**COURSE DESCRIPTION**

**Course Title:** Statistics

**Course Number:** 00282

**Course Prerequisites:** Grade of 75% or higher in Algebra I College Preparatory, Algebra II College
 Preparatory, and Geometry College Preparatory

**Course Description:** The Statistics is an academic course that covers methods of summarizing data, descriptive statistics, probability and probability distributions, sampling distributions, the central limit theorem, hypothesis testing, analysis of variance, and regression analysis. District marking period assessments are required.

**Suggested Grade Level**: Grades 11-12

**Length of Course:** Two Semesters

**Units of Credit:** 1

**PDE Certification and Staffing Policies and Guidelines (CSPG) Required Teacher Certifications:**

CSPG #50 Mathematics (7-12)

To find the CSPG information, go to [CSPG](https://www.education.pa.gov/Educators/Certification/Staffing%20Guidelines/Pages/default.aspx)

**Certification verified by the WCSD Human Resources Department:** [x] Yes [ ] No

**WCSD STUDENT DATA SYSTEM INFORMATION**

**Course Level:** Academic

**Mark Types:** Check all that apply.

[x] F – Final Average [x] MP – Marking Period [x] EXM – Final Exam

**GPA Type**: [ ]  GPAEL-GPA Elementary [ ]  GPAML-GPA for Middle Level [x]  NHS-National Honor Society

[x]  UGPA-Non-Weighted Grade Point Average [x]  GPA-Weighted Grade Point Average

**State Course Code**: 02205

To find the State Course Code, go to [State Course Code](https://nces.ed.gov/forum/sced.asp), download the Excel file for *SCED*, click on SCED 6.0 tab, and choose the correct code that corresponds with the course.

**TEXTBOOKS AND SUPPLEMENTAL MATERIALS**

**Board Approved Textbooks, Software, and Materials:**

**Title:**  *Elementary Statistics – Picturing the World, 7th edition*

**Publisher:** Pearson Education, Inc.

**ISBN #:**  978-0-13-468341-6

**Copyright Date:** 2019

**WCSD Board Approval Date:** 6/29/2020

**Supplemental Materials:** Kuta Software, SAS pdesas.org, Khan Academy, IXL, Brainfuse,
 Online Calculator: Desmos, Graphing Calculator: TI-83 Plus

**Curriculum Document**

**WCSD Board Approval:**

**Date Finalized:** 5/23/2022

**Date Approved:**  6/13/2022

**Date(s) Revised:**  6/12/2023, 5/22/2024 **Implementation Year:**  2022-2023

**SPECIAL EDUCATION, 504, and GIFTED REQUIREMENTS**

The teacher shall make appropriate modifications to instruction and assessment based on a student’s Individual Education Plan (IEP), Chapter 15 Section 504 Plan (504), and/or Gifted Individual Education Plan (GIEP).

**SCOPE AND SEQUENCE OF CONTENT, AND CONCEPTS**

**Marking Period 1: Introduction to Statistics and Descriptive Statistics**

* Basics of Statistics
* Data Classification
* Data Collection and Experimental Design
* Frequency Distributions and Graphs
* Statistical Graphs and Displays
* Measures of Central Tendency
* Measures of Variation
* Measures of Position
* **Marking Period 1 Review and Assessment**

**Marking Period 2: Probability and Discrete Probability Distributions**

* Basic Concepts of Probability and Counting
* Conditional Probability and the Multiplication Rule
* The Addition Rule
* Permutations and Combinations
* Application of the Counting Principals
* Probability Distributions
* Binomial Distributions
* Discrete Probability Distributions
* **Marking Period 2 Review and Assessment**

**Marking Period 3: Normal Probability Distributions and Confidence Intervals**

* Normal Distributions and the Standard Normal Distribution
* Normal Distributions: Finding Probabilities
* Normal Distributions: Finding Values
* Sample Distributions and the Central Limit Theorem
* Normal Approximations to Binomial Distributions
* Confidence Intervals for the Mean (σ Known)
* Confidence Intervals for the Mean (σ Unknown)
* Confidence Intervals for Population Proportions
* Confidence Intervals for Variance and Standard Deviation
* **Marking Period 3 Review and Assessment**

