***Introduction to Probability and Statistics*- Grade 10**
CURRICULUM MAP

INSTRUCTIONAL TIME PERIOD	SKILLS/OUTCOMES	ASSESSMENT
Unit 1	***Analyzing One-Variable Data*** **The students will be able to:** 1.Recognize the individuals and variables in a statistical study 2. Distinguish between categorical and quantitative variables 3. Express any numeric answer with appropriate context to data source 4. Identify the four steps in the statistical problem-solving process 5. Interpret the results of a statistical study from basic graphical displays 6. Differentiate between graphs meant for categorical and quantitative data, and recognize when a pie chart can and cannot be used 7. Make a bar graph of the distribution of a categorical variable or, in general, to compare related quantities 8. Interpret pie charts and bar graphs 9. Be aware of graphical abuses, especially in bar graphs and pictograms 10. Make a dotplot of stemplot of the distribution of a small set of observations 11. Make a histogram of the distribution of a quantitative variable 12. Assess from a dotplot, stemplot, boxplot, or histogram whether the shape of a distribution is roughly symmetric, distinctly skewed, or neither. Assess whether the distribution has one or more major peaks. 13. Describe the overall pattern by giving numerical measures of center and spread in addition to a verbal description of shape 14. Decide which measure of center and spread are more appropriate: the mean and standard deviation or the five-number summary based on shape and extreme values 15. Identify outliers and give plausible explanations for them 16. Compare distributions of categorical or quantitative variables 17. Find the median and the quartiles for a set of observations 18. Give the five-number summary and draw a boxplot; use boxplots to compare distributions 19. Find the mean and standard deviation from a small set of observations 20. Determine the effect of outliers on measures of center and spread **Standards:** **Statistics and Probability:** M.SP.IC.B.6, M.SP.ID.A1, M.SP.ID.A2, M.SP.ID.A3	• Pretest • Homework Problems from each section • Categorical Data Project • Chapter Activities • Data Explorations (many!) • 4-Step Process Project • Test • Final
Unit 2	***Analyzing Two-Variable Data*** **The students will be able to:** 1. Identify the explanatory and response variable in a bi-variate data set 2. Make a segmented bar graph to show the relationship between two categorical variables	• Homework Problems from each section • Chapter Activities • Lurking Variable Activity

	3. Determine if two categorical variables are associated based on a graph and describe that association 4. Make a scatterplot to display the relationship between two quantitative variables measured on the same subjects, correctly placing explanatory and response variables. 5. Describe the direction, form, and strength of the overall pattern of a scatterplot in context. In particular, recognize positive or negative associations and straight-line patterns. Recognize outliers in a scatterplot. 6. Give plausible explanations for an observed association between two variables: direct cause and effect, the influence of lurking variables, or both. 7. Assess the strength of statistical evidence for a claim of causation, especially when experiments are not possible **Standards:** **Statistics and Probability:** M.SP.ID.B.5, M.SP.ID.B.6, M.SP.ID.C.9, M.SP.CP.A.4	• Data Explorations • Quiz • How to Lie with Graphs Project
Unit 3	***Collecting Data*** **The students will be able to:** 1. Identify the population and the sample in a statistical study 2. Distinguish observational studies and experiments 3. Determine which method of data production is most appropriate for answering a given question of interest 4. Recognize bias due to voluntary response samples and other inferior sampling methods 5. Generate a Simple Random Sample from a population using a table of random digits or technology. 6. Explain how sample surveys deal with bias and variability in their conclusions 7. Identify non-sampling errors such as undercoverage, non-response, or response bias. 8. Apply knowledge of bias to determine if a statistic is an underestimate or overestimate of the population parameter 9. Identify the explanatory variables, treatments, response variables, and subjects in an experiment 10. Recognize bias due to confounding explanatory variables by lurking variables in either observational study or experiments 11. Outline the design of a completely randomized experiment using a diagram. 12. Use a table of random digits or technology to carry out random assignment of subjects to groups in a completely randomized experiment 13. Make use of matched pairs or other block designs when appropriate 14. Recognize the placebo effect. Recognize when the double-blind technique should be used. Be aware of weakness in an experiment, especially in the ability to generalize its conclusions 15. Explain why a randomized comparative experiment can give good evidence for cause-and-effect relationships 16. Recognize limitations in the kinds of conclusions that can be drawn from a statistical study based on how the data were produced **Standards:**	• Homework Problems from each section • Discussion groups on sampling flaws • Data Explorations • Sampling Quiz • Experiments Quiz • Desmos Activity • Ethics Discussion Groups • Experimental Design Activity • Unit Project on Data Collection

