

# School District of Springfield Township

## Springfield Township High School Course Overview

### **Course Name: Academic Statistics**

#### Course Description

This course provides an introduction to the fundamental ideas of statistics. The course is an interactive one with significant time spent exploring statistical concepts through Fathom statistical software. Students collect and analyze data, make predictions and communicate their results orally and in writing. This course is recommended for students going into business, science or medicine.

#### Course Prerequisites

A minimum final grade of "C" in Algebra II

#### Unit Titles

Unit 1: Exploring Data

Unit 2: Collecting Data

Unit 3: Anticipating Patterns

Unit 4: Statistical Inference

#### Essential Questions

1. How can we display and interpret data?
2. How do we collect data so that we can draw results that can be generalized?
3. What should the distribution of data look like under different patterns?
4. What conclusion can I draw from my data?

#### Big Ideas/Enduring Understandings

Unit 1: Exploring Data

- Using and analyzing appropriate summary statistics helps us to describe important characteristics of univariate data such as center, spread, and outliers as part of a complete description of the data.
- Describing and interpreting relationships in categorical data to helps us assess whether there is an association between the variables.
- Analyzing and interpreting patterns in quantitative bivariate data helps us interpret whether the data is linear.

Unit 2: Collecting Data

- Randomness plays a role in generalizing statistical results
- To understand the planning and conducting of a sample survey and what the problems are that may render our survey useless for generalization.
- Planning and conducting an experiment following specific procedures reduces unexplained variation to allow cause and effect conclusion.

### Unit 3: Anticipating Patterns

- Probability is a long run relative frequency.
- A simulation can approximate a probability.
- The role of sampling distributions is important in establishing the distribution of data for a particular set of parameters.

### Unit 4: Statistical Inference

- The need for a confidence interval
- What a p-value reveals about the data

## **Key Competencies/Skills/Procedures**

### Unit 1: Exploring Data

- Construct graphical displays of data
- Describe data using summary statistics and patterns within the data
- Compare categorical data using conditional distributions

### Unit 2: Collecting Data

- Explain the need for random sampling
- Use a random number generator in data design
- Show how to pick a random sample
- List the elements of experimental design

### Unit 3: Anticipating Patterns

- Use simulation to estimate probabilities
- Use simulation to establish sampling distribution models

### Unit 4: Statistical Inference

- Calculate and interpret a confidence interval
- Use a hypothesis test to assess the truth of a claim about a parameter

## **Core Vocabulary**

### Unit 1: Exploring Data

*variable, quantitative, categorical, binary, frequency, dotplot, histogram, stemplot, boxplot, center, spread, shape, outlier, symmetry, skew, mean, median, mode, resistance, range, interquartile range, standard deviation, 5-number summary, normal model, z-scores, two-way table, marginal and conditional distribution, segmented bar-graph, independence, scatterplot, correlation, regression, association, lurking and confounding variable, predicted value, residual, influential observation*

### Unit 2: Collecting Data

*population, parameter, sample, statistic, representative sampling, simple random sample, stratified random sample, random number table, observational study, experiment, explanatory and response variable, comparison, randomization, replication, control, blinding, blocking*

### Unit 3: Anticipating Patterns

*relative frequency, long-run value, simulation, Venn diagram, conditional probability. True/false positive/negative, normal model, z-scores, central limit theorem*

## Unit 4: Statistical Inference

*confidence interval, margin of error, hypothesis test, p-value*

### **Core Resources**

*Workshop Statistics: Discovery with Data*, 2001

Fathom statistical software

TI-84 calculator

### **Pennsylvania Standards Guiding Course**

#### Unit 1: Exploring Data

- 2.2.11.A Develop and use computation concepts, operations and procedures with real numbers in problem-solving situations.
- 2.2.11.B Use estimation to solve problems for which an exact answer is not needed.
- 2.2.11.C Construct and apply mathematical models, including lines and curves of best fit, to estimate values of related quantities.
- 2.2.11.D Describe and explain the amount of error that may exist in a computation using estimates.
- 2.2.11.E Recognize that the degree of precision needed in calculating a number depends on how the results will be used and the instruments used to generate the measure.
- 2.2.11.F Demonstrate skills for using computer spreadsheets and scientific and graphing calculators.
- 2.4.11.B Construct valid arguments from stated facts.
- 2.6.11.C Determine the regression equation of best fit (e.g., linear, quadratic, exponential).
- 2.6.11.D Make predictions using interpolation, extrapolation, regression and estimation using technology to verify them.
- 2.6.11.F Determine the degree of dependence of two quantities specified by a two-way table.
- 2.6.11.I Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.
- 2.8.11.A Analyze a given set of data for the existence of a pattern and represent the pattern algebraically and graphically.
- 2.8.11.K Select, justify and apply an appropriate technique to graph a linear function in two variables, including slope-intercept, x- and y-intercepts, graphing by transformations and the use of a graphing calculator.
- 2.8.11.L Write the equation of a line when given the graph of the line, two points on the line, or the slope of the line and a point on the line.
- 2.8.11.M Given a set of data points, write an equation for a line of best fit.
- 2.8.11.R Create and interpret functional models.

#### Unit 2: Collecting Data

- 2.6.11.A Design and conduct an experiment using random sampling. Describe the data as an example of a distribution using statistical measures of center and spread. Organize and represent the results with graphs. (Use standard deviation, variance and t-tests.)
- 2.6.11.B Use appropriate technology to organize and analyze data taken from the local community.
- 2.6.11.E Determine the validity of the sampling method described in a given study.
- 2.6.11.G Describe questions of experimental design, control groups, treatment groups, cluster sampling and reliability.

### Unit 3: Anticipating Patterns

- 2.4.11.B Construct valid arguments from stated facts.
- 2.6.11.I Describe the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed.
- 2.7.11.B Apply probability and statistics to perform an experiment involving a sample and generalize its results to the entire population.
- 2.7.11.C Draw and justify a conclusion regarding the validity of a probability or statistical argument.
- 2.7.11.D Use experimental and theoretical probability distributions to make judgments about the likelihood of various outcomes in uncertain situations.
- 2.7.11.E Solve problems involving independent simple and compound events.

### Unit 4: Statistical Inference

- 2.2.11.B Use estimation to solve problems for which an exact answer is not needed
- 2.4.11.B Construct valid arguments from stated facts.
- 2.5.11.A Select and use appropriate mathematical concepts and techniques from different areas of mathematics and apply them to solving non-routine and multi-step problems.
- 2.5.11.B Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas and results.
- 2.5.11.C Present mathematical procedures and results clearly, systematically, succinctly and correctly.
- 2.5.11.D Conclude a solution process with a summary of results and evaluate the degree to which the results obtained represent an acceptable response to the initial problem and why the reasoning is valid.
- 2.6.11.H Use sampling techniques to draw inferences about large populations.

Prepared 9.30.10—CM

Approved—chr