial and geometric distributions</li> <li>• Normal approximations for binomial distributions</li> </ul>	9 days
<b>Semester Review</b>	<b>Semester Exam on chapters 1-8</b> <ul style="list-style-type: none"> <li>• Review for semester exam</li> </ul>	4 days
<b>Probability to Inference</b>	<b>Chapter 9: Sampling Distributions</b> <ul style="list-style-type: none"> <li>• Sampling distributions for means</li> <li>• Sampling distributions for proportions</li> <li>• Central Limit Theorem</li> <li>• Activity: Pennies and the Central Limit Theorem</li> </ul>	12 days
<b>Inference and Normal Distributions</b>	<b>Chapter 10: Introduction to Inference</b> <ul style="list-style-type: none"> <li>• Confidence intervals</li> <li>• Hypothesis tests</li> <li>• Power</li> <li>• Tests of significance</li> <li>• The reasoning of a significance test</li> <li>• Statistical Significance</li> <li>• P-values</li> <li>• Using calculators to construct confidence intervals</li> <li>• Margin of Error</li> <li>• Interpreting confidence intervals and hypothesis tests in context</li> <li>• Inference as a decision (Type I and II errors)</li> <li>• Activity: Fathom and NBA Data: Using Fathom to sample data and construct confidence intervals and hypothesis tests.</li> <li>• Activity: Power of a test: Applet from WH Freeman website</li> <li>• Activity: Constructing a Hypothesis Test for the mean number of red M&amp;Ms in a Valentine's Day fun size bag.</li> </ul>	13 days
<b>Inference and Normal Distributions</b>	<b>Chapter 11: Inference for Distributions</b> <ul style="list-style-type: none"> <li>• Confidence interval for one proportion</li> <li>• Confidence interval for two proportions</li> <li>• Hypothesis test for one proportion</li> <li>• Hypothesis test for two proportions</li> <li>• Inference for the mean of a population</li> <li>• T-procedures</li> <li>• Matched t-tests</li> <li>• T confidence intervals</li> <li>• Comparing two means</li> <li>• Assumptions for comparing two means</li> <li>• Two-sample t procedures</li> <li>• Two-sample inference with the TI-83</li> <li>• Degrees of freedom</li> <li>• Activity: Bean Bull's Eye: a matched pairs test.</li> </ul>	9 days

<p><b>Inference</b></p>	<p><b>Chapter 12: Inference for Proportions</b></p> <ul style="list-style-type: none"> <li>• T-distributions</li> <li>• Confidence interval for one mean</li> <li>• Confidence interval for two means</li> <li>• Hypothesis test for one mean, matched pair samples</li> <li>• Hypothesis test for two means</li> <li>• Inference for a Population Proportion</li> <li>• Assumptions for inference about a proportion</li> <li>• Large Sample Inference for a population proportion</li> <li>• Choosing the sample size</li> <li>• TI-83 techniques to perform inference for a population proportion</li> <li>• Comparing Two proportions</li> <li>• Confidence Intervals for comparing two proportions</li> <li>• Significance Tests for comparing two proportions</li> <li>• TI-83 techniques to compare two population proportions</li> <li>• Activity: Is One Side of a Coin Heavier? Constructing confidence intervals and hypothesis tests for proportions.</li> </ul>	<p>9 days</p>
<p><b>Inference</b></p>	<p><b>Chapter 13: Inference for Tables: Chi-square Procedures</b></p> <ul style="list-style-type: none"> <li>• Chi-square distribution</li> <li>• Properties of the chi-square distributions</li> <li>• Goodness of fit</li> <li>• Test for independence</li> <li>• Test for homogeneity</li> <li>• Conducting inference by simulation</li> <li>• Inference for two-way tables</li> <li>• Expected counts</li> <li>• Chi-square statistic</li> <li>• Using technology to calculate chi-square (Fathom)</li> <li>• Using the chi-square table</li> <li>• Uses of the chi-square test</li> <li>• Activity: I didn't get enough blues! Constructing chi-squared tests for M&amp;Ms</li> </ul>	<p>10 days</p>
<p><b>Inference</b></p>	<p><b>Chapter 14: Inference for Regression</b></p> <ul style="list-style-type: none"> <li>• Confidence interval for slope</li> <li>• Hypothesis test for slope and correlation</li> <li>• Computer output</li> <li>• Inference for Regression</li> <li>• Confidence Intervals</li> <li>• Inference about Prediction</li> <li>• Checking Regression Assumptions</li> <li>• Activity: The Legacy of Jet Skis: Inference about the model</li> </ul>	<p>9 days</p>
<p><b>Review</b></p>	<p><b>AP Exam Preparation</b></p> <ul style="list-style-type: none"> <li>• Review using the complete 2002 AP exam</li> <li>• Review using the released AP exam free response questions</li> <li>• Review using multiple choice questions from AP exam prep books</li> </ul>	<p>11 days</p>
<p><b>Post Exam</b></p>	<p>Final Project</p>	<p>12 days</p>

