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KAP Statistics – Syllabus 2012-2013

Textbook: The Practice of Statistics, Yates, Moore & McCabe
Students will use TI-83/84/86/89 graphing calculators
Computer Resources: Fathom, Java Applets, Teacher created simulation programs

On most assignments, quizzes, and exams, students are expected to use one of the previously mentioned graphing calculators. I use all of the previously mentioned graphing calculators with either an overhead display or on the TV screen. Each chapter in the main text has a section on calculator use to give students instruction and practice for the TI-83/84. I give them instruction for how to do the same things with the TI-86/89. On some assignments and activities, students use the previously mentioned computer resources. Using graphing calculators and computer resources encourages the students' active engagement in doing statistics, enhancing their development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

Labs will be an integral part of the course from the first week of classes on. It is in the labs that students really learn how to do statistics. Each lab will require students to examine one or more problem situations, decide on an appropriate technique and/or experimental design, verify conditions, perform the statistical calculations, analyze the results, and draw conclusions.

Course projects, given throughout the year, are in the form of extended formal writing assignments in which form and technical adequacy are enforced. Through these projects, students gain strong experiences in developing statistical studies and making sound connections and judgments between the design and the results of an experiment. Students will clearly be able to describe their experimental design process from design to collection of data to descriptive report of their results, drawing connections between all aspects of the statistical process, including design, analysis, and conclusions. See Chapter 5 and Chapter 13 for specific examples.

Students will gain proficiency on accuracy and communication of statistical concepts, using the vocabulary of statistics, throughout the course, to include effectively communicating how methods, results, and interpretations of data for any given study, simulation, or experiment are valid. Writing complete sentences using appropriate justifications is learned to be a critical aspect of gaining statistical proficiency. This is emphasized on all homework assignments, write-ups from activities, investigations and experiments, and especially on student assessments. Every student assessment has a matching vocabulary section. And every assessment has a free response section that gives students the opportunity to use statistical vocabulary when communicating methods, results, and interpretations relevant to each chapter. Students also review each

other's responses on released AP Statistics free response questions, throughout the year and especially just before the AP Exam. Students work in groups using rubrics to score responses. Class time is spent discussing differences in their scores, helping students learn what constitutes an effective response.

Chapter 1: Exploring Data (6 days)

Text: 1.1, 1.2
Exploring Data: Describing patterns and departures from patterns.
A. Creating and interpreting graphical displays of data
   • Dotplot
   • Stemplot
   • Histogram
   • Frequency plot
   • Box plot
B. Measures of center and spread:
   • Range
   • Mean
   • Median
   • Standard deviation
   • Quartiles
C. Outliers
   • When are they ignored?
D. Clusters and gaps
E. Changing units
F. Variation within groups
G. Variation between groups
H. Comparing distributions

Technology: Graphing calculator to graph histograms, frequency plots, and box
             plots, as well as to calculate standard deviation and quartiles
Test, Homework, Vocabulary Quiz
Labs: Heart Rate study, Simple Survey of Personal Information
Reading: Essay on "Lies, Damn Lies…"

Chapter 2: The Normal Distribution (7 days)

Exploring Data: Describing patterns and departures from patterns.
Text: 2.1, 2.2
A. Shape of distributions
B. Standardizing observations
      • Examining the Standard Normal Distribution
C. Changing units
      • Any normal distribution can be standardized

Technology: Computer resources for normal distributions (applets)
Test, Homework, Vocabulary Quiz

Labs: Grains of salt on graph paper

Chapter 3: Examining Relationships (8 days)
Text: 3.1, 3.2, 3.3
Exploring Data: Describing patterns and departures from patterns.
A. Looking for patterns in scatterplots
     • How to examine data visually
B. Correlation and linearity
     • Drawing best fit line
C. Least-squares regression lines
     • Computing correlation values
     • Drawing regression lines
D. Residual plots
E. Outliers
     • When to include or not
F. Influential observations

Technology: Graphing calculators to graph scatterplots and least-squares regression lines; Graphing calculators, computer resources, and computer output to calculate and interpret least-squares regression lines
Test, 2 Quizzes, Homework, Vocabulary Quiz
Labs: SAT scores, shoe size vs. height, 1600 m times vs. 5000 m times

