

Secaucus  
Board of  
Education

# Introduction to Probability and Statistics

Course Code: 3322

*Mathematics Department*



*Born on August 2016*

*Aligned to the NJSL for Mathematics (2016), Technology (2014), & 21st Century Life and Careers (2014)*

*Adopted by the Secaucus Board of Education on: August 25, 2016*

### District Equity Statement

The Board of Education directs that all students enrolled in the schools of this district shall be afforded equal educational opportunities in strict accordance with the law. No students shall be denied access to or benefit from any educational program or activity or from a co-curricular or athletic activity on the basis of the student's race, color, creed, religion, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, gender identity or expression, socioeconomic status, or disability. The Board directs the Superintendent to allocate faculty, administrators, support staff members, curriculum materials, and instructional equipment supplies among and between the schools and classes of this district in a manner that ensures equivalency of educational opportunity throughout this district. The school district's curricula in the following areas will eliminate discrimination, promote mutual acceptance and respect among students, and enable students to interact effectively with others, regardless of race, color, creed, religion, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, gender identity or expression, socioeconomic status, or disability:

1. School climate/learning environment
2. Courses of study, including Physical Education
3. Instructional materials and strategies
4. Library materials
5. Software and audio-visual materials
6. Guidance and counseling
7. Extra-curricular programs and activities
8. Testing and other assessments.

Excerpt from Secaucus Board of Education, Policy 5750, Edited September 2016.

### **Course Description**

Introduction to Probability and Statistics is designed for the college bound student who has demonstrated success in Algebra 2 and wishes to continue to explore a large range of topics with an emphasis on “real world” applications such as games of chance, random population, and actuarial science. Students will be exposed to topics such as: organizing data, averages and variation, elementary probability theory, random variables and probability distributions, and normal distributions. Technology plays an important role in statistics and probability by making it possible to generate plots, regression functions, and correlation coefficients, and to simulate many possible outcomes in a short amount of time. Students will regularly apply the tools of technology in this course including the graphing calculator and computer software. They will be challenged through critical thinking exercises and participate in various group and individual activities that will enhance their mathematical reasoning ability and communication skills.

### **Primary Interdisciplinary Connections**

Business  
Health  
Finance  
Economics  
Social Studies  
Psychology  
Science

**Course Modifications (ELLs, Special Education, Gifted and Talented)**

The teacher will determine, with the assistance of guidance counselors, teacher assistant/aides, educational specialists and/or special education teachers, what modifications will be made for his/her students. Such examples of modifications can include, but not be limited to:

- Extended time as needed
- Modification of tests and quizzes
- Preferential seating
- Alternative/Formative assessment (projects)
- Effective teacher questioning (ranging from simple recall to higher order critical thinking questions)
- Supplemental materials
- Cooperative learning
- Teacher tutoring
- Peer tutoring
- Differentiated Instruction