	Statistics and Probability: M.SP.IC.A.1, M.SP.IC.A2, M.SP.IC.B.3, M.SP.IC.B.4, M.SP.IC.B.5, M.SP.IC.B.6, M.SP.MD.B.7	
Unit 4	***Probability*** **The students will be able to:** 1. Recognize that some phenomena are random. Probability describes the long-run regularity of random phenomena 2. Understand the idea of probability of an event as the proportion of times the event occurs in very many repetitions of a random phenomena. Use the idea of probability as long-run proportion to think about probability 3. Recognize that short runs of random phenomena do not display the regularity described by probability. Accept that randomness is unpredictable in the short run, and avoid seeking cause-and-effect explanations for random occurrences. 4. Design a simulation using random digits to model chance behavior 5. Estimate a probability be repeating a simulation many times 6. When probabilities are assigned to individual outcomes, find the probability of an event by adding the probabilities of the outcomes that make it up 7. Use probability rules to find the probabilities of events that are formed from other events, including unions, intersections, complements, and conditional probabilities 8. Determine if two events are independent based on the conditional probabilities 9. Use Probability distributions, Venn diagrams, two-way tables, and tree diagrams to model chance behavior. 10. Compute probabilities using information provided in Venn diagrams, two-way tables, and tree diagrams, with the application of computing conditional probabilities. 11. Use the multiplication counting principle to determine the number of possible outcomes of a chance process involving multiple steps 12. Count the number of distinct arrangements of a group of individuals using permutations 13. Count the number of distinct selections of a group of individuals using combinations 14. Distinguish counting situations in which order matters from those where it doesn't. Explain the relationship between the permutation and combination formulas 15. Solve probability problems using the multiplication counting principle, permutations, and combinations 16. Understand the idea of expected value as the average of numerical outcomes in a great many repetitions of a random phenomenon 17. Find the expected value of a random variable from a probability distribution 18. Estimate an expected value by repeating a simulation many times **Standards:** **Statistics and Probability:** M.SP.IC.A.2, M.SP.CP.A.1, M.SP.CP.A.2, M.SP.CP.A.3, M.SP.CP.A.4, M.SP.CP.A5, M.SP.CP.B.6, M.SP.CP.B.7, M.SP.CP.B.8, M.SP.CP.B.9, M.SP.MD.A.1, M.SP.MD.A.2, M.SP.MD.A.3, M.SP.MD.B.6	• Homework Problems from each section • Chapter Activities • Chapter Quiz • Data Explorations • Tree Diagram Activity • Casino Project • Test • Final

Unit 5	***Modeling One-Variable Quantitative Data*** **The students will be able to:** 1. Use percentiles to locate individual values within a distribution of data. 2. Find the standardized value (z-score) of an observation. Interpret z-scores in context. 3. Know that areas under a density curve represent proportions of all observations and that the total area under a density curve is 1 4. Approximately locate the median and the mean on a density curve 5. Recognize the shape of normal curves and estimate by eye both the mean and the standard deviation from such a curve 6. Use the 68-95-99.7 rule and a symmetry to state what percent of the observations from a normal distribution fall between two points when both points lie as the mean or one, two, or three standard deviations on either side of the mean. 7. Use tables to find the percentile of a value from any normal distribution (less than, greater than, and in between) in context 8. Use tables to find the value that corresponds to a given percentile in context **Standards:** **Statistics and Probability:** M.SP.ID.A.4	• Homework Problems from each section • Chapter Activities • Data Explorations • Mid-chapter Quiz • Back to the Future Activity • Baseball Project OR Test • Final

Revised: February 2023

Wisconsin Academic Standards for Math Covered in Intro to Prob and Stats - Essential Standards are in RED

Number and Quantity

M.N.Q.A.1 (F2Y) Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
M.N.Q.A.2 (F2Y) Define appropriate quantities for the purpose of descriptive modeling.
M.N.Q.A.3 (F2Y) Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra

M.A.CED.A.4 (F2Y) Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Functions

M.F.IF.B.4 (F2Y) For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity

Statistics and Probability

M.SP.ID.A.1 (F2Y) Represent data with plots on the real number line (dot plots, histograms, and box plots).
M.SP.ID.A.2 (F2Y) 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.
M.SP.ID.A.3 (F2Y) Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
M.SP.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 statistical packages calculators, spreadsheets, and tables to estimate areas under the normal curve.
M.SP.ID.B.5 (F2Y) 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 as examples of proportionality and disproportionality). Recognize possible associations and trends in the data.
M.SP.ID.B.6 (F2Y) Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

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 appropriate families of functions to model.

M.SP.ID.C.9 (F2Y) Distinguish between correlation and causation.
M.SP.IC.A.2 Decide if a specified model is consistent with results from a given data-generating process (e.g., using simulation).
M.SP.IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
M.SP.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.
M.SP.IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
M.SP.IC.B.6 Evaluate reports based on data.
M.SP.CP.A.1 (F2Y) 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").
M.SP.CP.A.2 (F2Y) 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.
M.SP.CP.A.3 (F2Y) 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.
M.SP.CP.A.4 (F2Y) Represent data from two categorical variables using two-way frequency tables and/or Venn diagrams. Interpret the representation when two categories are associated with each object being classified. Use the representation as a sample space to decide if events are independent and to approximate conditional probabilities.
M.SP.CP.A.5 (F2Y) Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
M.SP.CP.B.6 (F2Y) Use a representation such as a two-way table or Venn diagram to 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.
M.SP.CP.B.7 (F2Y) Use a representation such as a two-way table or Venn diagram to 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.
M.SP.CP.B.8 (+) Use a representation such as a tree diagram to 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.
M.SP.CP.B.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

M.SP.MD.A.2 (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
M.SP.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.
M.SP.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.

M.SP.MD.B.6 Use probabilities to make fair decisions (e.g., drawing for a party door prize where attendees earn one entry to the drawing for each activity they complete, using an electronic spinner to pick a team spokesperson at random from a group, flip a coin to decide which of two friends gets to choose the movie, using a random number generator to select people to include in a sample for an experiment).