Mr. Moody, Hilliard Bradley High School

Statistics

COURSE DESCRIPTION:

KAP / AP Statistics is the high school equivalent of a one semester, introductory college statistics course. In this course, students develop strategies for collecting, organizing, analyzing, and drawing conclusions from data. Students design, administer, and tabulate results from surveys and experiments. Probability and simulations aid students in constructing models for chance phenomena. Sampling distributions provide the logical structure for confidence intervals and hypothesis tests. Students use a TI-83/84 graphing calculator, and Minitab statistical software, and Web-based java applets to investigate statistical concepts. To develop effective statistical communication skills, students are required to prepare frequent written and oral analyses of real data.

COURSE GOALS: In KAP Statistics, students are expected to learn

Skills

- To produce convincing oral and written statistical arguments, using appropriate terminology, in a variety of applied settings.
- When and how to use technology to aid them in solving statistical problems

Knowledge

- Essential techniques for producing data (surveys, experiments, observational studies, simulations), analyzing data (graphical & numerical summaries), modeling data (probability, random variables, sampling distributions), and drawing conclusions from data (inference procedures – confidence intervals and significance tests)

Habits of mind

- To become critical consumers of published statistical results by heightening their awareness of ways in which statistics can be improperly used to mislead, confuse, or distort the truth.

COURSE DESIGN:

- Students will be given written assignments, book work assignments, web-based readings and projects involving data collection or sampling in order to foster important classroom discussions pertaining to statistics and data analysis.
- An ongoing yearlong project that students may use to enhance their ever-improving skills of data analysis and exploration will ask that student analyze articles found in newspapers, magazines, websites, etc.. Included in the analysis will be a copy of the "article", a short synopsis of what was stated and the viewpoint of the author of the article. The students will then give their insights as to any perceived biases, inaccuracies, analysis of graphs and any possible ramifications of the study.
- Students will use the TI-83 or TI-84 calculators and the statistics package to analyze data and perform tests on data as well as design and enhance programs of their own to analyze data and perform tests.
- Students will use the computers from the media center, signed out by the teacher on a weekly basis to surf the web, use Minitab statistical software and use applets found at the *Practice of Statistics* website.

COURSE OUTLINE:

Text: The Practice of Statistics (3rd edition), by Yates Daniel S., Moore David S., and Starnes Daren S., W. H. Freeman & Co., 2008.

(referred to below as TPS) ISBN: 10-7167-7303-7-0

Course content	Assignment

Activity: Article analysis (ongoing yearlong project)	Requirements:
	1. Copy of Article with Date and Magazine/Newspaper
	2. One or two paragraph synopsis of what the article is saying
	This synopsis must include…
	     Data given in the article
	     Opinions given in the article
	     Ramifications given in the article
	     Any person or "agency" quoted in the article
	     3. One or two paragraphs giving your opinion on

	future possible ramifications or insights you made while analyzing the article.
Overview: What is Statistics? (4 days)	
Activity: Water, water everywhere Can students tell bottled water from tap water? This activity models the components of the statistical problem solving process: research question, data production, data analysis, probability model, and inference	<u>Handout:</u> Getting to know your classmates.
Data production methods: Surveys, experiments, and observational studies **Activity: Create bookmarks for** W^5WH <u>(Who, What, Why, When, Where, How and by Whom.)</u>	1. Read preliminary chapter section on data production <u>and</u> do P1-P5 (EC for P6) Read Pgs 12 – 18 and Do P7, P9, P10, P11
Data analysis fundamentals: Key questions; Individuals, variables: quantitative vs. categorical; basic graphical displays—dotplot, bar graph **Activity: Analyze data from infamous survey**	P19, P21, P22, P24, P27, P28
Unit 1: Producing Data – Surveys, Experiments, Observational Studies, and Simulations (9 days)	
Sampling: good and bad methods Voluntary response; convenience samples; Simple random sample (SRS); stratified sampling; cluster sampling, systematic sampling, multi-stage sampling	TPS 5.2, 5.6, 5.7, 5.9, 5.11, 5.24, 5.26, 5.32
Designing polls and surveys Undercoverage, nonresponse, question wording, potential bias; <u>Skill:</u> Choosing samples with technology	TPS 5.15, 5.16, 5.18, 5.19, 5.20, 5.25, 5.27
Long-term Project: Students work in teams of 3-4 to design and carry out a survey project on a topic of their selection, write a summary report, and give a 10-15 minute oral synopsis to their classmates.	
Basics of experimental design Subjects, factors, treatments, explanatory & response variables; completely randomized design	TPS 5.33, 5.35, 5.37, 5.39, 5.40, 5.43
Principles of experimental design: control, random assignment, replication; placebo effect; blinding and double-blinding; multi-factor experiments	1. TPS 5.45, 5.46, 5.67 2. AP Exam Free Response (surveys)
More advanced experimental designs Block designs (RCB); why block?; blocking vs. stratifying **Video:** *Against All Odds:* blocking	1. TPS 5.47, 5.55, 5.57 2. Begin Multiple Choice practice packet
Matched pairs designs A special form of blocking!; cross-over designs **Activity:** Standing vs. sitting pulse rate	1. TPS 5.48, 5.49, 5.62, 5.68 2. Continue practice packet
REVIEW OF PRODUCING DATA	Finish practice packet
TEST ON PRODUCING DATA	*Case study: magnets and pain*