Chapter 4: More on Two Variable Statistics (8 days)
Text: 4.1, 4.2, 4.3
Exploring Data: Describing patterns and departures from patterns.
A. Transforming variables to achieve linearity
     • Exponential regression
     • Power regression
B. Marginal and joint frequencies
C. Correlation
D. Regression

Technology: Graphing calculators to graph and calculate exponential and power regression models
Test, Homework, Vocabulary Quiz
Labs: Flipping pennies onto graph paper, Computer simulation of fish population

Chapter 5: Producing Data (6 days)
Text: 5.1, 5.2, 5.3
Sampling and Experimentation: Planning and conducting a study.
A. Samples and Experiments
     • How to design a sample
     • How to design an experiment

B. How are samples and experiments different?
C. Bias
D. Simulation
E. Evaluating Experiments

Technology: See lab below
Test, Homework, Vocabulary Quiz
Labs: Class survey, Computer simulation of a random sample survey
        Design an Experiment
Reading: Should the U.S. census use random sampling? (will be revisited)

PROJECT: Students will design and conduct an experiment to investigate the
effects of response bias in surveys. They may choose the topic for their surveys,
but they must design their experiment so that it can answer at least one of the
following questions:

• Can the wording of the question create response bias?
• Do the characteristics of the interviewer create response bias?
• Does anonymity change the responses to sensitive questions?
• Does manipulating the answer choices change the responses?

PROJECT PROPOSAL:

• Describe the topic and state which type of bias is being investigated
• Describe how to obtain subjects (minimum sample size of 50)
• Describe what questions will be and how they will be asked, including how to
   incorporate direct control, blocking, and randomization

• RESULTS: Present the data in both tables and graphs in such a way that
   conclusions can be easily made. Make sure to label the graph/tables clearly
   and consistently.

* CONCLUSIONS: What conclusions can be drawn from the experiment? Be
specific. Were any problems encountered during the project? What could be
done different if the experiment were repeated? What was learned from this
project?

Chapter 6: Probability: The Study of Randomness (10 days)
        Text: 6.1, 6.2, 6.3
        Anticipating Patterns: Exploring random phenomena using
        probability and simulation
        A. Anticipating Patterns: Exploring random phenomena
                • Interpreting probability
                • Long-run relative frequency interpretation
                • Addition rule

• Multiplication rule
• Conditional probability
• Independence

Technology: Random number generator on graphing calculator to explore
random phenomena
Test, Homework, Vocabulary Quiz
Labs: Computer simulation of free throws, computer simulation of random walks

Chapter 7: Random Variables (7 days)
Text: 7.1, 7.2
**Anticipating Patterns: Exploring random phenomena using
probability and simulation**
A. Probability
• "Law of Large Numbers" concept
• Discrete random variables and their probablility distributions
• Simulation of random behavior and probability distributions
• Mean (expected value) and standard deviation of a random variable,
• linear transformations of a random variable
B. Combining independent random variables
• Notion of independence versus dependence
• Sums and differences of independent random variables

Technology: See lab below
Test, Homework, Vocabulary Quiz
Labs: Game of Craps, Roll Dice, Computer simulation of various dice

Chapter 8: The Binomial and Geometric Distributions (7 days)
Text: 8.1, 8.2
**Anticipating Patterns: Exploring random phenomena using
probability and simulation**
A. Probability
• Discrete random variables and their probability distributions,
• Geometric distributions and rules
• Binomial distributions and rules

Technology: Graphing calculator distribution menu to work with binomial and
                    geometric distributions; See lab below.
Test, Quiz, Homework, Vocabulary Quiz
Labs: Computer simulation of 'x' children families

Chapter 9: Sampling Distributions (10 days)
Text: 9.1, 9.2, 9.3
**Anticipating Patterns: Exploring random phenomena using
probability and simulation**
A. Sampling Distributions

- Sampling distribution of a sample proportion
- Sampling distribution of a sample mean
- Central Limit Theorem
- Simulation of sampling distributions
- Bias of a statistic

Technology: Graphing calculator and computer to simulate sampling
                   distributions for sample proportions and sample means
Test, Homework, Vocabulary Quiz
Labs: Height of women, Height of men

