Probability & Statistics, Part 2
Course Outline & Objectives

Course Description:

In Probability & Statistics, Part 2, students build on their understanding of probability and data analysis by studying statistical inference and advanced probability models. They evaluate sampling methods and experimental design, analyze binomial, geometric, and normal probability distributions, and use confidence intervals and hypothesis tests to draw conclusions about populations from sample data. Students also investigate relationships between variables using regression and apply statistical procedures such as chi-square tests and comparisons of means and proportions. Throughout the course, students use statistical evidence to evaluate claims, make predictions, and communicate data-driven conclusions.

Credits - One Semester (0.5 Carnegie unit / CA: 5 credits)
Prerequisites: Algebra 1, Geometry, and Algebra 2 (recommended)
OR Integrated Math 1, Integrated Math 2, and Integrated Math 3 (recommended)
AND Probability & Statistics, Part 1

Course Outline

Unit 1: Sampling and Experimental Design
1.1 Populations vs Samples
1.2 Sampling Types
1.3 Bias
1.4 Experimental vs Observational Studies

Unit 2: Probability Distributions
2.1 Intro to Probability Distributions
2.2 Binomial Distributions
2.3 Geometric Distributions
2.4 Normal Distribution
2.5 Standard Scores (z-scores)

Unit 3: Estimation and Confidence Intervals
3.1 Sampling Distributions and Central Limit Theorem
3.2 Margin of Error
3.3 Confidence Intervals
3.4 More Confidence Intervals

Common Core Standards

In Unit 1 students will:
Distinguish between population and sample.
Describe different sampling methods.
Explain potential sources of bias and error.
Differentiate between an experiment and a survey.
Design a survey or experiment to answer a research question.
[S-IC.A.1–6]

In Unit 2 students will:
Explain what a probability distribution is.
Calculate binomial and geometric probabilities.
Describe properties of the normal distribution.
Use z-scores and the Empirical Rule to calculate probabilities.
[S-MD.A.1–4, S-MD.B.5–7]

In Unit 3 students will:
Explain and apply the ideas of a sampling distribution.
Interpret the Central Limit Theorem in context.
Calculate and interpret confidence intervals for proportions and means.
Explain and calculate the margin of error.
[S-IC.A.1–6]

Course Outline

Unit 4: Hypothesis Testing

4.1 Null and Alternative Hypotheses
4.2 Errors (Type I and II)
4.3 Significance Levels
4.4 Tests for Proportions and Means
4.5 Real World Applications

Unit 5: Advanced Data Analysis

5.1 Chi Square Tests
5.2 Comparing Two Proportions or Means
5.3 Regression Analysis: Interpreting Slope and Residuals
5.4 Regression for Inference with Desmos
5.5 Minitab Outputs

Common Core Standards

In Unit 4 students will:
State null and alternative hypotheses.
Identify Type I and Type II errors.
Use technology to perform tests for proportions and means.
Interpret p-values and make conclusions in context.
[S-IC.B.3–6]

In Unit 5 students will:
Apply chi-square tests for categorical data.
Compare two proportions or two means.
Interpret regression models and residuals.
Complete a full statistical investigation and present results.
[S-ID.B.5–9, S-IC.B.3–6, S-MD.B.5–7]