Unit 2: Analyzing Univariate Data (9 days)	
Basic graphical displays: categorical variables—bar graphs and pie charts; quantitative variables—dotplots and stemplots	TPS 1.1, 1.2, 1.4, 1.5, 1.6
Displaying quantitative variables: histograms; constructing and interpreting; histograms vs. bar graphs <u>Skill:</u> Histograms on the calculator	TPS 1.7, 1.8, 1.11, 1.12, 1.26
Ogives and timeplots: Using ogives to determine percentiles from scores or scores from percentiles; seasonal variation, trends, cycles	1. TPS 1.13, 1.18, 1.25 2. AP exam free response (study design)
Numerical measures of center and spread/variability	TPS 1.27, 1.29, 1.31, 1.33, 1.35, 1.36

Mean, median, mode; Range, *IQR*; boxplots and the 1.5x*IQR* criterion for outliers Skill: Numerical summaries on the calculator	
Numerical measures of center and spread/variability standard deviation; determining which summary statistics to use when; changing units of measurement	TPS 1.39, 1.40, 1.42, 1.43, 1.45, 1.46
Comparing distributions Side-by-side or segmented bar graphs; back-to-back stemplots; parallel boxplots	TPS 1.47, 1.49, 1.50, 1.53
REVIEW OF ANALYZING UNIVARIATE DATA **Activity:** Matching boxplots, histograms, summary statistics	1. Multiple choice practice packet 2. Begin TPS 1.52, 1.55, 1.60, 1.61, 1.64, 1.66, 1.67, 1.70
SURVEY PROJECT WORK DAY	Finish practice packet and review questions
TEST ON ANALYZING UNIVARIATE DATA	*Case study: Nielsen ratings*
Short-term project: Critical statistical analysis – each student collects data and analyzes it using the techniques learned in this unit, prepares a written analysis. Evaluation using a four-point rubric like the AP Free Response questions.	

Unit 3: Describing location in a distribution (8 days)	
Measures of relative standing: percentiles and *z*-scores; Chebyshev's inequality	TPS 2.2, 2.3, 2.4, 2.7, 2.8
Density curves; Normal distributions and the 68-95-99.7 rule	TPS 2.9, 2.10, 2.12, 2.23, 2.24, 2.25
Introduction to Fathom software	Finish Fathom lab assignment
Standard Normal curve and table; Nonstandard Normal curves and calcuations	1. TPS 2.29, 2.32, 2.33, 2.35 2. Work on critical statistical analysis
Assessing normality: Normal probability plots; other graphical and numerical methods	TPS 2.36, 2.37, 2.38, 2.39, 2.50
PRACTICE PROBLEMS WITH DENSITY CURVES	TPS 2.43, 2.44, 2.45, 2.48, 2.54, 2.58, 2.59
SURVEY PROJECT WORK DAY	Prepare for Quiz
QUIZ ON UNIT 3	Finish Critical statistical analysis

Unit 4: Analyzing bivariate data (9 days)	
Scatterplots: constructing and interpreting Direction, shape, strength (and outliers) Skill: Making scatterplots on the calculator	TPS 3.1, 3.4, 3.5, 3.7, 3.9
Correlation: calculations & properties defining correlation; what affects correlation? **Activity:** Guess the correlation game (java applet)	TPS 3.13, 3.16, 3.19, 3.20, 3.23, 3.24
Introduction to linear regression: interpreting the slope and *y*-intercept in context; prediction vs. extrapolation Skill: Finding the LSRL on the calculator Skill: Interpreting computer regression output	TPS 3.29, 3.32, 3.33, 3.36, 3.38
More linear regression: the least-squares principle and properties $b = r \cdot s_y / s_x$; $(\overline{x}, \overline{y})$ on LSRL **Activity:** Java applet: minimizing sum of squared error **Activity:** Calculator discovery of LSRL properties	TPS 3.6, 3.34, 3.35, 3.37
Analyzing model quality: residuals & r^2 residual plots – constructing & interpreting; r^2 – calculation & interpretation Skill: residual plots on the calculator	TPS 3.39, 3.41, 3.43, 3.47
Unusual points in regression: outliers, influential points	1. TPS 3.60, 3.61, 3.62 2. Begin case study on new SAT scores

Cautions about correlation & regression	1. TPS 3.46, 3.55, 3.70, 3.71
	2. Begin Multiple choice practice packet
REVIEW OF ANALYZING BIVARIATE DATA	1. Finish multiple choice practice packet
	2. TPS 3.77, 3.80, 3.83, 3.84, 3.85
TEST ON ANALYZING BIVARIATE DATA	Case study: Are baseballs juiced?

