

# FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

## PROBLEM SOLVING and STATISTICS

**Date:** January, 2017

**Proposed Grade Level(s):** 11<sup>th</sup> – 12<sup>th</sup>

**Grading:** A-F

**CTE Sector / Pathway:** N/A

**Prerequisite(s):** C or better IM 2

**Intent to Pursue ‘A-G’ College Prep Status:** No

**Course Length:** 1 year

**Subject Area:** Mathematics

**Credits:** 5/ Semester

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### **COURSE DESCRIPTION:**

This course will feature one semester of Problem Solving and one semester of Statistics. During the semester of problem solving, students gain insight into the applications of a variety of problem solving strategies. Each problem requires that students engage in the Standards of Mathematical Practice, as outlined in the California State Framework for Mathematics. In addition, students will develop team building skills to work well in groups and enhance their mathematical communication skills. The semester of study sets the climate for the rest of the course, stressing skills such as reasoning and perseverance in traditional as well as nontraditional problems.

The Statistics portion of the course will emphasize the basics, techniques, and language of statistics with an overall focus on the usage, interpretation and meaning of statistical information. Students develop a formal and precise understanding of statistical inference. Students apply statistics ideas to real-world situations. They link classroom mathematics and statistics to everyday life, work, and decision making by applying these standards in modeling situations. Students select and use appropriate mathematics and statistics to analyze and understand empirical situations.

### **GENERAL GOALS/ESSENTIAL QUESTIONS:**

#### **Goals:**

- Students develop a growth mind set while applying the Math Practice Standards.
- Students develop perseverance in working through nontraditional problems.
- Students will understand the relationship between statistics and the world.
- The use of real data will bring to life statistics theory and methods.
- Students will study the Ethics in Statistics, which will highlight new guidelines that have been established in industry.

#### **Essential Questions:**

- What are the strategies people use in the real world to solve problems?
- What are the problem solving techniques and mindset that will help students solve complex problems?
- How do I [student] work collaboratively to effectively solve problems?
- How can I [student] communicate methodology and results to others?
- How do statisticians collect, organize, and analyze data?
- How are confidence intervals or hypothesis tests used to try and predict or judge outcomes?

- How should “I” [student] understand/interpret the statistics presented in the media, professional journals, classes, or future jobs?

## **COMMON CORE STATE ANCHOR STANDARDS FOR READING (K-12):**

### **Key Ideas and Details**

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

### **Craft and Structure**

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

### **Integration of Knowledge and Ideas**

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

### **Reading Range / Text Complexity**

10. Read and comprehend complex literary and informational texts independently and proficiently.

## **COMMON CORE STATE ANCHOR STANDARDS FOR WRITING (K-12):**

### **Text Types and Purposes**

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.

### **Production and Distribution of Writing**

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

### **Research to Build Knowledge**

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

**Range of Writing**

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

**COMMON CORE STATE ANCHOR STANDARDS FOR SPEAKING AND LISTENING (K-12):**

**Comprehension and Collaboration**

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

**Presentation of Knowledge and Ideas**

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and ensure that the organization, development, and style are appropriate to task, purpose, and audience.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

**CTE INDUSTRY SECTOR / PATHWAY / STANDARDS:**

N/A

**DETAILED UNITS OF INSTRUCTION:**

**SEMESTER 1: PROBLEM SOLVING**

CHAPTERS	SECTIONS
Chapter 0: Introduction	<ul style="list-style-type: none"> <li>• Letter to the Student</li> <li>• Answers to Questions That Students Usually Ask</li> <li>• Some Introductory Problems</li> </ul>
Chapter 1: Draw a Diagram	
Chapter 2: Systematic Lists	
Chapter 3: Eliminate Possibilities	
Chapter 4: Matrix Logic	
Chapter 5: Look for a Pattern	
Chapter 6: Guess-and-Check	
Chapter 7: Sub problems	
Chapter 8: Unit Analysis	
Chapter 9: Solve an Easier Related Problem	
Chapter 10: Physical Representation	<ul style="list-style-type: none"> <li>• Act It Out</li> <li>• Manipulatives and Models</li> </ul>

**SEMESTER 2: STATISTICS**

<b>CHAPTERS</b>	<b>SECTIONS</b>
Chapter 1: Introduction to Statistics	1.1 Review and Preview 1.2 Statistical Thinking and Critical Thinking 1.3 Types of Data 1.4 Collecting and Sampling Data
Chapter 2: Summarizing and Graphing	2.1 Review and Preview 2.2 Frequency Distributions 2.3 Histograms 2.4 Graphs that Enlighten and Graphs that Deceive
Chapter 3: Statistics for Describing, Exploring, and Comparing	3.1 Review and Preview 3.2 Measures of Center 3.3 Measures of Variation 3.4 Measures of Relative Standing and Boxplots
Chapter 4: Probability	4.1 Review and Preview 4.2 Basic Concepts of Probability 4.3 Addition Rule 4.4 Multiplication Rule: Basics 4.5 Multiplication Rule: Complements and Conditional Probability 4.6 Counting 4.7 Probabilities Through Simulations (on CD) 4.8 Baye's Theorem (on CD)
Chapter 5: Discrete Probability Distributions	5.1 Review and Preview 5.2 Probability Distributions 5.3 Binomial Probability Distributions 5.4 Parameters for Binomial Distributions 5.5 Poisson Probability Distributions
Chapter 6: Normal Probability Distributions	6.1 Review and Preview 6.2 The Standard Normal Distribution 6.3 Applications of Normal Distributions 6.4 Sampling Distributions and Estimators 6.5 Central Limit Theorem 6.6 Assessing Normality 6.7 Normal as Approximation to Binomial
Chapter 7: Estimates and Sample Sizes	7.1 Review and Preview 7.2 Estimating a Population Proportion 7.3 Estimating Population Mean 7.4 Estimating Population Standards Deviation or Variance
Chapter 8: Hypothesis Testing	8.1 Review and Preview 8.2 Basics of Hypothesis Training 8.3 Testing a Claim About a Proportion 8.4 Testing a Claim About a Mean 8.5 Testing a Claim About a Standard Deviation or Variance
Chapter 9: Inferences from Two Samples	9.1 Review and Preview 9.2 Two Proportions 9.3 Two Means: Independent Samples

