Unit 7: Statistics & Probability

Time: Approximate time frame 6-8 weeks

Standard(s):

Use random sampling to draw inferences about a population.

7.SP.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

7.SP.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

Draw informal comparative inferences about two populations

7.SP.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

Investigate chance processes and develop, use and evaluate probability models.

7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around ½ indicates an event that in neither unlikely nor likely, and a probability near 1 indicates a likely event.

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7.SP.6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

7.SP.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

a) Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

b) Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed

7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

b) Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in every day language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

c) Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

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Big Ideas: *Students will understand that …*

- Statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population.
- Random sampling tends to produce representative samples and support valid inferences.
- Two data distributions can be compared using visual and numerical representations based upon measures of center and measures of variability to draw conclusions.
- The probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.
- The probability of a chance event is approximated by collecting data on the chance process that produces it, observing its long-run relative frequency, and predicting the approximate relative frequency given the probability.
- A probability model, which may or may not be uniform, is used to find probabilities of events.
- Various tools are used to find probabilities of compound events. (Including organized lists, tables, tree diagrams, and simulations.)

Essential Questions:

- How are probability and the likelihood of an occurrence related and represented?
- How is probability approximated?
- How is a probability model used?
- How are probabilities of compound events determined?
- How can two data distributions be compared?
- How can statistics be used to gain information about a sample population?
- How can a random sample of a larger population be used to draw inferences?

Prerequisite Skills:

Students should already be able to*:*

- Understand statistical variability (6.SP.2)

- Display data in various ways (6.SP.4)

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• Interpret and summarize data as a numerical set in relation to its context (6.SP.5)

• Develop understanding of statistical variability. (6.SP.1-3)
• Summarize and describe distributions. (6.SP.4-5)

Skills: Students will be able to …

• Represent the probability of a chance event as a number between 0 and 1. (7.SP.5)
• Use the terms "likely", "unlikely," to describe the probability represented by the fractions used. (7.SP.5)
• Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency. (7.SP.6)
• Predict the approximate relative frequency of a chance event given the probability.(7.SP.6)
• Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. (7.SP.7)
• Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. (7.SP.7)
• Compare probabilities from a model to observed frequencies. (7.SP.7)
• If the agreement between a model and observed frequencies is not good, explain possible sources of the discrepancy. (7.SP.7)
• Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. (7.SP.8)
• Represent the probability of a compound event as the fraction of outcomes in the sample space for which the compound event occurs. (7.SP.8)
• Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. (7.SP.8)
• For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. (7.SP.8)
• Design and use a simulation to generate frequencies for compound events. (7.SP.8)

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Vocabulary: Simulation, Compound event, Probability, Sample space, Random sample, Outcome, Theoretical probability, Experimental probability, Relative Frequency, Tree diagram, Likelihood, Counting Principle, Uniform probability model, Empirical probability, Equally likely, More likely, Less likely, Fair, Unfair, Simple event, Fraction, Decimal, Percent, Combination, Permutation, Dependent Event, Independent Event, Complementary Event, Relative frequency, Random sample, Biased sample, Unbiased sample, Histogram, Box plot, Dot plot, Double box plot, Double dot plot, Statistics, Mean, Median, Mode,

Resources:

Textbook, ODE, Online Programs, Collaboration with Colleagues

Assessments:

- **Formative:** Exit cards, bell ringers, homework practice, observations, in-class practice, student self-reflection.
- **Summative:** Assessments, Quizzes, Projects