Unit 5: More on Relationships between Two Variables (9 days)	
Transforming to achieve linearity powers and logs Skill: Transformations and regression models on the calculator	TPS 4.2, 4.4
Exponential models Exponential growth; log *y* transformation	TPS 4.5, 4.7, 4.9
Power models log *x*, log *y* transformation	TPS 4.11, 4.12
Choosing the best model with technology **Fathom lab** Skill: PwrReg and ExpReg on the calculator	AP Exam review assignment (from ARTIST website)
Relationships between categorical variables: marginal and conditional distributions	TPS 4.23, 4.24, 4.25
Relationships between categorical variables: Simpson's paradox	TPS 4.29, 4.31 through 4.35
Establishing causation: Lurking variables; causation, common response, and confounding	TPS 4.41, 4.45, 4.50, 4.51
REVIEW OF UNIT 4	TPS 4.37, 4.53, 4.54, 4.57
QUIZ ON UNIT 4	Case study: insurance

Unit 6: Probability (9 days)	
Simulations: Basic process and examples—one where labels represent individuals; one where labels represent outcomes of chance phenomenon	TPS 6.1, 6.3, 6.13
Basic probability concepts Probability as long-run relative frequency; randomness; legitimate probability models; sample spaces, outcomes, events **Activity:** Spin 123	TPS 6.23, 6.24, 6.27, 6.28, 6.29, 6.33, 6.36
Basic probability rules Addition rule for disjoint events; complement rule; Venn diagrams – union and intersection; equally likely outcomes	1. TPS 6.37, 6.39, 6.43, 6.44 2. Begin AP Exam review assignment (from ARTIST website)
Independence & the multiplication rule; general addition rule Definition of independent; multiplication rule for independent events	TPS 6.45, 6.47, 6.49, 6.61, 6.66, 6.67
Conditional probability General multiplication rule & tree diagrams	TPS 6.70, 6.72, 6.73, 6.78, 6.86(a)-(d)
Independence & Bayes' theorem Proving independence; disjoint vs. independent	TPS 6.71, 6.81, 6.82, 6.87, 6.90, 6.91
PRACTICE PROBLEMS WITH PROBABILITY **Activity:** No dice!	Begin practice packet
REVIEW OF PROBABILITY	Finish practice packet
TEST ON PROBABILITY	

Unit 7: Random Variables (6 days)	
Introduction to random variables Discrete vs. continuous; probability distributions; notation	TPS 7.2, 7.3, 7.4, 7.5, 7.7, 7.9
Mean and variance of a random variable; law of large numbers	TPS 7.25, 7.30, 7.32, 7.33, 7.43

Rules for means & variances linear transformations; linear combinations of random variables; independence	TPS 7.38, 7.39, 7.41, 7.47, 7.51
Combining Normal random variables **Activity:** Simulation approach	TPS 7.44, 7.45, 7.46, 7.50
PRACTICE PROBLEMS WITH RANDOM VARIABLES	TPS 7.55 through 7.60
QUIZ ON RANDOM VARIABLES	AP Exam review assignment (old free response questions)

Unit 8: Binomial & Geometric Random Variables (6 days)	
Binomial settings & the binomial random variable BINS; X = # of successes; introduction to calculating binomial probability	TPS 8.1, 8.3, 8.4, 8.5, 8.8, 8.11, 8.12
Binomial distributions: mean and variance Using the calculator; Binomial pdf vs. binomial cdf <u>Skill:</u> Binomial distributions on the calculator	TPS 8.13, 8.14, 8.16, 8.23
Normal approximation to the binomial distribution; binomial simulations Estimating binomial probabilities with Normal calculations	TPS 8.19, 8.24, 8.27, 8.29, 8.30
Geometric distributions BITS; Y = # of trials up to and including 1st success; calculating geometric probabilities **Activity:** Mr. Nerdly & the Birth Day Game	TPS 8.36, 8.41, 8.43, 8.44,
PRACTICE PROBLEMS WITH BINOMIAL & GEOMETRIC RV'S	TPS 8.50, 8.51, 8.52, 8.59, 8.60, 8.63, 8.65, 8.66, 8.67, 8.68
QUIZ ON BINOMIAL & GEOMETRIC RV'S	Case study: ESP

EXAM REVIEW: 3 DAYS

SEMESTER 1 EXAM: Simulated AP format with Multiple Choice, Short Answer, Free Response

