Southern Cayuga Central School District – Curriculum Map

Subject: **Introduction to Statistics** School Year: **2023 – 2024**

Title or Topics w/ NYS Standards	Essential Questions & Vocabulary	Content Skills (Activities to cover Essential Questions)	Major Assessments (Tests, Project, etc.)	Time Frame

Qualitative Data	• How can I display data in a way that is easy for others to understand?
	• Qualitative Data
	• Frequency
	• Percent
	• Pie Chart
	• Frequency Distribution (Bar Graph)
		• Reading Pie Charts
		• Reading Frequency Distributions
		• Google Sheets Basics
		• Creating Pie Charts with Google Sheets
		• Creating Bar Graphs with Google Sheets
		• Class Discussion – Article "Pie Charts are the Worst"
		• Misleading Graphs
		  • What makes it misleading?
		  • How can it be fixed?
		  • What was the author's objective in using a misleading graph?
			• Warm Ups
			• Google Sheets Assignments (Exit Tickets)
			• Homework Assignments
			• Quiz
			• Project #1 – Visualizing Qualitative Data
				September

Collecting Data
• **S-IC.B.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
	• Why and when is sampling necessary?
	• How can I collect random, unbiased data?
	• Population
	• Sample
	• Survey
	• Random
	• Sampling
	• Simple Random Sampling
	• Systematic Sampling
	• Stratified Sampling
	• Cluster Sampling
		• The ethics of unbiased and anonymous surveys
		• Using Google Forms
		• Evaluating Surveys for Bias
		• Selecting Random Samples Using:
		  ○ Simple Random Sampling (Random Number Generators)
		  ○ Systematic Sampling
		  ○ Stratified Sampling
		  ○ Cluster Sampling
		• Evaluating Samples and Sampling Methods for Bias
		• Writing Objectives
			• Warm Ups
			• Exit Tickets
			• Homework Assignments
			• Project #2 – Sampling Practice
				September

	• Self-Selecting Sample • Convenience Sample • Bias • Objective			
Quantitative Data (Center and Spread of Data) • **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-IC.B.6 -** Evaluate reports based on data.	• How can I display data in a way that is easy for others to understand? • How can I summarize a set of data using numeric values? • Quantitative Data • Median • 1st / 3rd Quartile • Minimum / Maximum • Interquartile Range • 5 Number Summary • Box Plot • Outlier • Mean • Standard Deviation • Histogram • Skewed Left • Skewed Right • Symmetric • Relative Frequency Histogram	• Calculating the Median, Quartiles, and Interquartile Range • Interpreting the Median and IQR • Creating Box Plots • Interpreting Box Plots • Using the IQR to mathematically identify outliers • Calculating the Mean and Standard Deviation • Using the Mean and Standard Deviation to mathematically identify outliers • When to use the median vs. the mean • Reading Histograms and Relative Frequency Histograms • Creating Histograms on Google Sheets • Analyzing and Writing Results	• Warm Ups • Exit Tickets • Google Sheets Assignments • Homework Assignments • Quizzes • Project #3 – Quantitative Data	October
The Normal Distribution • **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.	• How can I extract information about a population with a sample of data? • Normal Distribution • The Empirical Rule • Percentages • Z-score • Percentile	• What does the Normal Distribution "sound" like? – Using popcorn to visualize and understand a Normal Distribution • Data that is typically Normally Distributed • Using the Empirical Rule to learn information about a population • Calculating z-scores	• Warm Ups • Exit Tickets • Homework Assignments • Quiz • Project #4 – Normally Distributed Data	November

		• Using z-scores to learn information about a population • Using the normal continuous distribution function on the graphing calculators • Calculating percentiles • Using the inverse normal function on the graphing calculators • Using percentiles to compare individuals from two populations		
Regression • **S-ID.B.6 -** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. • **S-ID.B.6.A -** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. • **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. • **S-ID.C.9 -** Distinguish between correlation and causation.	• How can I describe the relationship between two variables mathematically? • Correlation • Causation • Lurking Variable • Regression • Linear • Exponential • Correlation Coefficient • Scatterplot • Trend Line • Interpolation • Extrapolation • Reliable sources	• DESMOS – Charge! Activity • Comparing two variables using linear regression • Using the correlation coefficient to describe the strength and direction of correlation • Interpolating and Extrapolating information using the regression equation • Interpreting the slope and y-intercept of a regression equation • Activity - "Funny Graphs that Show Correlation Between Completely Unrelated Stats" • Correlation vs. Causation • Identifying possible lurking variables • Creating scatterplots on Google Sheets • Project #5 • Comparing two variables that have a correlation that is not linear • Comparing two variables using	• Warm Ups • Exit Tickets • Google Sheets Assignments • Homework Assignments • Quizzes • Project #5 – Linear Regression • Project #6 - Exponential Regression	December

