Decision 1: Curriculum Map **Course: Statistics**

Topic: Conditional Probability & the Rules of Probability

Key Learning(s): The students will understand independence and conditional probability and use them to interpret data.

Optional Instructional Tools:

Unit Essential Question(s): How do you understand independence and conditional probability and use them to interpret data?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-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").	CCSS.Math.Content.HSS-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.	CCSS.Math.Content.HSS-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. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*
Lesson Essential Questions: 1. How do you 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")?	**Lesson Essential Questions:** How do you 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? 1.	**Lesson Essential Questions:** 1. How do you construct and interpret two-way frequency tables of data when two categories are associated with each object being classified?
Vocabulary: subset, sample space, complement, union, intersection, conditional, probability, replacement	**Vocabulary: independent, dependent, compound event**	**Vocabulary: frequency table, conditional, union, intersection, conditional, probability, replacement**

Concept: CCSS.Math.Content.HSS-CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*	**Concept:**	**Concept:**
Lesson Essential Questions: 1. How do you recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations?	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:**
Vocabulary: conditional probability, independent, dependent	**Vocabulary:**	**Vocabulary:**

Attached Document(s):

Additional Info:
A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3

Topic:

Key Learning(s): The students will use the rules of probability to compute probabilities of compound events.

Optional Instructional Tools:

Unit Essential Question(s): How do you use the rules of probability to compute probabilities of compound events?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-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.	CCSS.Math.Content.HSS-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.	CCSS.Math.Content.HSS-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.
Lesson Essential Questions: 1. How do you 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?	**Lesson Essential Questions:** 1. How do you 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?	**Lesson Essential Questions:** 1. How do you 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?
Vocabulary: outcomes, probability	**Vocabulary: inclusive, addition rule, mutually exclusive, disjoint, rule of complementary events**	**Vocabulary: replacement, complement, intuitive mult. rule**

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-CP.B.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.		
Lesson Essential Questions: 1. How do you use permutations and combinations to compute probabilities of compound events and solve problems?	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:**
Vocabulary: compound events, permutations, combinations	**Vocabulary:**	**Vocabulary:**

Additional Info:
A1.2.3.3.1, A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3

Attached Document(s):

Decision 1: Curriculum Map **Course: Statistics**

Probability – Interpreting Categorical and Qualitative Data

Key Learning(s): **The students will summarize, represent, and interpret data on a single count or measurement variable.**

Optional Instructional Tools:

Unit Essential Question(s):
How do you summarize, represent, and interpret data on a single count or measurement variable?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	CCSS.Math.Content.HSS-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.	CCSS.Math.Content.HSS-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).
Lesson Essential Questions: 1. How do you represent data with plots on the real number line (dot plots, histograms, and box plots)?	**Lesson Essential Questions:** 1. How do you 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?	**Lesson Essential Questions:** How do you interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers)?
Vocabulary: poreto graph, bar graph, box plot, histogram, line graph	**Vocabulary:**	**Vocabulary: outlier, box plot, mean, median, mode, midrange, standard deviation, range, inner quartile range**

Concept: CCSS.Math.Content.HSS-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.	**Concept:**	**Concept:**
Lesson Essential Questions: 1. How do you 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?	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:**
Vocabulary: normal curve, bell curve, normal distribution, mean, standard deviation, z score	**Vocabulary:**	**Vocabulary:**

Attached Document(s):

Additional Info:
A1.2.3.1.1, A1.2.3.2.1, A1.2.3.2.2, A1.2.3.2.3

Topic:

Key Learning(s): The students will summarize, represent, and interpret data on two categorical and quantitative variables.

Optional Instructional Tools:

Unit Essential Question(s): How do you summarize, represent, and interpret data on two categorical and quantitative variables?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-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.	• CCSS.Math.Content.HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. CCSS.Math.Content.HSS-ID.B.6a 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. • CCSS.Math.Content.HSS-ID.B.6b Informally assess the fit of a function by plotting and analyzing residuals. • CCSS.Math.Content.HSS-ID.B.6c Fit a linear function for a scatter plot that suggests a linear association.	
Lesson Essential Questions: 1. How do you 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)?	**Lesson Essential Questions:** 1. How do you represent data on two quantitative variables on a scatter plot, and describe how the variables are related?	**Lesson Essential Questions:** 1.
Vocabulary:relative frequency, conditional relative frequency, cumulative frequency	**Vocabulary: scatter plot, best fit line, residuels, linear, quadratic, exponential**	**Vocabulary:**

Concept:	**Concept:**	**Concept:**
Lesson Essential Questions: 1.	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:**
Vocabulary:	**Vocabulary:**	**Vocabulary:**

Additional Info:
A1.2.1.1.1, A1.2.1.1.2, A1.2.1.1.3, A1.2.1.1.3, A1.2.1.2.1, A1.2.1.2.2, A1.2.2.2.1, A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4, A2.2.3.1.1, A2.2.3.1.2

Topic:

Key Learning(s): The students will

Interpret linear models .