Unit 9: Sampling distributions (7 days)	
What is a sampling distribution? Moving towards inference; bias and variability	TPS 9.1, 9.2, 9.3(a)(b), 9.5(a)(b), 9.6
Sampling distributions of $\hat{p}$ Mean and standard deviation of sampling distribution; normal approximation and rules of thumb **Activity:** Reese's Pieces Java Applet	1. TPS 9.8, 9.10, 9.19 2. Begin AP Exam review assignment
Sampling distributions of proportions: calculations and conditions	1. TPS 9.25, 9.27, 9.30 2. Continue AP Exam review assignment
Sampling distributions of $\overline{x}$ Mean and standard deviation of sampling distribution; Central Limit Theorem (CLT) **Activity: Rice University Java applet**	TPS 9.24, 9.31, 9.33
Calculations involving $\overline{x}$ Normal population distribution vs. CLT	TPS 9.35, 9.37, 9.38, 9.47
PRACTICE PROBLEMS WITH SAMPLING DISTRIBUTIONS	TPS 9.49, 9.50, 9.51, 9.58
QUIZ ON SAMPLING DISTRIBUTIONS	Finish AP Exam review assignment

Unit 10: Estimating an unknown parameter (9 days)	
Idea of a confidence interval; connect with sampling distributions **Activity:** Confidence interval capture simulation on	TPS 10.1, 10.2, 10.5, 10.6

calculator and computer	
Confidence interval for μ *when* σ *known* Inference toolbox introduced	TPS 10.7, 10.9, 10.11, 10.12
Confidence interval considerations Changing confidence level; interpreting CI vs. interpreting confidence level; determining sample size	TPS 10.15 through 10.18
Confidence interval for μ *when* σ *is unknown:* t-distributions and the one sample t interval	TPS 10.13, 10.27, 10.28, 10.31
Paired t procedures & Robustness of t procedures <u>Skill:</u> Performing t procedures on the calculator	TPS 10.35, 10.36, 10.42
Estimating an unknown population proportion CI's for p with the inference toolbox	TPS 10.45, 10.46, 10.47, 10.49
Determining sample size for proportion intervals	1. TPS 10.52, 10.54, 10.55 2. Begin practice packet
PRACTICE PROBLEMS WITH CI's for a single population parameter	1. TPS 10.66, 10.68, 10.72, 10.73 2. Finish practice packet
TEST ON ONE-SAMPLE CI'S	Case study: Need help? Give us a call!

Unit 11: Testing a Claim (8 days)	
Introduction to significance testing; Stating hypotheses **Activity:** Pick a card	TPS 11.1, 11.3(a), 11.5, 11.6
Components of a significance test: Conditions, calculations, interpretation; one-sided vs. two-sided tests; statistical significance and P-value	TPS 11.7, 11.8, 11.11, 11.12, 11.13, 11.14
Inference Toolbox & Tests from CI's duality	TPS 11.27, 11.29, 11.31 to 11.33
Uses and abuses of tests Statistical significance vs. practical importance;	TPS 11.43 to 11.48
Type I & II errors, Power Type I and II error in context; connection between power and Type II error **Activity:** Calculator program that connects these three concepts	TPS 11.49, 11.51, 11.53, 11.55, 11.56, 11.57
REVIEW OF SIGNIFICANCE TESTS	11.36, 11.65, 11.66, 11.71, 11.72, 11.73
AP EXAM PRACTICE DAY	Complete practice packet
TEST ON SIGNIFICANCE TESTS	Case study: I'm getting a headache!

Unit 12: Significance Tests in Practice (6 days)	
Testing a claim about μ *:* the one-sample t test	TPS 12.1, 12.3, 12.6, 12.20
Paired t tests <u>Skill:</u> t tests on the calculator and computer	TPS 12.9, 12.10, 12.12, 12.16
Testing a claim about p Significance tests with the inference toolbox <u>Skill:</u> Proportion inference on the calculator	TPS 12.23, 12.24, 12.25, 12.30
What if the conditions aren't met? A brief look at some nonparametric testing options	TPS 12.31, 12.33, 12.34, 12.37, 12.38
REVIEW OF ONE-SAMPLE TESTS	Practice packet
QUIZ ON ONE-SAMPLE TESTS	Case study: Do you have a fever?

Unit 13: Comparing Two Population Parameters (8 days)	
Comparing two population parameters: paired data vs. independent samples; estimating $\mu_1 - \mu_2$	TPS 13.1 to 13.4, 13.11
Two-sample t tests and assorted df possibilities	TPS 13.5, 13.7, 13.8, 13.9
Fathom lab: two-sample t	TPS 13.13, 13.14, 13.15, 13.17

Estimating $p_1 - p_2$: the two-proportion z interval	TPS 13.25, 13.27, 13.23
Significance test for comparing two population proportions	TPS 13.29, 13.32, 13.33, 13.39
AP EXAM REVIEW DAY	Begin TPS 13.40, 13.41, 13.44, 13.45, 13.46, 13.47
REVIEW OF TWO-SAMPLE INFERENCE	Finish practice problems
QUIZ ON TWO-SAMPLE INFERENCE	Case study: Fast Food Frenzy!

