Teacher: CORE	
Discrete Math & Statistics	Year: 2017-18
Course: Discrete Math & Statistics	Month: All Months

Election Theory

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How do we determine one selection from many	Preference Schedules	Read and Interpret preference schedules	Plurality/Majority Method				2.5.11.A-Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.
that most satisfies the preferences of a large group of individuals?		Compute the Borda quality point ranking	Borda Mehod				
		Conduct th runoff method, rewriting the preference schedule to make a decision	Runoff/Sequential Runoff Method				
		Run head to head comparisons Interpret the paradox of the condorcet method	Condorcet Method				
		Compare the advantages/disadvantaves of each method in determining a winner					
	Weighted Voting	Discuss weighted voting in our own presidential election	coalitions: winning and minimally winning				
		Generate a list of winning and minimally winning coalitions Determine the power index of a voting body	power index				

Graph Theory

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How can a graph comprising of vertices and edges	. Simple Graphs	Construct simple graphs to illustrate relationships between general objects	critical path analysis				2.5.11.A-Develop a plan to analyze a problem, identify the information needed to solve the

be used to solve problems of critical path analysis?			vertex edge connectivity adjacency				problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.
	Specialty Graphs	Trace Eulerian paths and circuits Prove if a graph has an Eularian circuit Trace Hamiltonian paths and circuits Prove if a graph has a Hamiltonian circuit	paths and circuits traceable graphs vertex degree Euler graphs (Leonhard Euler) Eulerizing Hamiltonian graphs (Sir William Rowan Hamilton)				
	Graph Coloring	Use graph coloring for compatibility and optimization models	graph coloring chromatic number				

Counting

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
What shortcuts and patterns can we use to	Method of Exhaustion	Exhausting possibilities and making comprehensinve lists	Method of Exhaustion				2.5.11.A-Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.

quickly and efficiently count an overwhelming number of outcomes?							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.
			tree diagram				
	Fundamental Counting Principal	Use the multiplication principle, addition principal, and factorials to count a number of tasks in succession . Rearrange objects where some of the objects are identical	factorials				
			FCP (fundamental counting principal)				
	Permutations and Combinations	. Count the number of ways to perform a task when order matters Count the number of ways to perform a task when order does not matter . Use binomial coefficients to represent a combination	"n choose r"				
		Count the elements in a sample space for the denominator of a probability calculation	binomial coefficient				

Probability

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How can we determine the probability of two or more events occurring?	Unions, Intersections	Using Venn diagrams to model events, and determine union and intersection	union and intersection				2.7.11.A-Use probability to predict the likelihood of an outcome in an experiment
		Use formulas to calculate the union of 2, 3, 4 or 'n' events. Investigate DeMorgan's Laws to learn about complements of unions/intersections					2.7.11.C-Compare odds and probability. 2.7.11.E-Use probability to make judgments about the likelihood of various outcomes

		Venn diagram	2.5.11.A-Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts. 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.
		DeMorgan's Laws	
		complements	
Conditional Probability	recognize vocabulary that indicates that a problem is conditional . Use formulas to calculate the probability of an event given the occurrence of another event	if, from, given, when	
		conditional probability	
Independence, Mutual Disjointedness	Declare independence of two or more events intuitively by logical explanation Declare independence of two or more events mathematically by showing the intersection equals the product Determine if two events cannot possibly occur simultaneously/have no intersection	intuitive independence	
		formulaic independence	
		mutually disjoint	

	Binomial Probability	Determine if a situation satisfies the binomial criteria Construct a probability distribution table for every possible binomial occurrence of 'n' trials Use a weighted average to calculate the expectation of a single event	binomial criteria expectation				

Producing Data

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How can we collect and obtain data that can be reliably used to draw conclusions about the population?	A. Methods of Data Collection	A1. Sample vs. Population A2. Categorical vs. Quantitative A3. Observational Study vs. Experiment	individuals variables categorical			**Textbook: Statistics: Concepts and Controversies, by David S. Moore** **Ch1: Where do Data Come From?** ***Article: "Report Measures Smoking's Effect"***	
	B. Planning and Conducting Surveys	B1. Recognizing sources of bias in surveys (Voluntary response and convenience sampling) B2. Increasing Accuracy in Surveys B3. Simple Random Samples (SRS) B4. Stratified, Cluster, and Systematic Sampling	quantitative voluntary response sample			***Article: "Survey of Center City"*** **Ch2: Samples: Good and Bad**	

		convenience sample	**Table of Random Digits**
	C1. Parameter vs. Statistic	simple random sample	***Article: from Phoenix, "Around the Town segment", Can you match the face with the answer?***
	C2. Variability vs. Precision C3. Construction of Histograms		
C. Sampling Variability	C4. Constructing and Interpreting 95% Confidence Intervals.	systematic, stratified, and cluster samples	**Ch 3: What do Samples Tell Us?**
		parameter	**Ch4: Sampling Errors**
		statistic	**Nielsen Ratings Book** ***Article: "Time May be Close for a Woman in the White House"***
		bias	
	D1. Recognizing under-coverage D2. Non Sampling Errors: Processing, Response, and Non Response Errors D3. Reflecting on the appropriateness of a sample (Big 8 Questions to ask about a sample)	precision	
		confidence interval	
D. Sampling Errors		MOE (Margin of Error)	