	9.4 Two Dependent Samples (Matched Pairs) 9.5 Two Variances or Standard Deviations
Chapter 10: (optional) Correlation and Regression	10.1 Review and Preview 10.2 Correlation 10.3 Regression 10.4 Prediction Intervals and Variation 10.5 Multiple Regression 10.6 Nonlinear Regression
Chapter 11: Goodness- of-Fit and Contingency Tables	11.1 Review and Preview 11.2 Goodness-of-Fit 11.3 Contingency Tables
Chapter 12 (optional) Analysis of Variance	12.1 Review and Preview 12.2 One-Way ANOVA 12.3 Two-Way ANOVA
Chapter 13: (omit) Nonparametric Tests	
Chapter 14: (omit) Statistical Process Control	
Chapter 15: Ethics, Projects, Procedures, and Perspectives	15.1 Ethics in Statistics 15.2 Projects 15.3 Procedures 15.4 Perspectives

### **TEXTBOOKS AND RESOURCE MATERIALS:**

**Textbook:** *Crossing the River with Dogs, Problem Solving for College Students, Wiley, (2012)*

**Textbook:** *Elementary Statistics, by Mario Triola, Pearson, 12<sup>th</sup> Edition, (2014)*

### **SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:**

#### **Problem Solving:**

The eight *Standards for Mathematical Practice* describe the attributes of mathematically proficient students and expertise that mathematics educators at all levels should seek to develop in their students. Mathematical practices provide a vehicle through which students engage with and learn mathematics with a focus on reading, writing, and explaining.

All eight standards for mathematical practice are integrated repeatedly throughout this course, and are the core of the first semester Problem Solving course content.

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure

Look for and express regularity in repeated reasoning

### **Statistics and Probability**

## **Interpreting Categorical and Quantitative Data**

*Summarize, represent, and interpret data on a single count or measurement variable.*

S-ID 3: Interpret differences in shape, center and spread in the context of the data, accounting for possible effects of outliers.

S-ID 4: Use the mean and standard deviation of a data set to fit it to a normal distribution and estimate percentages.

S-ID 5: Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of data. Recognize possible associations and trends in the data.

S-ID 8: Compute using technology and interpret a linear regression model and correlation.

S-ID 9: Distinguish between correlation and causation.

## **Making Inferences and Justifying Conclusions**

*Understand and evaluate random processes underlying statistical experiments.*

S-IC 1: Understand statistics is a process for making inferences about population parameters based on a random sample from that population.

*Make inferences and justify conclusions from sample surveys, experiments, and observational studies.*

S-IC 3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

S-IC6: Evaluate reports based on data.

## **Conditional Probability and the Rules of Probability**

*Understand independence and conditional probability and use them to interpret data.*

S-CP-5: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

*Use the Rules of probability to compute probabilities of compound events in a uniform probability model.*

S-CP-7: Apply the addition rule and interpret the answer in the terms of the model.

S-CP-8: Apply the general multiplication rule and interpret the answer in the terms of the model.

S-CP-9: Use permutation and combinations to compute probabilities of compound events and solve problems.

## **Using Probability to Make Decisions**

*Use probability to evaluate outcomes of decisions.*

S-MD-7: Analyze decisions and strategies using probability concepts.

## **Advanced Placement Probability and Statistics**

1.0 Students solve probability problems with finite sample spaces by using the rules for addition, multiplication, and complementation for probability distributions and understand the simplifications that arise with independent events.

8.0 Students determine the mean and standard deviation of a normally distributed random variable.

9.0 Students know the central limit theorem and can use it to obtain approximations for probabilities.

10.0 Students know the definitions of mean, median, and mode of distribution of data and compute each of them in particular situations.

14.0 Students organize and describe distribution of data by using a number of different methods, including frequency tables, histograms, standard line graphs and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.

17.0 Students determine confidence intervals for a simple random sample from a normal distribution of data and determine the sample size required for desired margin of error.

18.0 Students determine the P-value for a statistic for a simple random sample from a normal distribution.

## **DISTRICT ESLRS TO BE ADDRESSED:**

**Students will be:**

- **Self-Directed Learners:** Students will use a variety of problem solving strategies to solve rich mathematical problems.
- **Constructive Thinkers:** Students will use real data to interpret the statistics presented in the media, professional journals, and classes.
- **Effective Communicators:** Students will analyze data and then discuss strategies and potential outcomes of the data analysis.
- **Collaborative Workers:** Students will work in small group settings to solve real-world math problems and to analyze and evaluate real data.
- **Quality Producers/Performers:** Through individual and collaborative work on real-life problems, students will produce accurate statistical analysis of data.
- **Responsible Citizens:** Students will study and discuss the Ethics in Statistics, which highlight new industry standards.