## **Special Problems and Activities**

The special problems are in the form of extended writing assignments. These are formal writing assignments. As a consequence, form and technical adequacy are enforced. These assignments are given throughout the year. Activities are mostly completed in class, giving students a hands on or more in depth look at a topic. A simple random sample of special problems and activities are included below.

### Special Problem 7A

Create your own game of chance. You will need to provide a very clear and coherent set of rules for your game. You need to practice game to ensure that you have provided all the necessary rules. Your game will need to have a prize for winning and a cost for losing. You need to find the expected value of your game and the standard deviation of the game. You must also provide the outcomes of several trials of your game and the mean and standard deviation of your trials.

#### Grading

Rules were clear and easy to follow	1	2	3	4
Rules were complete	1	2	3	4
Game was creative	1	2	3	4
Outcomes were clearly stated	1	2	3	4
Expected Value is included	1	2	3	4
Standard Deviation is included	1	2	3	4
Trials were completed	1	2	3	4
Expected value of trials is included	1	2	3	4
Standard deviation of trials is included	1	2	3	4

Name \_\_\_\_\_

### Bean Bull's Eye: Matched pairs

*Materials needed:*

*small dry red beans, paper plates, target sheets, stop watches*

1. What is a matched pair study?
2. Explain why your left and right hands would be considered a matched pair.

Directions: Directly in front of you place a paper plate filled with a large handful of beans. Behind the paper plate place the target sheet so that you, the plate, and the target sheet form a line. Using one hand only, practice placing one bean into each circle of the target sheet. Do this for each hand. You will be timed to see how long it takes to place a bean in each circle. Discuss ways of controlling bias and variability in the experiment (use of timer, placement of hands at the beginning,...)

The object of this experiment is to see if there is a time difference between the two hands. Is the dominant hand faster?

3. Personal data: Which is your dominant hand? L R Neither

Time: Dominant (h1): \_\_\_\_\_ Other (h2): \_\_\_\_\_ Difference: (h1 - h2): \_\_\_\_\_

Collect data for the entire class. List the results in the following table.

				Subject	Dominant: h <sub>1</sub>	Other: h <sub>2</sub>	h <sub>1</sub> - h <sub>2</sub>
Subject	Dominant: h <sub>1</sub>	Other: h <sub>2</sub>	h <sub>1</sub> - h <sub>2</sub>	15	.	.	.
1	.	.	.	16	.	.	.
2	.	.	.	17	.	.	.
3	.	.	.	18	.	.	.
4	.	.	.	19	.	.	.
5	.	.	.	20	.	.	.
6	.	.	.	21	.	.	.
7	.	.	.	22	.	.	.
8	.	.	.	23	.	.	.
9	.	.	.	24	.	.	.
10	.	.	.	25	.	.	.
11	.	.	.	26	.	.	.
12	.	.	.	27	.	.	.
13	.	.	.	28	.	.	.
14	.	.	.		.	.	.

4. Calculate the sample mean, standard deviation, and standard error of the statistic of the difference between the two hands.
5. Check the distribution of the differences using a quantile plot and a box plot. Sketch the plots. Note any outliers and the overall shape of the distribution.

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6. According to your plots, is it appropriate to use t procedures on this data set?
7. Is this data from an SRS of the population of interest?
8. Summarize the assumptions that one makes before using t-procedures.
9. State your null and alternative hypothesis. Label all variables. Calculate the test statistic, and p-value. State your conclusions in terms of the hypothesis.

## Gummy Bears in Space

Question: Does the launch angle and its position on the launch ramp interact in their effects on how far you can shoot a gummy bear?

Objective: The goals of this lesson are to see how to use a two-way factorial design to study the effects of two factors at once, as well as to see how to summarize the results in an interaction graph.

Preparation: Wrap a rubber band tightly around two popsicle sticks near the end. Pull the two sticks apart and insert a pencil between them. Mark the position the pencil is in on the popsicle stick to ensure that the pencil is in the same spot for every launch.

