Probability and Statistics Scope & Sequence

Days May Vary	Unit	Outcomes	Essential/Guiding Questions
14-16	Unit 1: Foundations of Statistics	• Identify variables in a statistical study. • Distinguish between quantitative and qualitative variables. • Identify populations and studies. • Distinguish between parameters and statistics. • Compare descriptive and inferential statistics • Explain the importance of random samples as you design your own.	• What is the nature of data and why are statistics important? • What are the different sampling techniques? • How can you design ways to collect data?
11-13	Unit 2: Correlation and Regression	• Create a scatter diagram and estimate the location of the "best-fitting" line for a scatter diagram. • Use sample data to to compute	• How can you use a scatter diagram to visually estimate the degree of linear correlation of two random variables?

		the sample correlation coefficient t, and investigate the meaning of it. • Explain the difference between interpolation and extrapolation. • Explain why the extrapolation beyond the sample data range might give results that are misleading or meaningless. • Use r^2 to determine explained and unexplained variation of the response variable y.	• How do you compute the correlation coefficient and what does it tell you about the strength of the linear relationship between two random variables? • What is the least-squares criterion and how do you find the equation of the least-squares line? • What is the coefficient of determination, and what does it tell you about the explained variation of y in a random sample of data pairs (x,y)?
10-12	Unit 3: Elementary Probability Theory	• Assign probabilities to big events and explain how the law of large numbers relates to relative frequencies. • Apply the basic rules of probability to everyday life. • Explain the relationship between probability and statistics. • Compute probabilities of general compound events, independent events, and mutually exclusive events. • Use survey results to compute	• Why study probability? • What are the basic definitions and rules of probability? • What are counting techniques, trees, permutations, and combinations?

		conditional probabilities	
11-13	Unit 4: Random Variables	• Distinguish between discrete and continuous random variables. • Graph discrete probability distributions. • List the defining features of a binomial experiment. • Compute binomial probabilities using the formula. • Use the binomial probability distribution to solve real-world problems.	• What is a random variable and how do you compute it? • How can you use the binomial probability distribution to compute the probability of r successes. • How do you solve real-world problems using binomial probability distribution?
9-11	Unit 5: Normal Distributions	• Graph a normal curve and summarize its important properties. • Apply the empirical rule to solve real-world problems. • Graph the standard normal distribution, and find areas under the standard normal curve. • Compute the probability of "standardized events". • Use the inverse normal to solve guarantee problems.	• What are the characteristics of a normal distribution? What does the empirical rule tell you about data spread about the mean? • How do you convert any normal distribution to a standard distribution? • How do sampling distributions help us make good decisions based on incomplete information? • How can we use this information in the real world?

15-17	Unit 6: Statistical Inference	• Explain the meaning of confidence level, error of estimate, and critical value. • Find the critical value corresponding to a given confidence level. • Find critical values using degrees of freedom and • Estimate p, in the binomial distribution.	• How do you estimate the expected value of a random variable and how much confidence should be placed in such an estimate? • How large of a sample size do you need at the beginning design stage of a statistical project? • How do you estimate the proportion, p, of successes in a binomial experiment and how does the normal approximation fit into this process?
7-9	Unit 7: Inferences using Chi-Squared and Inferences related to Linear Regression	• Design a test to investigate independence of random variables. • Use contingency tables to compute the sample x^2 statistic. • Find and estimate the P-value of the sample x^2 statistic and complete the test. • Conduct a test of homogeneity of populations. • Set up a test to see how well a sample distribution fits a given distribution.	• How do you decide if random variables are dependent or independent? • How do you decide if different populations share the same proportions of specified characteristics? • How do you test a correlation coefficient? • How do you compute the standard error of estimate and how is it used? • How do you compute

		• Use the x^2 distribution to estimate a P-value and conclude the test.	confidence intervals for a least-squares prediction?
6-8	Unit 8: Inferences about Differences	• Identify paired data and dependent samples. • Explain the advantages of paired data tests. • Compute differences and the sample test statistic. • Estimate the P-value and conclude the test. • Identify independent samples and sampling distributions.	• What are the statistical advantages of paired data values? • How do you construct statistical tests? • How do we compare means from two independent populations? • How do we use sample data to compare proportions from two independent populations?