Randolph Township Schools
Randolph High School

Statistics A Curriculum

"Facts are stubborn, but statistics are more pliable"

-Mark Twain

STEM Department

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Randolph Township Schools
Department of Science, Technology, Engineering, and Math

Statistics

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Randolph Township Schools

Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

Randolph Township Schools
Affirmative Action Statement

Equality and Equity in Curriculum

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

RANDOLPH TOWNSHIP BOARD OF EDUCATION
EDUCATIONAL GOALS
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

Randolph Township Schools
STEM Department

Statistics Introduction

Statistics is an elective course in the STEM department for juniors and seniors who have completed Algebra II. It introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. Students will become familiar with the vocabulary, method, and meaning in the statistics which exist in the world around them. Through this course, students will become critical consumers of published conclusions based on statistical analysis, and become aware of the ways in which statistics can be improperly used to mislead, confuse, or distort the truth. The course provides a strong basis for students to continue the study of statistics at the college level.

The course makes use of technology to analyze and present real data. Students are encouraged to incorporate their knowledge and interest in other disciplines into project work. In addition to gaining skills necessary to produce, analyze, model and draw conclusions from data, students are encouraged to develop skills required to produce convincing oral and written statistical arguments, using appropriate terminology in a variety of settings.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Curriculum Pacing Chart
Statistics A

SUGGESTED TIME ALLOTMENT	UNIT NUMBER	CONTENT - UNIT OF STUDY
5 weeks	I	Surveys, Sampling, and Experiments
5 weeks	II	Descriptive Statistics
4 weeks	III	Linear Regression
7 weeks	IV	Probability and Random Variables
6 weeks	V	Probability Models and Sampling Distributions
9 weeks	VI	Statistical Inference

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT I: Surveys, Sampling, and Experiments

TRANSFER: Students will investigate statistical studies, analyzing experimental designs and potential sources of bias as a means of assessing the overall validity of the reported results.

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
S-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S-IC.A.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. **S-IC.B.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S-IC.B.6** Evaluate reports based on data. .	Careful planning is essential in order to avoid bias and obtain valid data that allows for useful comparison between groups.	• How do we collect data?
	Sophisticated tools for data analysis cannot compensate for poorly collected data.	• To what extent does data collection methodology affect results?
	Randomization is an essential part of all good sampling methods and experiments.	• How can variability be minimized through randomization?
	Simulation is a useful tool for modeling random behavior in the real world.	• To what extent is all data biased?
	Well-designed experiments can be used to establish causation.	• To what extent can data be purposefully biased?
	KNOWLEDGE	**SKILLS**
	Students will know: Simulations can be carried out to answer questions involving probability and outcomes of many random events. Different methods of data collection and their effectiveness in different situations. Techniques for planning and conducting a survey.	**Students will be able to:** Design, implement and interpret simulations using various sources of random numbers. Identify an appropriate data collection method. Identify populations, samples, parameters and statistics.

		Recognize sources of bias in sampling and surveys. Recognize and apply sampling methods.
	Techniques for analyzing, planning and conducting experiments.	Document the design of an experiment with a diagram showing treatment groups and sizes, randomization, blocking and measurement of a response variable.
	VOCABULARY: census, simple random sample, stratified random sample, cluster sample, systematic sample, convenience sample, observational study, experiment, treatment, factor, level, response variable, placebo, blinding, response bias, nonresponse bias, control, replication, completely randomized design, blocked design, matched pairs design, statistically significant	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Analyzing the benefits and drawbacks of sampling methods.
- Critiquing the design, methods, and findings of a quantitative study.
- Performing statistical analysis of data collected via simulations and hands-on experiments.

KEY LEARNING EVENTS AND INSTRUCTION:

- Corn Simulation – This allows students to understand the benefit of SRS with experimental design.
- Sampling Bias Activity – Students write their own survey questions, both biased and unbiased, to recognize the impact of a variety of biases.
- Helicopter Activity – This experiment uses two types of paper helicopters. Students collect data on flight times and analyze the results to make conclusions.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
Unit I: Surveys, Sampling, and Experiments

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
5 Weeks	Unit I – Surveys, Sampling and Experiments • Simulations • Sampling methods • Survey design • Experimental design	Textbook: Chapters 10 – 12 AP FRQs: 2013 #2, 2011 #3, 2010 #1, 2007 #2, 1999 #3 Jelly Blubbers, a hands-on introduction to simple random samples and the importance of sample size http://exploringdata.net/sampling.htm Corn Simulation Sampling Bias Activity Helicopter Activity

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT II: Descriptive Statistics

TRANSFER: Students will be able to analyze any data display in the news or on the Internet and draw conclusions about the variables of interest.