**Marking Period 4: Hypothesis Testing with One Sample, \*Hypothesis Testing with Two Samples,
 and Correlation and Regression**

* Hypothesis Testing Basics
* Hypothesis Testing for the Mean (σ Known)
* Hypothesis Testing for the Mean (σ Unknown)
* Hypothesis Testing for Proportions
* Hypothesis Testing for Variance and Standard Deviation
* \*Hypothesis Testing for the Mean (Independent Samples, $σ\_{1}$ and $σ\_{2}$ Known)
* \*Hypothesis Testing for the Mean (Independent Samples, $σ\_{1}$ and $σ\_{2}$ unknown)
* \*Testing the Difference Between Proportions
* Correlation
* Linear Regression
* Measures of Regression and Prediction Intervals
* Multiple Regression
* **Marking Period 4 Review and Assessment**
* **\*Final Exam**

\*Included for CHS(College in the High School) through the University of Pittsburgh, Bradford campus

**Standards/Eligible Content and Skills**

| **Performance Indicator** | **PA Core Standard and/or Eligible Content** | **Marking Period Taught**  |
| --- | --- | --- |
| Define: population, sample, parameter, statistics. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Distinguish between a population and a sample.  | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Distinguish between a sample and a statistic. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Distinguish between descriptive statistics and inferential statistics. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Distinguish between and identify data as qualitative and/or quantitative. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Classify data with respect to four levels of measurement: nominal, ordinal, interval, ratio. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Design a statistical study. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Distinguish between an observational study and an experiment. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Collect data by using a survey or a simulation. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Design an experiment. | S-IC.1, S-IC.2 S-IC.3 | MP1 |
| Create a sample using random sampling, simple random sampling, stratified sampling, cluster sampling, and systematic sampling. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Identify a biased sample. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Construct a frequency distribution including limits, midpoints, relative frequencies, cumulative frequencies, and boundaries. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Construct frequency histograms, frequency polygons, relative frequency histograms, and ogives. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Graph and interpret quantitative data sets using stem-and-leaf plots and dot plots. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Graph and interpret qualitative data sets using pie charts and Pareto charts. | S-IC.4, S-IC.6 S-ID.2, S-ID.3S-ID.5, S-ID.6 | MP1 |
| Graph and interpret paired data sets using scatter plots and time series charts. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Find the mean, median, and mode of a population and of a sample. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Find a weighted mean of a data set. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Estimate the sample of mean grouped data. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Describe the shape of a distribution as symmetric, uniform, skewed and compare the mean and median for each distribution. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Find the range of a data set. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Find the variance and standard deviation of a population and of a sample. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Use the Empirical Rule and Chebyshev’s Theorem to interpret standard deviation. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Estimate the sample standard deviation for grouped data. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Use the coefficient of variation to compare variation in different data sets. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Find the first, second, and third quartiles and interquartile range of a data set. | S-IC.4, S-IC.6S-ID.2, S-ID.3S-ID.5, S-ID.6 | MP1 |
| Represent a data set graphically using a box-and-whisker plot. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Calculate and interpret other fractiles, including percentiles, for a specific data entry. | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| Find and interpret the standard score (z score). | S-IC.4, S-IC.6 S-ID.2, S-ID.3 S-ID.5, S-ID.6 | MP1 |
| **Marking Period 1 Review and Assessment** |  | **MP1** |
| * Review and demonstrate knowledge of Statistical Introductory Basics.
 |  | MP1 |
| * Review and demonstrate knowledge of Descriptive Statistics.
 |  | MP1 |