Unit 14: Inference about Distributions of Population Proportions (6 days)	
Chi-square goodness of fit test The chi-square family of distributions **Activity:** M&M color distributions	TPS 14.1, 14.5, 14.8
Chi-square test of homogeneity Independent SRS's or randomized experiments	TPS 14.11, 14.15, 14.16, 14.18
Chi-square test of association/independence Distinguishing between homogeneity and association/independence questions <u>Skill:</u> Chi-square tests on the calculator	TPS 14.22, 14.24, 14.25, 14.29
PRACTICE PROBLEMS WITH CHI-SQUARE	TPS 14.35, 14.36, 14.39, 14.41
AP EXAM REVIEW DAY	Practice for Quiz on Chi-square
QUIZ ON CHI-SQUARE	Case study: Does acupuncture promote pregnancy?

Unit 15: Inference about Linear Regression (2 days)	
The linear regression model Population vs. sample regression lines; CI for slope **Activity:** Investigating Old Faithful eruption data	TPS 15.2, 15.3, 15.9
Significance tests about β Nasty formulas; computer output; abbreviated inference toolbox <u>Skill:</u> Regression inference on the calculator	TPS 15.8, 15.15, 15.16

AP EXAM REVIEW (6 days)
- TPS Part Review Exercises
- Practice AP Free Response Questions
- Mock Grading Sessions
- Rubric development by student teams
- Practice Multiple Choice Questions

AP STATISTICS EXAM (1 DAY)

AFTER THE AP EXAM: Students complete a final project, alone or in teams, on a topic of their choosing. Both a written analysis and a brief oral presentation are required for this project.

<u>Evaluation (Grading):</u>   Your grade in this course will be determined by your performance on tests, quizzes, homework, graded assignments, projects, and exams. *Late work is penalized 10% per day.*
- **Tests**   Tests will be given about once every 3 weeks. Corrections with reflections may be made on any test for up to half-credit. I will provide more information following our 1st test.
- **Quizzes**   There will be occasional announced quizzes on course content. Corrections are generally not available for quizzes.
- **Homework**   Homework will be inspected and/or collected regularly. For each assignment, a ☑will be awarded for a satisfactory effort to complete all assigned questions according to directions

provided in class within a one hour time limit. A ☑+ may be awarded for exceptional work, and a ☑- may be awarded for incomplete work or for failure to follow prescribed format. You begin each quarter with a homework grade of 90 points (out of a possible 100). A ☑+ raises your homework average by 2 points, while a ☑- lowers it by 2 points. Failure to submit an assignment deducts 5 points from your homework average. You will receive one HOMEWORK PASS per quarter that you may submit in lieu of an assignment. You may also "redeem" an unused pass at the end of a quarter for a 5 point increase in your homework average.

"Flashback" problems, which will often be graded, should be written up separately.

- **Graded assignments**   Computer assignments, labs, CSA's, and cumulative reviews will be scored on their statistical accuracy, organization, appearance, and communication quality.
- **Project** I will distribute a grading rubric with each project. Remember that each member of your group will earn the same grade, and that I expect you to do an equal amount of work.
- **Exams**   There will be a first semester exam during the scheduled exam week. In addition, there will be a final practice AP exam that counts for 2 test grades. Seniors with low grades and/or effort marks may be required to take a final exam second semester.

Obtaining your grade: Here is how you can determine your course average: Your *quarter grade* will be determined by computing $\frac{\text{Points earned}}{\text{Points possible}} \times 100$. Your *semester grade* will be determined by computing 80% of your pre-exam average plus 20% of your exam score (on a 100 point scale).

On the pages that follow, you will find descriptions of a typical case study and a CSA, as well as details of our survey project (1st semester) and our final project (2nd semester).

Chapter 1 Case Study   Nielsen Ratings

What does it mean to say that a TV show was ranked #1? The Nielsen Media Research company randomly samples about 5100 households and 13,000 individuals each week. The TV viewing habits of this sample are captured by metering equipment, and data is sent automatically in the middle of the night to Nielsen. Broadcasters and companies that want to air commercials on TV use the data on who is watching TV and what they are watching. The results of this data gathering appear as Ratings on a weekly basis. For more information on the Nielsen TV Ratings, go to www.nielsenmedia.com, and click on "About Us." Then under "Related," select "What Are TV Ratings?"

Here are the top primetime shows for viewers ages 18 to 49 during the week of November 22-28, 2004.