<b>Unit 1:</b>	Introduction to Statistics, Summarizing and Graphing Data, and Describing, Exploring, and Comparing Data	
<b>Timing:</b>	8 weeks	
<b>Standards:</b>	<p><u>NJSLS for Mathematics:</u> S.ID.A.1, S.ID.A.2, S.ID.A.3, S.ID.B.5, S.IC.B.3, MP.1-8</p> <p><u>NJSLS 21st Century Life and Careers:</u> CRP1, CRP2, CRP4, CRP8, CRP11, CRP12</p>	
<b>Essential Questions:</b>	<b>Objectives:</b>	<b>Activities, Investigation, and Student Experiences:</b>
<ul style="list-style-type: none"> <li>● Why is statistics important?</li> <li>● How can we draw a random sample?</li> <li>● How can we select graphs appropriate for given data sets?</li> <li>● What are common distribution sets?</li> <li>● How do variance and standard deviation measure data spread? Why is this important?</li> <li>● When data have already been grouped in a frequency table or histogram, how can we estimate the mean and standard deviation?</li> </ul>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>● Identify the variables in a study and be able to classify them.</li> <li>● Identify populations and samples.</li> <li>● Describe simulations, observational studies, and experiments.</li> <li>● Construct a simple random sample using random numbers.</li> <li>● Identify control groups, placebo effects, and randomized two-treatment design.</li> <li>● Determine types of graphs appropriate for specific data.</li> <li>● Construct bar graphs, Pareto charts, circle graphs, and time plots.</li> <li>● Interpret information displayed in graphs.</li> </ul>	<ul style="list-style-type: none"> <li>● Introduction to Statistics: <ul style="list-style-type: none"> <li>○ <i>Where Have all the Fireflies Gone?</i></li> </ul> </li> <li>● Organizing Data: <ul style="list-style-type: none"> <li>○ <i>Say it with Pictures Problem</i></li> </ul> </li> <li>● Averages and Variation: <ul style="list-style-type: none"> <li>○ <i>College Investigation</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>● Recognize basic distribution shapes: uniform, symmetric, bimodal, skewed.</li> <li>● Compare a stem-and-leaf display to a histogram.</li> <li>● Compute mean, median, and mode from raw data.</li> <li>● Find the range, variance, and standard deviation.</li> <li>● Make box-and-whisker plots.</li> </ul>	
<b>Assessments:</b>	<b>Materials:</b>	<b>Resources:</b>
<ul style="list-style-type: none"> <li>● Classroom Observations</li> <li>● Student Participation</li> <li>● Do Nows</li> <li>● Homework</li> <li>● Quizzes</li> <li>● Unit Test</li> <li>● Projects</li> <li>● Exit Cards</li> </ul>	<ul style="list-style-type: none"> <li>● TI-83/84 Calculator</li> <li>● Excel Software</li> <li>● Interactive Whiteboard</li> <li>● Computer</li> <li>● TI-84 SmartView Software</li> </ul>	<ul style="list-style-type: none"> <li>● The Practice of Statistics 2015(5th Edition)</li> <li>● The Practice of Statistics <a href="#">Instructor Site</a></li> <li>● The Practice of Statistics <a href="#">Student Site</a></li> </ul>

<b>Unit 2:</b>	Probability, Discrete Probability Distributions	
<b>Timing:</b>	12 weeks	
<b>Standards:</b>	<p><u><i>NJSLS for Mathematics:</i></u> S.CP.A.1, S.CP.A.2, S.CP.A.3, S.CP.A.4, S.CP.A.5, S.CP.B.6, S.CP.B.7, S.CP.B.8, S.CP.B.9, S.MD.A.1, S.MD.A.2, S.MD.A.3, S.MD.A.4, S.MD.B.5, MP. 1-8</p> <p><u><i>NJSLS for Technology:</i></u> 8.1.12.A.4, 8.1.12.A.5, 8.2.12.E.1, 8.2.12.E.3, 8.2.12.E.4</p> <p><u><i>NJSLS 21st Century Life and Careers:</i></u> CRP1, CRP2, CRP4, CRP8, CRP11, CRP12</p>	
<b>Essential Questions:</b>	<b>Objectives:</b>	<b>Activities, Investigation, and Student Experiences:</b>
<ul style="list-style-type: none"> <li>• What are the basic definitions and rules of probability?</li> <li>• What are counting techniques, trees, permutations, and combinations?</li> <li>• What is a random variable?</li> <li>• How is the binomial distribution related to the other probability distributions such as geometric and Poisson?</li> </ul>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the meaning of the probability of a random event.</li> <li>• Assign probabilities to events.</li> <li>• Apply basic rules of probability in everyday life.</li> <li>• Explain the relationship between statistics and probability.</li> <li>• Compute probabilities of general compound events.</li> </ul>	<ul style="list-style-type: none"> <li>• Elementary Probability Theory: <ul style="list-style-type: none"> <li>◦ <i>How often do lie detectors lie?</i></li> </ul> </li> <li>• Binomial Probability Distribution: <ul style="list-style-type: none"> <li>◦ <i>What is the probability that your teachers are introverts or extroverts?</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>● Explain how counting techniques relate to probability in everyday life.</li> <li>● Use simulation analysis and sample space to produce probabilities.</li> <li>● Distinguish between discrete and continuous random variables.</li> <li>● Graph discrete probability distributions</li> <li>● Compute a linear combination of two independent random variables.</li> <li>● Use the binomial probability distribution to solve real world applications.</li> </ul>	
<b>Assessments:</b>	<b>Materials:</b>	<b>Resources:</b>
<ul style="list-style-type: none"> <li>● Classroom Observations</li> <li>● Student Participation</li> <li>● Do Nows</li> <li>● Homework</li> <li>● Quizzes</li> <li>● Unit Test</li> <li>● Projects</li> <li>● Exit Cards</li> </ul>	<ul style="list-style-type: none"> <li>● TI-83/84 Calculator</li> <li>● Excel Software</li> <li>● Interactive Whiteboard</li> <li>● Computer</li> <li>● TI-84 SmartView Software</li> </ul>	<ul style="list-style-type: none"> <li>● Khan Academy - <a href="#">High School Statistics</a></li> <li>● Inside Mathematics - <a href="#">Performance Tasks and Problems</a></li> <li>● The Practice of Statistics 2015(5th Edition)</li> <li>● The Practice of Statistics <a href="#">Instructor Site</a></li> <li>● The Practice of Statistics <a href="#">Student Site</a></li> </ul>

