Summary of NCTM Standards Related to Probability and Statistics

Data Analysis and Probability Standard for Grades Pre-K–2

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
  - pose questions and gather data about themselves and their surroundings;
  - sort and classify objects according to their attributes and organize data about the objects;
  - represent data using concrete objects, pictures, and graphs.
- Select and use appropriate statistical methods to analyze data.
  - describe parts of the data and the set of data as a whole to determine what the data show.
- Develop and evaluate inferences and predictions that are based on data.
  - discuss events related to students' experiences as likely or unlikely.

Data Analysis and Probability Standard for Grades 3–5

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
  - design investigations to address a question and consider how data-collection methods affect the nature of the data set;
  - collect data using observations, surveys, and experiments;
  - represent data using tables and graphs such as line plots, bar graphs, and line graphs;
- Select and use appropriate statistical methods to analyze data.
  - describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed;
  - use measures of center, focusing on the median, and understand what each does and does not indicate about the data set;
  - compare different representations of the same data and evaluate how well each representation shows important aspects of the data.
- Develop and evaluate inferences and predictions that are based on data.
  - propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions.
- Understand and apply basic concepts of probability.
  - describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible;
  - predict the probability of outcomes of simple experiments and test the predictions;
    - understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.
• **Formulate questions** that can be addressed with data and collect, organize, and display relevant data to answer them.
  - Formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population;
  - Select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots.

• **Select and use** appropriate statistical methods to analyze data.
  - Find, use, and interpret measures of center and spread, including mean and interquartile range;
  - Discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots.

• **Develop and evaluate** inferences and predictions that are based on data.
  - Use observations about differences between two or more samples to make conjectures about the populations from which the samples were taken;
  - Make conjectures about possible relationships between two characteristics of a sample on the basis of scatterplots of the data and approximate lines of fit;
  - Use conjectures to formulate new questions and plan new studies to answer them.

• **Understand and apply** basic concepts of probability.
  - Understand and use appropriate terminology to describe complementary and mutually exclusive events;
  - Use proportionality and a basic understanding of probability to make and test conjectures about the results of experiments and simulations;
  - Compute probabilities for simple compound events, using such methods as organized lists, tree diagrams, and area models.

**Data Analysis and Probability Standard for Grades 9–12**

• **Formulate questions** that can be addressed with data and collect, organize, and display relevant data to answer them.
  - Understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each;
  - Know the characteristics of well-designed studies, including the role of randomization in surveys and experiments;
  - Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable;
  - Understand histograms, parallel box plots, and scatterplots and use them to display data;
- compute basic statistics and understand the distinction between a statistic and a parameter.

- **Select and use** appropriate statistical methods to analyze data.
  - for univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics;
  - for bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools;
  - display and discuss bivariate data where at least one variable is categorical;
  - recognize how linear transformations of univariate data affect shape, center, and spread;
  - identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled.

- **Develop and evaluate** inferences and predictions that are based on data.
  - use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions;
  - understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference;
  - evaluate published reports that are based on data by examining the design of the study, the appropriateness of the data analysis, and the validity of conclusions;
  - understand how basic statistical techniques are used to monitor process characteristics in the workplace.

- **Understand and apply** basic concepts of probability.
  - understand the concepts of sample space and probability distribution and construct sample spaces and distributions in simple cases;
  - use simulations to construct empirical probability distributions;
  - compute and interpret the expected value of random variables in simple cases;
  - understand the concepts of conditional probability and independent events;
  - understand how to compute the probability of a compound event.