SHOW	NETWORK	Viewers (millions)
1. Desperate Housewives	ABC	16.2
2. CSI	CBS	10.9
3. CSI: Miami	CBS	10.5
4. Extreme Makeover: Home Edition	ABC	9.7
5. Two and a Half Men	CBS	8.8
6. Without a Trace	CBS	8.2
7. Raymond	CBS	8.0
8. Law & Order: SVU	NBC	7.8
Monday Night Football	ABC	7.8
Survivor: Vanuatu	CBS	7.8
11. Seinfeld Story	NBC	7.6
12. Boston Legal	ABC	7.4
13. Apprentice	NBC	7.1

14. Fear Factor	NBC	6.5
15. Amazing Race	CBS	6.1
CSI: NY	CBS	6.1
17. NFL Monday Showcase	ABC	5.7
18. According to Jim	ABC	5.5
19. 60 Minutes	CBS	5.4
Biggest Loser	NBC	5.4

Source: *USA Today,* December 2, 2004

Which network is winning the ratings battle? Give appropriate statistical evidence to support your answer.

AP STATISTICS
Critical Statistical Analysis (CSA) #1: Exploring Quantitative Data
DUE:

Locate a set of quantitative data (at least 25 data values) in a newspaper, magazine, periodical, recent book, or on the Internet. YOU must obtain this data without consultation from other students. Be certain to make a copy of the source data and to record the bibliographical information. They are part of the CSA scoring rubric.

Once you have obtained your data, use appropriate graphical (dotplots, stem-and-leaf plots, boxplots, histograms) and numerical (mean, median, mode, IQR, range, standard deviation, 5 number summary) descriptive techniques to present the data. Then, write a narrative analysis of the data in context based on your graphical and numerical summaries. Comment on each of your graphical representations. Discuss which display(s) and statistics are most helpful in exposing the key features of the data set. Use appropriate terminology, and write in complete, grammatically correct sentences. DO NOT discuss your analysis with any other person – it is to be your own work. Aim for one page of narrative and one to two pages of figures.

Your CSA will be evaluated on: accuracy of graphical representations and numerical summaries, quality of your written analysis, neatness, and organization. The marking guide follows.

Accuracy of Graphical/Numerical Summary Techniques

4   4   The student has used all required statistical techniques correctly and appropriately. All minor points are included.

3   3   The student has generally used each of the required statistical techniques correctly and appropriately. There may be minor omissions or errors.

2   2   The student has used some of the required statistical techniques correctly and appropriately. There are, however, significant errors in one or more techniques or a plethora of minor mistakes.

1   1   The student has made some attempt to use required techniques correctly and appropriately, but the effort is flawed in some major way.

0   0   The student has used inappropriate techniques for the given set of data.

Quality of Statistical Analysis

4   The student thoroughly and accurately discusses the implications of the statistical techniques employed in the context of the data. Correct terminology is used throughout.

3   The student accurately describes the implications of the statistical techniques employed in the context of the data and generally uses correct terminology. There are minor omissions/errors.

2   The student produces a generally accurate interpretation of the statistical techniques employed with some use of appropriate terminology or with inadequate connection to context. A key omission or inaccurate conclusion may also have been made.

1   The student attempted to interpret the statistical techniques that were employed, but failed to expose some key ideas. Terminology and reference to context are inadequate or missing.

0   The student interprets the statistical techniques employed incorrectly or not at all.

Organization, Transition, Appearance

4   The CSA shows evidence of careful organization, flows naturally from statistical technique to statistical analysis, and is neat in appearance.

3   There are minor flaws in **one** of the areas: organization, transition, appearance.

2   There are major flaws in **one** of the areas: organization, transition, appearance, OR minor flaws in **two** areas.

1   Completely inadequate in **two** of: organization, transition, appearance.

0   Inadequate in all three areas.

English Mechanics

4   The student's writing is grammatically correct, is punctuated properly, and flows logically from one point to the next. No spelling mistakes!

3   The student's writing has a minor flaw in **one** of the areas: grammatically correct, punctuated properly, logical flow, spelling.

2   The student has made significant errors in **one** of the areas: grammatically correct, punctuated properly, logical flow, spelling, OR minor flaws in **two** areas..

1   The student's writing has major flaws in **two** of the areas: grammatically correct, punctuated properly, logical flow, spelling.

0   The student's writing has major flaws in **more than two** of the areas: grammatically correct, punctuated properly, logical flow, spelling.

Source Documentation

4   The student has selected a source that is appropriate for the assignment and has correctly referenced the source.

3   The student has selected a source that is appropriate for the assignment, but has made some error or omission in the citation.

2   The chosen source is slightly inappropriate for the assignment OR referencing is incomplete or inaccurate.

1   The chosen source is inappropriate.

0   No source documentation is provided.

Scoring Guide: Your grade on this CSA will be determined based on your total points, as follows:

21-24	A
16-20	B
11-15	C
6-10	D
< 6	F

AP Statistics Survey Project

Phase I: Team members brainstorm possible survey topics on issues of school interest

Phase II: Each team submits a typed proposal describing:
- Topic/question of interest
- Background motivation for selecting this topic/question
- Questions to be included in the survey
- Methodology
  - The type of sampling procedure do you intend to use – stratified, cluster, SRS, or systematic
  - Precise description of your randomization, including labeling
  - When, where, and how you will administer the survey

Phase III: Select your sample and administer your survey

Phase IV: Organize, summarize, and analyze your data

Phase V: Prepare a written report that documents your survey. Follow these guidelines.