Activity: Investigate the following factors and their effects on the distance a gummy bear will travel.

Factor #1: Launch angle (the number of books under the end of the launch ramp)

Factor #2: Launch position (the launcher is at the front or the back of the ramp)

1. Plan the experiment.
  - a) Assign jobs: loader/launcher, holder (keeps the launch equipment steady), measurer, data recorder/supervisor.
  - b) List the conditions:

Factor #1: Use three different launch angles: 1, 5 or 9 books under the end of the launch ramp.

Factor #2: Use two different positions for the launcher on the ramp: front of the ramp and back of the ramp.
  - c) Randomize the order. Which treatment will go first? Second? Etc.
  - d) Keep other conditions fixed. (Do not change who does which job, what types of books you are using or where the pencil is.)
2. Produce and record the data.
  - a) Set up your equipment for the first combination of launch angle and launch position on the ramp. Launch a gummy bear, and measure how far it went. Measure the distance from the *front* of the ramp, and measure only in the direction parallel to the ramp. Do three more launches and find the average of all four launches for this treatment.
  - b) Create a table to record the averages of the four launches for each treatment.
  - c) Now reset your launch equipment for the second treatment. Then do a second set of four launches, and compute their average.
  - d) Repeat for third through sixth treatments.
3. Interpret interaction.

How much distance do you gain or lose by launching from the back of the ramp instead of the front? Use your data to answer this question by computing the difference “back average minus front average.” Compute this difference first for the two sets of launches with 1 book under the ramp. Compute a second difference for five books and a third difference for 9 books. Show the differences in your table by adding a third row call difference. If the two factors interact, then the three differences will be different. Is interaction present in your launch data?
4. Graph your results.

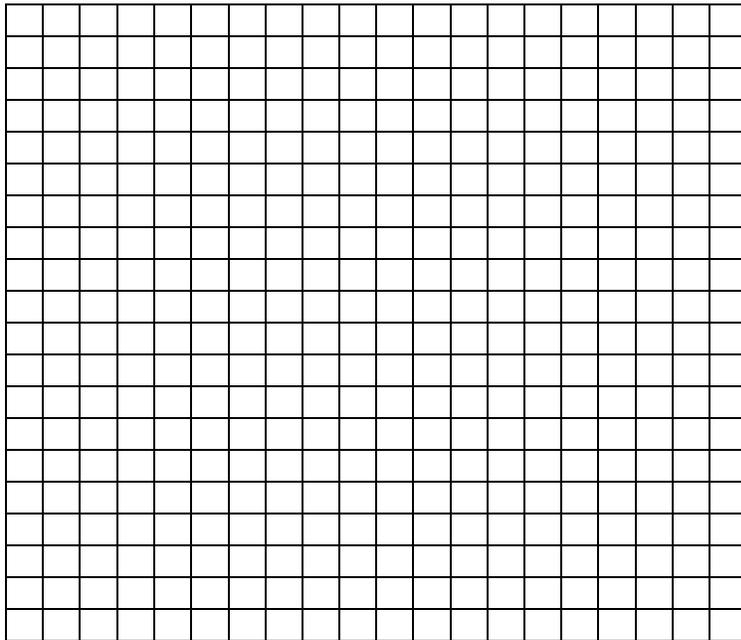
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Place the response variable on the y-axis. Choose one explanatory variable to place on the x-axis and graph different lines to represent the other explanatory variable.