			undercoverage				
			processing, response, and non response error				
Experiments							
Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How can randomized controlled experiments produce valid data?	A. Planning and Conducting Experiments	A1. Treatments, control groups, experimental units, random assignment, replication	observational studies and experiments			Ch5: Experiments: Good and Bad	2.6.11.A-Design and conduct an experiment using random sampling.
		A2. Hidden Bias, confounding, placebo effect, blinding					
		A3. Completely randomized design	explanatory, response, and lurking variables			Ch6: Experiments in the Real World	
		A4. Block and Matched Pairs designs					
		A5. Generalizing results from observational studies and experiments	randomization, replication and control			*Articles:*	
		A6. Random Digit Simulation				*"Botched Experiment Leads to Banning of Red Dye FD&C #2"*	
		A7. Refusals, Non-adherers, and Dropouts	refusals, non-adherers, and dropouts			*"AIDS drug Trials Enter New Age"*	
	B. Measurement		RCE (randomized controlled experiments, block designs, and matched pairs				
		B1. Identifying the appropriate instrument				Ch7: Ethics	

		B2. Valid vs. Invalid	statistical significance				
		B3. Rates vs. Counts					
		B4. Construct validity vs. Content Validity				Ch 8: Measurement	
		B5: Accuracy in Measurement: reliability and lack of bias	measurement				
						Howard Gardner's Multiple Intelligences	
			validity				
			accuracy				
			content/construct				

Organizing Data

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How can we display data in an organized way to compare and draw	A. Graphical Displays of Distributions	A1. Selecting a Two way table, Bar graph, or Pie chart for categorical data	bar graph, pie chart			Ch 10: Graphs: Good and Bad	2.6.11.C-Select or calculate the appropriate measure of central tendency, calculate and apply the interquartile range for one-variable data, and construct a line of best fit and calculate its equation for two-variable data.
conclusions about both categorical and quantitative distributions?		A2. Constructing a line graph to illustrate change over time					
		A3. Selecting a histogram or Stem plot for quantitative data	histogram, stem plot			Misleading graphs	
		A4: Constructing back to back and split stem plots					
		A5: Interpreting graphs via center shape and spread	skyscraper, pancake				
						Ch 11: Displaying Distributions with Graphs	

Ch12: Describing Distributions with Numbers

B1. Using Mean, median or mode to determine the center of a distribution

B2. Calculating standard deviation as a measure of spread

B3. Finding the five number summary as a measure of spread

Ch 13: Density Curves and Normal Distributions

B4. Constructing a box and whisker plot to display a five number summary

B5. Determining which measure of spread is most appropriate

B. Numerical Summaries of Distributions

Z tables

mean, median, mode

C1. Understanding the transformation of histograms into density curves

C2. Characteristics of Density Curves

resistance, non resistance

C3. Measuring center (mean, median and mode) on a density curve

C4.Characteristics of Normal Curves

standard deviation, variance

C5. Sketching Normal Curves

C6: Using the Empirical Rule: 68/95/99.7 rule

five number summary, box and whisker plot

C7. Converting data into the Standardized Z Score

How can we use the properties of a Normal Distribution

to make conclusions about populations in nature?	C. Density Curves and Normal Distributions		density curves Normal Distribution Empirical Rule X, Z, probability				
BiVariate Data							
Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
How can we use a scatter plot and correlation to	A. Scatterplots and Correlation	A1. Determining explanatory and response variables	scatter plot			Ch 14: Describing Relationships; Scatterplots and Correlation	2.6.11.C-Select or calculate the appropriate measure of central tendency, calculate and apply the interquartile range for one-variable data, and construct a line of best fit and calculate its equation for two-variable data.
assess the relationship between two quantitative variables?		A2. Assessing positive, negative, and no association					
		A3. Describing direction, form and strength	association			Scatter Plots from Bush/ Buchanon 2000 Primary Election show the effects of the dimpled chads in Palm Beach County	
	B. Regression	A4. Calculating correlation as a measure of strength	correlation				

						Ch15: Regression, Prediction, and Causation	
		B1. Fitting a Least Squares Regression Line to a set of data B2. Interpreting r^2, the coefficient of determination B3. Realizing the impact of extrapolation B4. Determine if an association is attributable to causation, common response, or confounding	least squares regression line coefficient of determination causation, common response, confounding				

Culminating Project

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
		Students will choose an explanatory and response variable that they want to investigate (with approval of the teacher) and collect, display, analyze and interpret their findings in a presentation to the class.					