Your written report should include each of the sections described below. The finished product will be evaluated according to the rubric on the attached page, so read it carefully.

- Topic/Question – should be descriptive, and eye-catching

- Background – Why did you decide to investigate this topic/question?

- Methodology – This should be clear enough so that anyone who reads your description could replicate the survey effortlessly.

  - Describe and defend your chosen sampling procedure.
  - Detail your randomization process.
  - Carefully explain when, where, and how you administered the survey.
  - Provide a copy of your survey.

- Data – Organize your data in tabular form.

- Analysis – Include appropriate graphical and numerical summaries – bar graphs, pie charts, counts, proportions, percents.

- Interpretation – Discuss what the data tells you about the topic/question you chose. What generalizations might you draw about the population from which the sample was drawn?

- Pitfalls and extensions – Share any difficulties you experienced during the survey project. What might you do differently if you were to repeat the survey? Are there any possible extensions of this survey project that might prove interesting?

Phase VI: Class Presentation – a ten minute opportunity for you to share the critical aspects of your survey project with your classmates. Make it interesting!! See the attached grading guide.

AP Statistics Survey Project Scoring Rubric

Topic/question and Background

4   The topic/question selected is clearly stated, is of interest to the school community, and is appropriately narrow in scope. The background provided gives strong motivation for the team's choice of this topic/question and delineates its relevance to the school community.

3   The topic/question selected is clearly stated, is of interest to the school community, and is appropriately narrow in scope. The background provided gives considerable support for the team's choice of this topic/question, and some attempt is made to show its relevance to the school community.

2   Either the topic/question is flawed in one of the areas: clearly stated, of interest to the school community, appropriately narrow in scope OR the background provided fails in either its support for the chosen topic/question or the relevance to the school community.

1   Both the topic/question and the background provided are flawed in at least one area. However, one or both satisfactorily address at least half of the areas specified.

0   Neither the topic/question nor the background provided satisfactorily address at least half of the specified areas.

Methodology – Sampling Procedure

4   The chosen sample procedure is appropriate for addressing the selected topic/question, is described accurately, and is implemented according to the stated plan.

3   The chosen sample procedure satisfies two of the three criteria mentioned above, but is weak in the other area.

2   The chosen sample procedure satisfies two of the three criteria completely, and does not satisfy the third requirement OR the chosen sample procedure satisfies one of the three criteria completely and the other two partially.

1   The chosen sample procedure satisfies one of the three criteria completely, and one of the other two criteria partially.

0   The chosen sample procedure does not satisfy any of the three criteria completely.

Methodology – Randomization

4   The randomization process includes a clear and correct labeling of subjects, a description of the number selection process (random number table or calculator), and the results of that randomization (i.e. the numbers and subjects chosen). In addition, the randomization process matches the chosen sampling procedure.

3   The randomization process includes all three components listed above. However, clarity of communication would prevent easy replication of this randomization. Still, the randomization process matches the chosen sampling procedure.

2   The randomization process includes all three components listed above. However, the randomization process does not match the chosen sampling procedure OR the randomization process matches the chosen sampling procedure, but the clarity of communication would prevent easy replication of this randomization, in spite of it being correctly designed and implemented.

1   There is some flaw in the randomization procedure itself. Some aspect of the randomization – labeling, number selection, or results is completely correct.

0   The randomization is flawed in all three areas – labeling, number selection, and results.

Methodology – Administration of Survey

4   The survey is administered according to the stated plan. All those selected in the randomization process actually complete the survey successfully. No evidence of bias is present.

3   The survey is administered almost entirely according to the stated plan. Nearly all of those selected in the randomization process complete the survey successfully. No evidence of bias.

2   The survey is administered almost entirely according to the stated plan, and nearly all of those selected actually complete the survey. Some evidence of bias is present. OR The survey administration deviates from the stated plan in some way that does not introduce bias, but that might impact who completes the survey.

1   Bias has impacted the survey administration to a great extent, but the stated plan was generally followed OR the administration procedure deviated markedly from the stated plan, with some bias.

0   The administration process deviates markedly from the stated plan and bias is noticeable.

Methodology – The Survey

4   Survey questions have all been pre-tested and refined. They are clear and unbiased.

3   Survey questions have all been pre-tested and refined. They are unbiased, but somewhat unclear.

2   Survey questions have been pre-tested, but not completely refined or show some bias.

1   Survey questions have not been pre-tested, but are somewhat clear and relatively unbiased.

0   Survey questions are unclear and show distinct bias.

Data Recording and Summarization

4   Original data provided and summarized in appropriate tabular form. Neat and accurate.

3   Original data provided and summarized in tabular form, but with a minor error in tabulation or sloppy presentation.

2   Either original data is omitted, but the data is summarized neatly and accurately in tabular form OR the original data is presented, and there is a major flaw in the presentation of the data (but not in the accuracy of the tally).