STANDARDS / GOALS	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
S-ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). **S-ID.A.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. **S-ID.A.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). **S-ID.A.4** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	Data needs to be summarized and displayed in an appropriate way in order to extract meaning from it.	• How do we best summarize and display a particular set of data?
	It is important to understand how data was collected in order to draw valid conclusions from it.	• What kinds of questions can be answered using different graphical displays and numerical summaries?
	Statistical analysis and data displays often reveal patterns that may not be obvious.	• How does the normal distribution apply to the real world?
	Statistical analysis and data displays can often be misleading and contain bias.	• What does it mean to lie with statistics? How can statistics be misleading, and to what extent?
	KNOWLEDGE	**SKILLS**
	Students will know: In order to draw valid conclusions from data, it is important to understand the methods employed in the data collection process. Distributions (the set of possible values a variable can take and the frequency with which those values occur) can be summarized in frequency tables and characterized by their shape, center, spread and outliers.	**Students will be able to:** Identify the 5 W's of how data is collected. Given a set of quantitative data, describe the shape, center and spread of a distribution from a graph. Identify outliers, if present, and determine their effect on the shape, center and spread of the distribution. Given categorical data, construct and interpret two-way (contingency) tables.

S-ID.B.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	Appropriate graphical displays and numeric summaries can be selected based on the type of variable and the shape of the distribution. The Normal distribution is a useful family of models that describes much symmetric, real-world data. **VOCABULARY:** categorical, quantitative, bar chart, pie chart, segmented bar chart, histogram, dot plot, stem plot, box plot, mean, median, standard deviation, IQR, z-score, percentile, symmetric, skewed, outliers, standard normal model, empirical rule, five number summary, SOCS - Shape, Outliers, Center, Spread	Calculate and interpret probabilities, conditional probabilities and marginal probabilities. Choose appropriate numerical summaries and graphical displays for a given data set. Create graphical displays for categorical and quantitative data sets. Calculate and interpret descriptive statistics. Recognize the symmetric, unimodal, bell-shaped Normal curve. Compute and interpret z-scores. Apply the 68-95-99.7% Empirical Rule to understand spread and distribution of a given data set. Use the 68-95-99.7% Empirical Rule to compare values from different Normal distributions.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Creating visual displays of data, including histograms, dot plots, and stem and leaf plots.
- Using descriptive statistics to characterize the shape, center, and spread of a given data set.

KEY LEARNING EVENTS AND INSTRUCTION:

- Social Club creation based on z-score requirement. Use sample data to set up an entrance requirement into a club of people with similarly unique characteristics such as the "Boston Beanstalks."

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT II: Descriptive Statistics

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
5 Weeks	Unit II – Descriptive Statistics • Observational units and types of variables • Graphical displays • Numeric summaries • Normal models	Textbook: Chapters 1 – 5, first half of Chapter 6 AP FRQs: 2011B #1, 2007B #1, 2004 #1, 2006#1, 2011 #1 Census at School: http://www.amstat.org/censusatschool/ Gallery of Data Visualization: The Best and Worst of Statistical Graphics http://www.datavis.ca/gallery/index.php Data and Story Library http://lib.stat.cmu.edu/DASL/ Data Sets https://kaggle.com Applet Collection http://rossmanchance.com/applets/ Social Club creation based on z-score requirement

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT III: Linear Regression

TRANSFER: Students will analyze two numerical variables to determine if there is a potential relationship.

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
S-ID.B.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related. a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology. c. Fit a linear function for a scatter plot that suggests a linear association. **S-ID.C.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. **S-ID.C.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.	Mathematical models, created using techniques of linear regression, can be useful for making predictions about the future.	• When is linear regression an appropriate technique?
	High correlation between two quantitative variables does not necessarily imply a cause and effect relationship between them.	• How can you judge the effectiveness of linear regression?
	There are limitations to the usefulness of mathematical representation and modeling.	• Does correlation mean causation?
	KNOWLEDGE	**SKILLS**
	Students will know: Bivariate data can be represented graphically in a scatterplot. Techniques to construct and use least squares regression lines, with and without technology. Methods to analyze the meaning and effectiveness of a linear regression model.	**Students will be able to:** Create scatterplots. Describe the form, direction and strength of the relationship between two quantitative variables, as shown in a scatterplot. Find the equation of the least squares regression line. Use the least squares regression line to make predictions and find residuals. Calculate the slope and intercept of a linear regression and interpret in the context of the data.