Unit Essential Question(s):

How do you **interpret linear models?**

Optional Instructional Tools:

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	CCSS.Math.Content.HSS-ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.	CCSS.Math.Content.HSS-ID.C.9 Distinguish between correlation and causation.
Lesson Essential Questions: 1. How do you interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data?	**Lesson Essential Questions:** 1. How do you compute (using technology) and interpret the correlation coefficient of a linear fit?	**Lesson Essential Questions:** 1. How do you distinguish between correlation and causation/
Vocabulary: constant, slope, intercept	**Vocabulary: correlation, coefficient**	**Vocabulary: correlation, causation**

Attached Document(s):

Additional Info:

A1.2.1.2.1, A1.2.1.2.2, A1.2.2.2.1, A2.2.1.1.1, A2.2.1.1.2, A2.2.1.1.3, A2.2.1.1.4, A2.2.2.2.1

Decision 1: Curriculum Map **Course: Statistics**

Topic: Making Inferences & Justifying Conclusions

Key Learning(s): The students will understand and evaluate random processes underlying statistical experiments.

Optional Instructional Tools:

Unit Essential Question(s): How do you understand and evaluate random processes underlying statistical experiments?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	CCSS.Math.Content.HSS-IC.A.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model*?	
Lesson Essential Questions: How do you understand statistics as a process for making inferences about population parameters based on a random sample from that population?	**Lesson Essential Questions:** How do you decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation? *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model*? 1.	**Lesson Essential Questions:** 1.
Vocabulary: Parameters, inferences, random sample	**Vocabulary:** simulation	**Vocabulary:**

Concept:	**Concept:**	**Concept:**
Lesson Essential Questions: 1.	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:**
Vocabulary:	**Vocabulary:**	**Vocabulary:**

Additional Info:
A.1.2.3.3.1, A2.2.3.2.1, A2.2.3.2.2, A2.2.3.2.3

Topic:

Key Learning(s): The students will make inferences and justify conclusions from sample surveys, experiments, and observational studies .

Optional Instructional Tools:

Unit Essential Question(s): How do you make inferences and justify conclusions from sample surveys, experiments, and observational studies?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	CCSS.Math.Content.HSS-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.	CCSS.Math.Content.HSS-IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
Lesson Essential Questions: 1. How do you recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each?	**Lesson Essential Questions:** 1. How do you 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?	**Lesson Essential Questions:** 1. How do you use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant?
Vocabulary: survey, experiments, procedures, observational studies	**Vocabulary: simulation, mean, median, mode, midrange, standard deviation**	**Vocabulary: parameter, placebo, treatment group**

Attached Document(s):

Additional Info:

Topic:

Key Learning(s): The students will make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Unit Essential Question(s): How do you make inferences and justify conclusions from sample surveys, experiments and observational studies?

Optional Instructional Tools:

Concept: CCSS.Math.Content.HSS-IC.B.6 Evaluate reports based on data.	**Concept:**	**Concept:**
Lesson Essential Questions: 1. How do you evaluate reports based on data?	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:** 1.
Vocabulary: report, data, significance	**Vocabulary:**	**Vocabulary:**

Attached Document(s):

Additional Info:

Decision 1: Curriculum Map **Course: Statistics**

Topic: Using Probability to Make Decisions

Key Learning(s): The students will calculate expected values and use them to solve problems.

Optional Instructional Tools:

Unit Essential Question(s): How do you calculate expected values and use them to solve problems?

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-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.	CCSS.Math.Content.HSS-MD.A.2 (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	CCSS.Math.Content.HSS-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. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*
Lesson Essential Questions: 1. How do you 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?	**Lesson Essential Questions:** 1. How do you calculate the expected value of a random variable; interpret it as the mean of the probability distribution?	**Lesson Essential Questions:** 1. How do you develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value?
Vocabulary: random variable	**Vocabulary: probability distribution, expected value**	**Vocabulary: binomial probability distribution**

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-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. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*		
Lesson Essential Questions: 1. How do you develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value?	**Lesson Essential Questions:** 1.	**Lesson Essential Questions:**
Vocabulary: random, independent, uniform distribution	**Vocabulary:**	**Vocabulary:**

Attached Document(s):

Additional Info:

Topic:

Key Learning(s): The students will use probability to evaluate outcomes of decisions.

Unit Essential Question(s): How do you use probability to evaluate outcomes of decisions?

Optional Instructional Tools:

Concept:	**Concept:**	**Concept:**
CCSS.Math.Content.HSS-MD.B.5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. CCSS.Math.Content.HSS-MD.B.5a Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* CCSS.Math.Content.HSS-MD.B.5b Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*	CCSS.Math.Content.HSS-MD.B.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	CCSS.Math.Content.HSS-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).
Lesson Essential Questions: 1. How do you weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values?	**Lesson Essential Questions:** 1. How do you use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator)?	**Lesson Essential Questions:** 1. How do you analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game)?
Vocabulary: payoff value, expected value	**Vocabulary: fair decisions, random number generator**	**Vocabulary:**