<b>Unit 3:</b>	Normal Probability Distributions, Estimates and Sample Sizes	
<b>Timing:</b>	11 weeks	
<b>Standards:</b>	<p><u>NJSLS for Mathematics:</u> S.ID.A.4, S.MD.A.1, S.ID.B.6, S.IC.A.1, S.IC.B.3, S.IC.B.4, MP.1-8</p> <p><u>NJSLS for Technology:</u> 8.1.12.A.4, 8.1.12.A.5, 8.2.12.E.1, 8.2.12.E.3, 8.2.12.E.4</p> <p><u>NJSLS 21st Century Life and Careers:</u> CRP1, CRP2, CRP4, CRP8, CRP11, CRP12</p>	
<b>Essential Questions:</b>	<b>Objectives:</b>	<b>Activities, Investigation, and Student Experiences:</b>
<ul style="list-style-type: none"> <li>• What are some characteristics of a normal distribution? What does the empirical rule tell us about the data spread around the mean?</li> <li>• How do we convert any normal distribution to a standard normal distribution?</li> <li>• What do we mean by a probability sampling distribution?</li> <li>• What is the Central Limit Theorem?</li> </ul>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Graph a normal curve and summarize its important properties.</li> <li>• Apply the empirical rule to solve real-world problems.</li> <li>• Use control limits to construct control charts. Examine the chart for three possible out-of-control signals.</li> <li>• Graph the standard normal distributions, and find areas under the standard normal curve.</li> <li>• Find the z score from a given normal probability.</li> </ul>	<ul style="list-style-type: none"> <li>• Normal Distributions: <ul style="list-style-type: none"> <li>○ <i>Determine the probability of daily attendance for a show</i></li> </ul> </li> <li>• Sampling Distributions: <ul style="list-style-type: none"> <li>○ <i>Grocery List: Impulse buying problem</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>● State assumptions needed for the normal approximation to the binomial.</li> <li>● Use the central limit theorem and explain.</li> <li>● From raw data, construct a relative frequency distribution for x values and compare the results to a theoretical sampling distribution.</li> <li>● Construct P-charts.</li> </ul>	
<b>Assessments:</b>	<b>Materials:</b>	<b>Resources:</b>
<ul style="list-style-type: none"> <li>● Classroom Observations</li> <li>● Student Participation</li> <li>● Do Nows</li> <li>● Homework</li> <li>● Quizzes</li> <li>● Unit Test</li> <li>● Projects</li> <li>● Exit Cards</li> </ul>	<ul style="list-style-type: none"> <li>● TI-83/84 Calculator</li> <li>● Excel Software</li> <li>● Interactive Whiteboard</li> <li>● Computer</li> <li>● TI-84 SmartView Software</li> </ul>	<ul style="list-style-type: none"> <li>● Khan Academy - <a href="#">High School Statistics</a></li> <li>● Inside Mathematics - <a href="#">Performance Tasks and Problems</a></li> <li>● The Practice of Statistics 2015(5th Edition)</li> <li>● The Practice of Statistics <a href="#">Instructor Site</a></li> <li>● The Practice of Statistics <a href="#">Student Site</a></li> </ul>