S-ID.C.9 Distinguish between correlation and causation.	**VOCABULARY:** scatterplot, direction, form, strength, influential point, residual, slope, intercept, residual plot, least squares regression line, r, r-squared	Calculate the correlation coefficient and interpret in the context of the data. Calculate the coefficient of determination and interpret in the context of data. Identify outliers and use them to assess the effectiveness of the model. Create a residual plot and use it to determine whether a linear regression is appropriate for the given data set.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Applying technology to derive a linear model of a given data set.
- Assessing the fit of the derived linear model.
- Predicting output values for input values not included in an original dataset.

KEY LEARNING EVENTS AND INSTRUCTION:

- Hand Size vs. # of Starbursts Picked Up – This can be used to introduce scatterplots or review linear regression.
- Paper Doll Activity – Students create their own paper doll. Using the floor tiles as a coordinate plane, the class creates a scatterplot with their dolls. The students review aspects of linear regression.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT III: Linear Regression

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 Weeks	Unit III – Linear Regression • Scatterplots • Least squares regression line (LSRL) • Using and interpreting the LSRL	Textbook: Chapters 7, 8 AP FRQs: 2007B #4, 2002 #4, 1991 #1, 2002B #1 Guess the Correlation http://guessthecorrelation.com/ http://istics.net/Correlations/ (matching) Applet Collection http://rossmanchance.com/applets/ Hand Size vs. # of Starbursts Picked Up Paper Doll Activity

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics
UNIT IV: Probability and Random Variables

TRANSFER: Students will investigate chance phenomena to aid in the decision-making process.

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
S-CP.A.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). **S-CP.A.2** Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. **S-CP.A.3** Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.	Random phenomena are unpredictable in the short term but show long-term regularity.	• How are probabilities calculated for simple and compound events?
	The probability of an event is the proportion of times the event will occur over many trials.	• How does independence affect probability calculations?
	Probability is the basis for statistical inference.	• How can we base decisions on chance?
	KNOWLEDGE	**SKILLS**
	Students will know: Types of probability.	**Students will be able to:** Differentiate between theoretical and empirical probability.
	Formal rules of probability.	Identify sample space. Calculate the probability of a simple event and its complement. Determine upper and lower limits on probability.
	Rules for calculating probabilities of compound events.	Identify independent or mutually exclusive events. Calculate probabilities of compound events using rules of addition and multiplication appropriately. Use Venn diagrams to aid in modeling probability problems.

S-CP.A.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. **S-CP.A.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. **S-CP.B.6** Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model **S-CP.B.7** Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. **S-CP.B.8** Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. **S-CP.B.9** Use permutations and combinations to compute probabilities of compound events and solve problems.	Types of random variables. Probability distributions are defined to represent random variables. **VOCABULARY:** sample space, event, outcome, trial, independent, mutually exclusive, tree diagram, conditional, random variable, expected value, complement, Addition Rule, Multiplication Rule, Discrete, Continuous	Interpret and calculate conditional probabilities using formulas and tree diagrams. Differentiate between discrete and continuous random variables. Determine discrete probability distributions and use them to make decisions. Calculate expected value and use to make predictions. Interpret variance and standard deviation and use them to make decisions.

S-MD-A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. **S-MD-A.2** Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. **S-MD-A.3** Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. **S-MD-A.4** Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. **S-MD-B.6** Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). **S-MD-B.7** Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).		

ASSESSMENT EVIDENCE: Students will show their learning by:

- Constructing visual aids and lists to analyze the sample space for simple and compound events.
- Applying counting strategies to calculate probabilities for simple and compound events.

KEY LEARNING EVENTS AND INSTRUCTION:

- Monty Hall Problem – Explore the Monty Hall dilemma by watching a clip of the show as well as commentary by Monty Hall. Students will then simulate rounds of the Monty Hall problem and determine if it is better to switch doors.
- Money Duck 3 Act - Students will guess the cost of the Money Duck (hand soap with either $1, $5, $10, or $50 dollars inside of it) based on seeing someone use 6 bars of soap and collect the money out of them. Students are trying to find the expected value of each duck.
- "1 in 6" simulation – Activity to see the likelihood that at least 3 out of 7 people would win a free soda if the company is stating that 1 in 6 people are winners.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics
Unit IV: Probability and Random Variables

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
7 Weeks	Unit IV – Probability and Random Variables • Calculating probabilities • Random variables	Textbook: Second half of Chapter 6 Chapters 14, 15 First half of Chapter 16 AP FRQs: 2011 #2, 2009B #2 Applet Collection http://rossmanchance.com/applets Money Duck 3 Act "1 in 6" simulation

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics
UNIT V: Probability Models and Sampling Distributions

TRANSFER: Students will analyze sample data and patterns of sample size to generalize about a population.