5. Summarize your findings.

**Table:**


**Graph:**



**Summary:**



## Special Problem 10

### Using Fathom to analyze NBA Players

1. Go to the web site <http://www.troy.k12.oh.us/~ths/math/Nirode/Stats/Stats.htm> open the NBA Players data (Fathom version). This should open a Fathom screen with a collection labeled NBA Players 0607 on the screen.
2. Highlight the NBA Players 0607 box (do not double click!) and then click and drag down a “new case table,” it is the second picture icon in the tool bar. This should create a table with a lot of information about the 06-07 NBA Players. Take a moment to look at all the information given to you.
3. Highlight the NBA Players 0607 box again. Click on the “Analyze” drop down menu and select “Sample Cases.” A new box should appear labeled “Sample of NBA Players 0607.”
4. Double click on this new box. Another box will appear titled “Inspect Sample of NBA Players 0607.” The tab labeled “sample” should be selected.
5. Uncheck the “animation on” box. Uncheck the “with replacement” box. Highlight the number 10 and change it to 50 cases.
6. Click on the sample more cases button.
7. Now click on the tab labeled “measures.”
8. Click on “new” and type in “MeanHeight” with no space and hit enter.
9. Right click on the box under formula and select “edit formula.”
10. Click on the following: functions, statistical, one attribute, and double click on mean.
11. Inside the parenthesis, type in Height (the word Height should turn blue) and click o.k. You should be back at the “Inspect Sample of NBA Players 0607” box with the measures tab highlighted. There should be a mean in the middle column for your sample. Write down that MeanHeight here: \_\_\_\_\_.
12. Click on new and type in MeanWeight (no space) and hit enter.
13. Right click on the second box under formula (under mean(height)) and select edit formula.
14. Click on the following: functions, statistical, one attribute, and double click on mean.
15. Inside the parenthesis, type in weight (the word weight should turn blue) and click o.k. You should be back at the “Inspect Sample of NBA Players 0607” box with the measures tab highlighted. There should be a mean in the middle column for your sample. Write down that MeanWeight here: \_\_\_\_\_.

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16. Construct a 90% confidence interval for the average height of the 50 players in your sample. Note:  $\sigma = 3.73867$
17. Construct a 90% confidence interval for the average weight of the 50 players in your sample. Note:  $\sigma = 28.8165$
18. Make sure the “Sample of NBA Players 0607” box is still highlighted.
19. Click on the “Analyze” drop down menu and select “collect measures.” A new box should appear named “Measures from Sample of NBA Players 0607.” Double click on this new box.
20. Uncheck “animation on.” Also, uncheck “empty this collection first.”
21. Change 5 to 50 measures.
22. Click on the “collect more measures” button.
23. Click on the “cases” tab.
24. Now, click and drag down a new scatter plot (the third picture icon from the left in the toolbar).
25. Click and drag “MeanHeight” from the “Inspect Measures from Sample of NBA Players 0607” table and drop it on the x-axis of the scatter plot. This should create a dot plot of the mean heights of 55 different samples of size 50 each.
26. Describe the distribution of this dot plot.
27. Now create a second graph by again clicking on the scatter plot icon and dragging it down into your work area. Make a dot plot of the mean weights of the samples by clicking and dragging “MeanWeight” from the “Inspect Measures from Sample of NBA Players 0607” table and dropping it on the x-axis of the scatter plot.
28. Describe the distribution of this dot plot.
29. Go back to your “Inspect Measures from Sample of NBA Players 0607” table and click on the “Collect Measures” tab.
30. Click on the “Collect More Measures” button several more times until your dot plots look approximately normal.
31. Right click on the dot plot of MeanHeight and select “Plot Value.”
32. Click on the following: functions, statistical, one attribute, and double click on count. Type in MeanHeight (MeanHeight should turn blue) and click o.k.
33. Write down the count given under your graph. \_\_\_\_\_

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34. Right click on the MeanHeight dot plot again and once more select “Plot Value.”
35. Click on the following: functions, statistical, one attribute, and double click on mean. Type in MeanHeight (MeanHeight should turn blue) and click o.k.
36. Write down the mean given under your graph. \_\_\_\_\_
37. According to the CLT ( \_\_\_\_\_ ) from chapter 9 the number you just found for the mean of all the MeanHeights should be equal to \_\_\_\_\_.
38. Is this number in the confidence interval that you constructed for heights? \_\_\_\_\_
39. Now repeat these steps for the other graph.
40. Right click on the dot plot of MeanWeight and select “Plot Value.”
41. Click on the following: Functions, Statistical, One Attribute, and double click on Count. Type in MeanWeight (MeanWeight should turn blue) and click o.k.
42. Write down the count given under your graph. \_\_\_\_\_
43. Right click on the MeanWeight dot plot again and once more select “Plot Value.”
44. Click on the following: Functions, Statistical, One Attribute, and double click on Mean. Type in MeanWeight (MeanWeight should turn blue) and click o.k.
45. Write down the mean given under your graph. \_\_\_\_\_
46. Is this number in the confidence interval that you constructed for weights? \_\_\_\_\_
47. Please copy and paste both of your dot plots into a Word document and print this page to turn in with your special problem.
48. Now let’s find the true  $\mu$  for our population. Double click on the “NBA Players 0607” box. Select the “measures” tab.
49. Click on new and type “MeanHeight.” Right click on the box under formula and select “Edit Formula.” Create the formula for the mean just as you did for the sample data. Also create a new measure for “MeanWeight.” Note the values you just found here:  
Mean Height \_\_\_\_\_ Mean Weight \_\_\_\_\_
50. Are the true population height and weight close to the mean of the x-bar distribution graphs? Are the true population values in your confidence intervals?
51. Now that you know how to use Fathom, we will construct a hypothesis test. Your friend claims that the average jersey number is 10. You think this is awfully low, especially since the top three leading free throw shooters are Dirk Nowitzki (#41), Ray Allen (#34) and Kobe Bryant (#24) for an average jersey number of 33. You decide to create a hypothesis test to verify your friend’s claim.