		exponential regression • Using the correlation coefficient to determine the validity of the equation • Interpolating and Extrapolating information using the regression equation • Interpreting the percent growth or percent decay • Finding reliable information on the Internet • Project #6		
Midterm Project	• How can I display and share information in a way that will make others want to learn about my topic? • Infographic	• Analyze and describe example infographics • How to use piktochart.com • Select topic and collect information • Informal meeting • Continue collecting information • Work on infographic • Presentations	• Midterm – Infographic • Midterm - Presentation	January

Probability
• **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
	• How can I determine how likely an event is?
	• How can I determine how likely multiple events are?
	• Probability
	• Experiment
	• Outcome
	• Event
	• Tree Diagram
	• Sample Space
	• Sets
	• Venn Diagram
	• Union
	• Intersection
	• Probability Addition
		• Monty Hall Activity
		• Intro to Probability with equally likely outcomes
		• Probabilities with M&M's
		  ○ Single event
		  ○ Union
		  ○ Intersection
		  ○ Conditional
		• Union and Intersection with Venn Diagrams
		• Adding probabilities
		• Tree Diagrams with outcomes of different likeliness
		• Calculating Expected Value
		• Conditional Probabilities
		• Determining independence
			• Warm Ups
			• Exit Tickets
			• Homework Assignments
			• Quiz
			• Project #7 – Create a Probability Based Game
				February - March

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. • **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.	Rule • Expected Value • Conditional Probability • Independent • Dependent • Two-way frequency table • Multiplication property of probability • Combinations • Permutations	mathematically • Are these two events dependent on one another? Activity • Using Two-Way Frequency tables • Combinations vs. Permutations – Lock Box Challenge • Calculating Combinations and Permutations • Using combinations and permutations in probability • Revisit the Monty Hall Activity • Project #7		

Binomial Probability Distributions	• How can we use probabilities to make decisions? • Binomial Probability • Probability Distribution • Probability Histogram • Binomial Experiment • Binomial Probability Distribution • Expected Value • Confidence Interval • 95% Confidence Interval	• Is this a fair die? – Group Activity • Mathematically proving whether or not the die is fair • Calculating a 95% C.I. • Comparing M&M samples using a binomial probability • Do these probabilities make sense? Activity • Project #8	• Warm Ups • Exit Tickets • Homework Assignments • Quiz • Project #8 – Is the representation accurate?	March - April
Conducting Experiments	• How can I accurately, effectively, and ethically collect data where I need to use test subjects? • Experiment • Experimental Design • Factors • Treatment • Subject • Control Group • Placebo • Blinding • Single-blind • Double-blind	• Tuskegee Experiments – Article & Group Discussion • APA's Code of Ethics • How would you show whether or not mint helps students on exams? Activity • The steps of the experimental design process • Project #9	• Warm Ups • Exit Tickets • Homework Assignments • Quiz • Project #9 – Design an Experiment (Do not run it at this point!)	April
Hypothesis Testing	• How to I analyze data after I conduct an experiment? • What can information from an experiment actually tell me? • Hypothesis • Null Hypothesis	• What do I need for this experiment? – Group Activity • Types of Hypothesis • Can we prove something is true? – Group Activity • Calculating p-values for two-tailed test • Calculating p-values for one-	• Warm Ups • Exit Tickets • Homework Assignments • Quiz • Project #10 – Conduct an Experiment	May

	• Alternative Hypothesis • Two-tailed test • Left-tailed test • Right-tailed test • Type 1 Error • Type 2 Error • P-value	tailed test • What if we are wrong? – Types of Errors – Group Discussion • Project #10		
Final Project				June