| Identify the sample space of a probability experiment and simple events. | S-CP.0, S-CP.5S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Use the Fundamental Counting Principle to find the number of ways two or more events can occur. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Distinguish among classical probability, empirical probability, and subjective probability. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Find the probability of the complement of an event. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Use a tree diagram and the Fundamental Counting Principle to find probabilities. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Find the probability of an event given that another event has occurred. | S-CP.0, S-CP.5 S-CP.6, S-CP.7S-CP.8, S-MD.5a | MP2 |
| Distinguish between independent and dependent events. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Use the Multiplication Rule to find the probability of two or more events occurring in sequence. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Find conditional probabilities. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Determine whether two events are mutually exclusive. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Use the Addition Rule to find the probabilities of two events. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Find the number of ways a group of objects can be arranged in order and the number of ways to choose several objects from a group without regard to order. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Use counting principles to find probabilities. | S-CP.0, S-CP.5 S-CP.6, S-CP.7 S-CP.8, S-MD.5a | MP2 |
| Distinguish between discrete random variables and continuous random variables. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Construct and graph a discrete probability distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Determine whether a distribution is a probability distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Find the mean, variance, and standard deviation of a discrete probability distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Find the expected value of a discrete probability distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Determine whether a probability experiment is a binomial experiment. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Find the binomial probabilities using the binomial probability formula, a binomial probability table, and technology. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Construct and graph a binomial distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Find the mean, variance, and standard deviation of a binomial probability distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Find probabilities using geometric distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| Find probabilities using Poisson distribution. | S-CP.2, S-CP.3 S-CP.4, S-MD.6 S-MD.7, S-MD.5b | MP2 |
| **Marking Period 2 Review and Assessment** |  | **MP2** |
| * Review and demonstrate knowledge of Probability.
 |  | MP2 |
| * Review and demonstrate knowledge of Discrete Probability Distributions.
 |  | MP2 |
| Interpret graphs of normal probability distributions. | S-ID.4 | MP3 |
| Find areas under the standard normal curve. | S-ID.4 | MP3 |
| Find probabilities for normally distributed variables using a table and using technology. | S-ID.4 | MP3 |
| Find a z-score given the area under the normal curve. | S-ID.4 | MP3 |
| Transform a z-score to an x-value. | S-ID.4 | MP3 |
| Find a specific data value of a normal distribution given the probability. | S-ID.4 | MP3 |
| Find sampling distributions and verify their properties. | S-ID.4 | MP3 |
| Interpret the Central Limit Theorem. | S-ID.4 | MP3 |
| Apply the Central Limit Theorem to find the probability of a sample mean. | S-ID.4 | MP3 |
| Determine when a normal distribution can approximate a binomial distribution. | S-ID.4 | MP3 |
| Find the continuity correction. | S-ID.4 | MP3 |
| Use a normal distribution to approximate binomial probabilities. | S-ID.4 | MP3 |
| Find a point estimate and margin of error. | S-IC.1, S-IC.4 | MP3 |
| Construct and interpret confidence intervals for a population mean when the standard deviation σ is known. | S-IC.1, S-IC.4 | MP3 |
| Determine the minimum sample size requirement when estimating a population mean. | S-IC.1, S-IC.4 | MP3 |
| Interpret the t-distribution and use a t-distribution table.  | S-IC.1, S-IC.4 | MP3 |
| Construct and interpret confidence intervals for a population mean when standard deviation σ is not known. | S-IC.1, S-IC.4 | MP3 |
| Find a point estimate for a population proportion. | S-IC.4, S-IC.5 S-IC.6 | MP3 |
| Construct and interpret confidence intervals for a population proportion. | S-IC.4, S-IC.5 S-IC.6 | MP3 |
| Determine the minimum sample size required when estimating a population proportion. | S-IC.4, S-IC.5 S-IC.6 | MP3 |
| Interpret the chi-square distribution and use a chi-square distribution table. | S-IC.4, S-IC.5 S-IC.6 | MP3 |
| Construct and interpret confidence intervals for a population variance and standard deviation σ. | S-IC.4, S-IC.5S-IC.6 | MP3 |
| **Marking Period 3 Review and Assessment** |  | **MP3** |
| * Review and demonstrate knowledge of Normal Probability Distributions.
 |  | MP3 |
| * Review and demonstrate knowledge of Confidence Intervals.
 |  | MP3 |