Chapter 10: Sampling Distributions (15 days)
Text: 10.1, 10.2, 10.3, 10.4
Statistical Inference: Estimating population parameters and
testing hypotheses
A. Estimation (point estimators and confidence intervals)
- Estimating population parameters
- Margins of error
- Logic of confidence intervals
- Meaning of confidence level and confidence intervals
- Properties of confidence intervals
B. Tests of significance
- Logic of significance testing
- Null and alternative hypotheses
- p-values
- One and two-sided tests: Type I and Type II errors
- Concept of power

Technology: Graphing calculator significance test menu for hypothesis testing
                   and calculating p-values
Test, 2 Quizzes, Homework, Vocabulary Quiz
Labs: Measuring pencils from a box of golf pencils

Chapter 11: Inference for Distributions (6 days)
Text: 11.1, 11.2
Statistical Inference: Estimating population parameters and
testing hypotheses
A. Estimation (point estimators and confidence intervals)
- Confidence interval for a mean
- Confidence interval for a difference of means (unpaired/paired)
B. Tests of significance
- Test for a mean
- Test for a difference of means (unpaired/paired)
- Sampling distribution for difference of two independent sample means

Technology: Graphing calculator significance test menu for hypothesis testing
                      and calculating p-values
Test, Homework, Vocabulary Quiz
Labs: Paper airplane flight characteristics

Chapter 12: Inference for Proportions (6 days)

Text 12.1, 12.2
**Inference: Estimating population parameters and
testing hypotheses**
A. Estimation (point estimators and confidence intervals)
   • Large sample confidence interval for a proportion
   • Large sample confidence interval for a difference between two
          proportions
B. Tests of significance
   • Large sample test for a proportion
   • Large sample test for a difference between two proportions
   • Sampling distribution for difference of independent sample proportions

Technology: Graphing calculator significance test menu for hypothesis testing
                      and calculating p-values
Test, Homework, Vocabulary Quiz
Labs: Spinning coins vs. flipping coins

Chapter 13: Inference for Tables: Chi-Square Procedures (8 days)

Text: 13.1, 13.2
**Inference: Estimating population parameters and
testing hypotheses**
A. Test of Goodness of Fit
   • Computing chi-square statistic
   • Degrees of freedom
   • Expected count
   • Two-way tables
B. Inference of Two-Way Tables
   • Chi-square and the Z-test
   • Comparing population proportions

Technology: Graphing calculator, computer, and computer output to calculate
                      and/or interpret a goodness of fit test
Test, Quiz, Homework, Vocabulary Quiz
Labs: M&M color distribution, Distribution of bolts in sample box
Reading: Come back to census essay

PROJECT: Students will design and conduct a study or experiment to investigate
statistical inference. They may choose their own topic provided it incorporates
confidence intervals and/or tests of significance or goodness of fit tests.

PROPOSAL: The proposal should:
- Describe the topic
- Describe the parameter of the confidence interval or the hypothesis test
- State the hypothesis
- Describe the design and how data will be gathered so as to limit bias (random sampling, randomization, controlling variables)

RESULTS: Present the data in both tables and graphs in such a way that conclusions can be easily made. Make sure to label the graphs/tables clearly and consistently. Clearly show the calculations for the confidence interval and/or test statistic and p-value.

CONCLUSIONS: What conclusions can be drawn from the confidence interval and/or p-value? Was the sample size or number of observations large enough? Be specific. Were any problems encountered during the project? What could be done differently if the experiment were to be repeated? What was learned from this project?

Chapter 14: Inference for Regression (8 days)
Text: 14.1, 14.2, 14.3
Statistical Inference: Estimating population parameters and testing hypotheses
A. Estimation (point estimators and confidence intervals)
   • Confidence interval for the slope of a least-squares regression line
B. Tests of significance
   • Test for the slope of a least-squares regression line

Technology: Computer output for calculating and interpreting confidence intervals and hypothesis tests for the slope of a least squares regression line
Test, Homework, Vocabulary Quiz
Labs: Legacy of Jet Skis

Review For AP Exam (10 days)

Practice AP Tests, Homework
Labs: Practice using calculators