<b>Unit 4:</b>	Hypothesis Testing, Inferences from Two Samples, Correlation and Regression	
<b>Timing:</b>	12 weeks	
<b>Standards:</b>	<p><u>NJSLS for Mathematics:</u> S.MD.B.7, S.IC.B.4, S.IC.B.5, SS.IC.B.6, S.ID.B.6, S.ID.C.7, S.ID.C.8, S.ID.C.9, MP.1-8</p> <p><u>NJSLS for Technology:</u> 8.1.12.A.4, 8.1.12.A.5, 8.2.12.E.1, 8.2.12.E.3, 8.2.12.E.4</p> <p><u>NJSLS 21st Century Life and Careers:</u> CRP1, CRP2, CRP4, CRP8, CRP11, CRP12</p>	
<b>Essential Questions:</b>	<b>Objectives:</b>	<b>Activities, Investigation, and Student Experiences:</b>
<ul style="list-style-type: none"> <li>• What is the attained level of significance of a statistical test?</li> <li>• What are the advantages of pairing data values?</li> <li>• How do we construct statistical tests for differences of independent random variables?</li> <li>• How is the least-squares lines mathematically determined?</li> <li>• What is the mathematical definition of the correlation coefficient, and how is it</li> </ul>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Identify the null and alternate hypotheses in a statistical test.</li> <li>• Recognize types of errors, levels of significance, and power of a test.</li> <li>• Use the hypotheses to identify an appropriate critical region.</li> <li>• Understand the meaning of “accepting” or “rejecting” a given hypothesis.</li> <li>• Visually estimate the location of the “best-fitting” line for a scatter diagram.</li> </ul>	<ul style="list-style-type: none"> <li>• Hypothesis Testing: <ul style="list-style-type: none"> <li>○ <i>Business Opportunities and Start Up Costs Problem</i></li> </ul> </li> <li>• Regression and Correlation: <ul style="list-style-type: none"> <li>○ <i>Changing Populations and Crime Rate Activity</i></li> </ul> </li> </ul>

computed?	<ul style="list-style-type: none"> <li>• Visually estimate the degree of linear correlation.</li> </ul>	
<b>Assessments:</b>	<b>Materials:</b>	<b>Resources:</b>
<ul style="list-style-type: none"> <li>• Classroom Observations</li> <li>• Student Participation</li> <li>• Do Nows</li> <li>• Homework</li> <li>• Quizzes</li> <li>• Unit Test</li> <li>• Projects</li> <li>• Exit Cards</li> </ul>	<ul style="list-style-type: none"> <li>• TI-83/84 Calculator</li> <li>• Excel Software</li> <li>• Interactive Whiteboard</li> <li>• Computer</li> <li>• TI-84 SmartView Software</li> </ul>	<ul style="list-style-type: none"> <li>• Khan Academy - <a href="#">High School Statistics</a></li> <li>• Inside Mathematics - <a href="#">Performance Tasks and Problems</a></li> <li>• The Practice of Statistics 2015(5th Edition)</li> <li>• The Practice of Statistics <a href="#">Instructor Site</a></li> <li>• The Practice of Statistics <a href="#">Student Site</a></li> </ul>