1   Original data is provided, but is not appropriately tabulated OR the original data is omitted but the data is summarized partially correctly in tabular form.

0   Original data is not provided and the data is not tabulated appropriately.

Interpretation

4   The student thoroughly and accurately interprets the meaning of the graphical and numerical summaries in the context of the data. In addition, the student identifies any generalizations that may be drawn about the population from which the sample was drawn.

3   The student interprets the meaning of the graphical and numerical summaries in the context of the data correctly, except for minor errors or omissions. In addition, the student identifies any generalizations that may be drawn about the population from which the sample was drawn.

2   The student accurately interprets the meaning of either the graphical or numerical summaries in the context of the data, but makes serious errors/omissions in interpreting the other. In addition, the student identifies any generalizations that may be drawn about the target population.

1   The student makes a genuine attempt to interpret both the numerical and graphical summaries, but fails to completely or correctly address either one. The student might also omit generalizations to the target population.

0   The student's interpretation of both the numerical and graphical summaries is inadequate.

Graphical and Numerical Summaries

4   The student has correctly summarized the data using bar graphs/pie charts and counts/proportions/percentages. Graphs and calculations are neat and accurate.

3   The student has correctly summarized the data using bar graphs/pie charts and counts/proportions/percentages, but has made a minor error in either computation or graphing.

2   The student has correctly summarized the data either graphically or numerically, but has made a major error in the other component.

1   The student has used appropriate techniques to summarize the data either graphically or numerically, but has not executed the techniques correctly.

0   Neither the graphical nor the numerical summary is appropriate.

Pitfalls and Extensions

4   The student articulates all pitfalls encountered, and clearly explains how (s)he dealt with each of these obstacles. In addition, the student shares at least one plausible extension of the survey project.

3   The student articulates all pitfalls encountered, and explains how (s)he dealt with each obstacle, though not in a clear manner. In addition, the student shares at least one plausible extension of the survey project.

2   The student articulates some of the pitfalls encountered, and explains how (s)he dealt with some of these obstacles. The student also shares at least one plausible extension of the survey project.

1   The student articulates some pitfalls encountered, but does not explain how (s)he dealt with these obstacles or does not share at least one plausible extension of the survey project.

0   The student does not articulate the obstacles (s)he encountered.

English Mechanics

4   The student's writing is grammatically correct, is punctuated properly, and flows logically from one point to the next. No spelling mistakes!!

3   The student's writing is grammatically correct, is punctuated properly, and flows logically from one point to the next, except for minor errors in **one** of these categories. No spelling mistakes!!

2   The student has made significant errors in one of the areas: grammar, punctuation, spelling, flow OR minor errors in two areas.

1   The student's writing is flawed in two or three of the areas: grammar, punctuation, spelling, flow.

0   The student's writing is deficient in all four areas: grammar, punctuation, spelling, flow.

Scoring Guide: 35 – 40 A
                            26 – 34 B
                            17 – 25 C
                            10 – 16 D
                            < 10 F

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

Thursday, May 5	Project overview; topic selection begun; groups/individuals
Monday, May 9	*Topic and study design proposal due*
Tuesday, May 10	Project work
Wednesday, May 11	AP Exam discussed; course evaluation
Thursday, May 12	Project work
Monday, May 16	*Interim report due*
Tuesday, May 17	Senior Day
Wednesday, May 18	Project work; data collection completed
Thursday, May 19	Project work; data analysis
Monday, May 23	*Rough draft of written report due*
Tuesday, May 24	Prepare for presentations
Wednesday, May 25	*Written Reports due; Oral Presentations*
Thursday, May 26	*Oral Presentations*

Grading Rubric

This project is worth 250 points, to be allocated as follows:

Topic/study design proposal   25   due: Monday, May 9th
   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

Interim report   25   due: Monday, May 16th
   One to two-page, typewritten, double-spaced 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)   10
   Individual contributions significant and balanced   10
   Communication quality – grammar, flow, organization, spelling   5

Performance assessment   50
   Daily observations of work; individual conferencing with project groups – 5 points per day

Rough draft   **25**   **due Monday, May 23rd**

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   **75**   **due Wednesday, May 25th**

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   **50**   **Wed, May 25 or Thurs, May 26**

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

Meets time guidelines	5
Content accuracy – technical vocabulary used correctly	20
Presentation dynamics: Organization, flow, transitions, Voice quality	10
Visual aids	10
(including something for posting in the classroom; required!)	
Equitable participation of all group members	5