| State a null hypothesis and alternate hypothesis. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Identify type I and type II errors and interpret the level of significance. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Know whether to use a one-tailed or a two-tailed statistical test and find a P-value. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Make and interpret a decision based on the results of a statistical test. | S-IC.1, S-IC.4 S-IC.5, S-IC.6 | MP4 |
| Write a claim for a hypothesis test. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Find and interpret P-values. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Use P-values for a z-test for a mean µ when the standard deviation σ is known. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Find critical values and rejection regions in the standard normal distribution. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Use rejection regions for a z-test for a mean µ when the standard deviation σ is known. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Find critical values in a t-distribution. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Use the t-test to test a mean µ when the standard deviation σ is not known. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Use technology to find P-values and use them with a t-test to test a mean µ when the standard deviation σ is not known. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Use the z-test to test a population proportion *p.* | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Find the critical values for the chi-square test. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Use the chi-square test to test a variance σ2 or a standard deviation σ. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| \*Determine whether two samples are independent or dependent. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| \*Perform a two-sample z-test for the difference between two means $μ\_{1}$ and $μ\_{2}$ using independent samples with $σ\_{1}$and $σ\_{2}$ known. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| \*Perform a two-sample t-test for the difference between two means $μ\_{1}$ and $μ\_{2}$ using independent samples with $σ\_{1}$and $σ\_{2}$ unknown. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| \*Perform a two-sample z-test for the difference between two population proportions $p\_{1}$ and $p\_{2}$. | S-IC.4, S-IC.5 S-IC.6 | MP4 |
| Construct a scatter plot and find a correlation coefficient. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Test a population correlation coefficient *p* using a table. | S-ID.6, S-ID.7S-ID.8, S-ID.9 | MP4 |
| Perform a hypothesis test for a population correlation coefficient *p.* | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Find the equation of a regression line. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Predict y-values using the regression equation. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Find and interpret the coefficient of determination. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Find and interpret the standard error of estimate for a regression line. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Construct and interpret a prediction interval for y. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Use technology to find and interpret a multiple regression equation, the standard error of estimate, and the coefficient of determination. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| Use a multiple regression equation to predict y-values. | S-ID.6, S-ID.7 S-ID.8, S-ID.9 | MP4 |
| **Marking Period 4 Review and Assessment** |  | **MP4** |
| * Review and demonstrate knowledge of Hypothesis Testing with One Sample.
 |  | MP4 |
| * \*Review and demonstrate knowledge of Hypothesis Testing with Two Samples.
 |  | MP4 |
| * Review and demonstrate knowledge of Correlation and Regression.
 |  | MP4 |
| **\*Final Exam** |  | MP4 |

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**ASSESSMENTS**

**PDE Academic Standards, Assessment Anchors, and Eligible Content:** The teacher must be knowledgeable of the PDE Academic Standards, Assessment Anchors, and Eligible Content and incorporate them regularly into planned instruction.

**Formative Assessments:** The teacher will utilize a variety of assessment methods to conduct in-process evaluations of student learning.

**Effective formative assessments for this course include:
Suggested but not limited to:**

* Pre-assessments of prior knowledge (e.g., Entrance cards or KWL chart)
* Bellringers/Problems of the Day (PODs)
* Discussions
* Exit ticket
* Teacher observations/Questioning
* Graphic organizers (e.g., Venn Diagrams, word mapping, webbing, KWL chart, etc.)
* Outlining
* Cooperative learning
* Written work
* Quizzes
* Oral response
* Self-evaluation
* Homework
* Summarizing
* Note-taking

**Summative Assessments:** The teacher will utilize a variety of assessment methods to evaluate student learning at the end of an instructional task, lesson, and/or unit.

**Effective summative assessments for this course include:
Suggested but not limited to:**

* Performance assessment
* Chapter/unit tests
* Quizzes
* Marking period assessments
* \*Final exam
* Projects
* Student presentations

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