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52. Describe what you are searching for in terms of population parameters:

53. State the null hypothesis and the alternative hypothesis:

$H_0$ : \_\_\_\_\_

$H_a$ : \_\_\_\_\_

54. Calculate the mean of a sample of size 50 using the same methods we used to calculate our confidence intervals. Evaluate this statistic. Note  $\sigma = 15.8715$ .

55. State your P-value.

56. Write a sentence to state your answer in the context of the problem. Is your friend right? Is the average jersey number 10?

57. Design and test another **confidence interval** using this data. You will need to write up all of your work explaining clearly what you are testing.

58. Design and test another **hypothesis test** using this data. You will need to write up all of your work explaining clearly what you are testing.

59. Use the “Hypothesis Test” feature under the “Analyze” drop down menu and experiment with at least two tests. You will need to select a test from the drop down menu labeled Empty Test. Click and drag an attribute to that box, once you have selected the type of test to conduct. Once you have completed a test, highlight the test box then click on the “Test” drop down menu and select “Show Test Statistic Distribution.” For one of your tests, paste a copy of the test and its graph into your word document so that I can see it. Then try to state in your own words what you think Fathom is doing with these tests.

60. Experiment using the “Estimate Parameters” feature under the “Analyze” drop down menu. Experiment with at least two of the parameters listed. For one of the estimates: paste a copy of your parameter estimate into your word document so that I can see your work. State in your own words what you are reading from Fathom.

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The last two pieces of this special problem are designed to help you experiment with Fathom. I simply need to see that you are using Fathom and are interpreting the results correctly.

## AP Statistics Final Project

Now that you have demonstrated your understanding of statistics content on the AP exam, you get a chance to apply what you have learned in designing, carrying out, and presenting the results of a statistical study on a topic of your choosing. Choose a research question that you can answer using statistical methods that we have studied this year. Your project must involve data production, data analysis, probability models, and inference. This project will consume most of our class time and homework time from now until the end of the year. A detailed timeline and grading rubric follow.

### Project Timeline

Project overview; topic selection begun; groups/individuals  
*Topic and study design proposal due*  
Project work  
AP Exam discussed; course evaluation  
Project work  
*Checkup*  
Project work; data collection completed  
Project work; data analysis  
*Rough draft of written report due*  
Prepare for presentations  
*Written Reports due; Oral Presentations*  
*Oral Presentations*

### Grading Rubric

This project is worth 150 points, the points will be distributed as follows:

#### Topic/study design proposal **25**

*One-page, typed, double-spaced proposal detailing research question(s), rationale, proposed study design (very thorough), and anticipated method of data analysis*

Research question(s) – clear and achievable	5
Study design – thorough; proper use of terminology	10
Method of analysis – correct for the design	5
Communication quality – grammar, flow, organization, spelling	5

#### Checkup **10**

*Summary of progress made thus far, with specific reference to the individual contributions of all group members.*

Clear evidence of progress toward answering initial question(s)	5
Individual contributions significant and balanced	5

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**Performance assessment** **20**

*Daily observations of work; individual conferencing with project groups – 2 points per day*

**Rough draft** **10**

*Three to five-page, typewritten, double-spaced skeleton of the written report. Use the same major section headings as for the written report.*

**Written Report** **50**

*Final, typewritten, double-spaced report.*

Research question(s) and rationale	5
Study design, including any modifications made	10
Raw data summarized	5
Exploratory data analysis – graphical, numerical, verbal	15
Inference	15
Obstacles encountered and how addressed	5
Conclusion, including possible extensions	5
Communication quality – neatness, grammar, flow, organization, spelling	15

**Oral presentation** **35**

*10 to 15-minute class presentation of major aspects of your study.*

Meets time guidelines	3
Content accuracy – technical vocabulary used correctly	10
Presentation dynamics: Organization, flow, transitions, Voice quality	7
Visual aids (including something for posting in the classroom; required!)	10
Equitable participation of all group members	5