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
S-MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. **S-MD.A.2** Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. **S-MD.A.3** Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. **S-MD.A.4** Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.	Binomial distributions can be used to model situations with two possible outcomes.	• What real-world situations can be modeled by the Binomial probability distribution?
	The Normal distribution arises frequently in the real world and can be used to model many continuous phenomena.	• What real-world situations can be modeled by Normal distributions?
	Average values from population samples can be modeled with a Normal distribution even if the underlying population is not Normally distributed.	• What specific Normal distributions can be used to model situations where a proportion or a mean is calculated based on a sample from a population?
	Larger sample sizes result in reduced variability and more reliable conclusions.	• How do we calculate probabilities arising from Normal and Binomial distributions?
	KNOWLEDGE	**SKILLS**
	Students will know: Situations in which the Binomial distribution can be used. Procedures to calculate binomial probabilities if a binomial setting is met.	**Students will be able to:** Identify and check conditions for using the Binomial distribution. Calculate probabilities, expected value, variance and standard deviation using the Binomial distribution. Use formulas to calculate probabilities, expected value, variance, and standard deviation by hand. Utilize technology to calculate probabilities, expected value, variance and standard deviation.

S-MD.B.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. b. Evaluate and compare strategies on the basis of expected values. .	Situations in which the Normal distribution can be used. Normal probabilities can be calculated when specific conditions are met. The relationships between sampling distributions and the Normal distribution. **VOCABULARY:** sampling distribution, binomial, geometric, point estimate, Central Limit Theorem, normal approximation, binomial settings, 10% condition, Statistically significant	Identify and check conditions for using a Normal distribution. Perform normal probability calculations, with the z-score table and with technology. Determine whether a Normal model is appropriate based on the distribution of the underlying population and sample size. Find the mean and standard deviation for the Normal model to represent the sampling distribution.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Making predictions about a given population based on sampling data.
- Using virtual and physical simulations to model and analyze real-world events.

KEY LEARNING EVENTS AND INSTRUCTION:

- German Tank Activity (Sampling Distributions) – This discovery activity allows students to create their own estimator to determine the number of cards in a paper bag. This mimics what happened in WWII when the Americans captured German tanks and estimated how many tanks the Germans had in all.
- Reeses Pieces Discovery (Sampling Distributions) – This uses an applet from Rossman Chance to introduce sampling distributions of proportions in regards to their shape, center, and spread.
- Lebron Free Throw activity (Binomial) – Simulation that will allow students to further develop the formulas for a binomial distribution for small and large sample sizes.
- Lucky Day Activity (Geometric) – Simulation that will allow students to further develop the formulas for a geometric distribution for small and large sample sizes as well as explain why there is never a standard deviation for the geometric model.
- Card Game Activity (Probability Model) – Simulation to develop the expected value of a random variable.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics
Unit V: Probability Models and Sampling Distributions

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
6 Weeks	Unit V – Probability Models and Sampling Distributions • Binomial • Normal • Sampling distributions	Textbook: Second half of Chapter 16 AP FRQs: 2010B #3, 2006B #3, 2009 #2, 2007 #3 Applet Collection http://rossmanchance.com/applets German Tank Activity Reese's Pieces Discovery Lebron Free Throw Activity Lucky Day Activity Card Game Activity

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT VI: Statistical Inference

TRANSFER: Students will make predictions about a population using sample data.

