URBANDALE COMMUNITY SCHOOL DISTRICT
CURRICULUM FRAMEWORK OUTLINE

SUBJECT: Mathematics
COURSE: Probability and Statistics   1 Credit/1 Semester
PREREQUISITES: Algebra II

COURSE DESCRIPTION:
Probability provides a framework for dealing with uncertainty and for interpreting predictions based on uncertainty. Students use probability to make informed observations about the likelihood of events and to interpret and judge the validity of statistical claims. Statistics is utilized for the collecting, representing, and processing of important data. Learning to apply these statistical techniques in solving problems, students enhance their social awareness and career opportunities.

STANDARDS AND COURSE BENCHMARKS WITH INDICATORS:
In order that our students may achieve the maximum benefit from their talents and abilities, the students of Urbandale Community School District's Probability and Statistics course should be able to…

Standard II: Understand quantities.
Benchmark: Reason quantitatively and use units to solve problems. Iowa Core: HSN.Q.A.1, 2, 3
Indicators: Choose and interpret the scale and the origin in graphs and data displays.
                Define appropriate quantities for the purpose of descriptive modeling.
                Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Benchmark: Understand and apply the mathematics of voting. Iowa Core: HSN.Q.IA.3
Indicators: Understand, analyze, apply, and evaluate some common voting and analysis methods in addition to majority and plurality, such as runoff, approval, the so-called instant-runoff voting (IRV) method, the Borda method and the Condorcet method.

Standard VII: Understand statistics & probability.

Benchmarks: Summarize, represent, and interpret data on a single count or measurement variable. Iowa Core: HSS.ID.A 1, 2, 3, 4
Indicators: Represent data with plots on the real number line: Dot plots
                Represent data with plots on the real number line: Histograms
                Represent data with plots on the real number line: Box plots
                Use statistics appropriate to the shape of the data distribution to compare center (median, mean) of two or more different data sets

Use statistics appropriate to the shape of the data distribution to compare spread (interquartile range, standard deviation) of two or more different data sets

Interpret differences in shape, center, and spread in the context of the data sets.

Interpret differences in shape, center, and spread accounting for the possible effects of extreme data points (outliers)

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.

Benchmark: Summarize, represent, and interpret data on two categorical and quantitative variables. Iowa Core: HSS-ID.B.5, 6

Indicators:　　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.

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

Fit a function to the data.

Use functions fitted to data to solve problems in the context of the data.

Benchmark: Interpret linear models. Iowa Core: HSS.ID.C.9

Indicators:　　Distinguish between correlation and causation.

Benchmark: Understand and evaluate random processes underlying statistical experiments. Iowa Core: HSS.IC.A.1, 2

Indicators:　　Demonstrate an understanding of statistics as a process for making inferences about population parameters based on a random sample from that population.

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?

Benchmark: Make inferences and justify conclusions from sample surveys, experiments, and observational studies. Iowa Core: HSS.IC.B.3, 4, 5, 6

Indicators:　　Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

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.

Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

Evaluate reports based on data.

Benchmark: Understand independence and conditional probability and use them to interpret data. Iowa Core: HSS.CP. A 1, 2, 3, 4, 5

Indicators: 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")

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.

Understand the conditional probability of A given B as P(A and B)/P(B).

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.

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.

Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Benchmark: Use the rules of probability to compute probabilities of compound events in a uniform probability model. Iowa Core: HSS.CP.B.6, 7, 8, 9

Indicators: Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A.

Interpret the answer in terms of the model.

Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B).

Interpret the answer in terms of the model.

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.

Use permutations and combinations to compute probabilities of compound events and solve problems.

Benchmark: Calculate expected values and use them to solve problems. Iowa Core: HSS.MD.A.1, 2, 3, 4

Indicators: 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.

Calculate the expected value of a random variable.

Interpret expected value as the mean of the probability distribution.

Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated.

Find the expected value.

Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically.

Find the expected value.

Benchmark: **Use probability to evaluate outcomes of decisions. Iowa Core: HSS.MD.B.5, 6, 7**

Indicators: 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.

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.

Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).