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
S-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S-IC.B.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. **S-IC.B.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	Inference is a process by which we draw conclusions about a population based on sample data.	• In what way are hypothesis tests like the American legal system, where a defendant is found to be guilty or not guilty, but never proven innocent?
	Tests of significance and confidence intervals drive decision making in our world.	• How much evidence is required to convince you that a claim is true, and does that vary according to the situation?
	Inference is based on chance and an understanding of the variability of repeated samples from a population.	• How are the width of a confidence interval and the results of a hypothesis test affected by changes in sample size, confidence level or significance level?
	Confidence intervals are effective tools for estimation.	• How can you make an accurate estimation about a population?
	Hypothesis testing determines whether results are statistically significant or are likely to have occurred due to chance.	• What types of errors are possible as a result of statistical inference?
	KNOWLEDGE	**SKILLS**
	Students will know: The process to calculate confidence intervals and their meaning.	**Students will be able to:** Check conditions for the interval in the context of the problem. Calculate and interpret confidence intervals.

		Identify standard error and margin of error. Interpret confidence intervals in the context of the problem.
	The process to perform a hypothesis test.	Check conditions for hypothesis testing in the context of the problem. Set up and carry out hypothesis tests. Interpret the results of a hypothesis test in the context of the problem.
	Types of errors that can be made as a result of hypothesis tests.	Describe Type I and Type II errors in the context of a hypothesis test. Check conditions for the interval in context of the problem.
	The process to perform a Chi square goodness of fit test and test for independence.	Set up and carry out Chi square tests for categorical variables. Write the null and alternate hypotheses. Use calculated Chi square statistic and p-value to either reject or fail to reject the null hypothesis.
	VOCABULARY: confidence interval, hypothesis test, p value, t value, standard error, margin of error, null and alternative hypotheses, one tailed and two tailed tests, t-distribution, Chi-square distribution, Type I and II errors	

ASSESSMENT EVIDENCE: Students will show their learning by:

- Writing null and alternative hypothesis statements.
- Determining the statistical significance of calculated test statistics.
- Using calculated test statistics to either reject or fail to reject the null hypothesis.

KEY LEARNING EVENTS AND INSTRUCTION:

- Hershey Kiss Activity (proportions) – Students use Hershey Kisses to estimate the proportion that will land face up when tossed.
- Court Case Activity (two-sample) – Students use two-sample inference procedures to determine if there was racial discrimination in a fire fighter exam.
- M&M Activity (chi-squared) – Students use a package of M&Ms to determine if Mars is lying about the percentage of each color.
- Paper Airplanes (any means or proportions) – Students create their own paper airplanes and gather data on flight distance. They use two sample inference procedures to analyze the data.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A
UNIT VI: Statistical Inference

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
9 Weeks	Unit VI – Statistical Inference • Confidence intervals for a single proportion or mean (standard deviation known) • Hypothesis tests for a single proportion or mean (standard deviation known) • Confidence intervals and hypothesis tests for two proportions • Chi square goodness of fit and test for independence	Textbook: Chapters 17, 18, 20, 21 AP FRQs: 2011B #5, 2010 #3, 2012 #5, 2006B #6, 2005B #6, 2012 #5, 2012 #4, 2011B #4, 2008#5, 2004 #5, Hershey Kiss Activity (proportions) Court Case Activity (two-sample) Paper Airplanes (any means or proportions) M&M Activity (chi-squared)

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A

APPENDIX A

RESOURCES:

Textbook:
Stats in Your World
Authors: Bock, Mariano
ISBN13: 9780131384897
Copyright 2012 Pearson Education, Inc.

Technology:
- Software capable of statistical analysis in the educational environment such as Fathom
- Spreadsheet software such as Excel
- Word processor software such as Word
- Presentation software such as Powerpoint
- Graphing calculator

Web addresses:
College Board Statistics Page: https://apcentral.collegeboard.org/courses/ap-statistics/exam?course=ap-statistics
Rice Virtual Lab in Statistics: http://onlinestatbook.com/rvls/index.html
Dartmouth-developed materials to support a course in quantitative literacy: http://www.dartmouth.edu/~chance/
Rossman-Chance applet collection: http://www.rossmanchance.com/applets/index.html
Statistics teaching materials, M. Krummel, Howard County Public School, Maryland: http://mrskrummel.com/teachersapstat.html
Consortium for the Advancement of Undergraduate Statistics Education: http://www.causeweb.org/
Statistics @ SUNY Oswego: http://www.oswego.edu/~srp/stats/index.htm
AP Stats Monkey: http://apstatsmonkey.com/StatsMonkey/Statsmonkey.html
Stat Trek: https://stattrek.com/

APPENDIX B

Opportunities exist for interdisciplinary units with courses such as Animal Behavior, Marine Biology and other science electives.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Statistics A

APPENDIX C

It is assumed that the student has successfully completed Algebra I, Geometry and Algebra II, or the equivalent.