# Unit 7: Statistics & Probability

Content Area: **Mathematics**
Course(s): **Mathematics**
Time Period: **Week 31**
Length: **4 weeks**
Status: **Published**

## Unit Overview

In this unit, students will learn about probability and how to properly get and display data. This unit will begin with an explanation of what probability is, and that the probability of a given outcome can be written as a fraction, decimal, or percentage. Next, students will learn what expected value is and how they can apply their previous knowledge of proportions to make predictions based on the probability of a certain situation. Once students understand expected value they will learn about the differences between experimental and theoretical probability. To truly grasp the difference students will actually conduct experiments to see if the experimental probability in fact does match the theoretical probability. Students at this time will also learn about different simulations that can be done to model different situations. Once students have a good grasp on singular probability they will learn about compound probabilities (specifically independent and dependent events). As with singular probability, students will conduct experiments to see if the experimental probability for the compound situation matches the theoretical probability.

The second half of this unit will focus solely on statistics. The first thing students will learn about statistics are different types of samples/sampling techniques. Students will learn the differences between biased and unbiased samples in addition to learning how to conduct a random sample that would accurately represent the population. Next, students will review the different types of data displays (specifically dot plots and box and whisker plots). It's important to be able to create and analyze these data displays because students will also be asked to explain why a given data display could be considered misleading. Lastly, students will be able to compare and contrast populations (given a box and whisker plot) and be able to discuss which population shows more consistency.

## Standards

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| MA.7.SP.A.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. |
| MA.7.SP.A.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. |
| MA.7.SP.B.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. |
| MA.7.SP.B.4 | Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. |
| MA.7.SP.C.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 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a |

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| | likely event. |
| MA.7.SP.C.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. |
| MA.7.SP.C.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. |
| MA.7.SP.C.7a | Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. |
| MA.7.SP.C.7b | Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. |
| MA.7.SP.C.8a | 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. |
| MA.7.SP.C.8b | Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. |
| MA.7.SP.C.8c | Design and use a simulation to generate frequencies for compound events. |

## Essential Questions

- How do you know which type of graph to use when displaying data?
- Why is choosing an appropriate sample important when surveying a group of people?
- How can the probability of an outcome help influence in making decisions?
- Why is it important to understand how different data displays can be misleading when portraying information?

## Application of Knowledge: Students will know that…

- A biased sample of a population occurs when instances were not equally likely to be selected.
- A box and whisker plot shows measures of variation for a set of data (shows how consistent a set of data is).
- A combination is when the order in which things are selected is not important.
- A graph can be considered misleading based on the size of the picture being represented in a pictograph.
- A graph can be considered misleading if the intervals are not consistent throughout the entire display.
- A permutation is when the order in which things are arranged in is important.
- A simulation is a way to model random events.
- A tree diagram can be used to help list all possible outcomes of a test.
- An unbiased sample occurs when everything has an equally likely chance of being selected.
- Certain probabilities have a 100% chance of occurring.
- Dependent events occur when the probability of one event does effect the probability of the second event.

- Equally likely probabilities have a 50% chance of occurring.
- Experimental probability is the probability that you actually get after conducting an experiment.
- Impossible probabilities have a 0% chance of occurring.
- Independent events occur when the probability of one event does not effect the probability of the second event.
- Probabilities can be written as a fraction, decimal, or percent.
- Probability is the likelihood that an event will occur.
- The expected value of a situation is a prediction based on a given probability.
- The solution to a compound probability problem can be achieved by multiplying the probability of each event together.
- Theoretical probability is the probability that should occur before conducting a test.
- When comparing populations using box and whisker plots you can compare the center by examining the median.
- When comparing populations you can compare the variation of each by examining the inter-quartile range for each.

## Application of Skills: Students will be able to...

- Apply proper surveying techniques to seek an answer to a statistical question.
- Calculate the expected value of an event occurring.
- Calculate the experimental/theoretical probability of a given event occurring.
- Calculate the probability of a compound situation (independent/dependent event).
- Calculate the singular probability of a given event.
- Choose an appropriate data display to depict given information properly.
- Compare and contrast information about two populations presented in a box and whisker plot.
- Create a box and whisker plot to represent a given set of data.
- Create a simulation to model the probability of an event occurring.
- Determine whether or not a given data display is misleading.
- Identify on a number line (from 0 to 1) the likelihood that an event will occur.
- Represent the probability of an event as a fraction, decimal, and percent.

## Assessments

- Do Now's: Will be used to check for prior knowledge and to determine mastery of particular topics. If needed the teacher will remediate the previous lesson before continuing.
- Tickets to leave: Will be used to measure student understanding of the lesson and assist in determining whether remediation is needed for the topic.
- Communicator Practice: Will be used as a quick whole-class assessment tool to check for complete comprehension.
- Quarterbacks Project: In this project, students will compare the touchdowns of two different quarterbacks and from there analyze the graphs and state who was a more consistent quarterback.
- Survey Project: Students will be asked to come up with a survey question and apply appropriate surveying techniques to get responses to their survey. Students will then display their results using a

variety of different data displays and then must explain which display is the best to display their information.
- Unit Quiz: focusing only on probability concepts.
- Unit test: focusing on all concepts covered within the "Probability & Statistics" unit.
- Information from this unit will be included on a locally developed, mid-year or end of year benchmark assessment that may take the form of a test, performance based project, or other summative assessment. From this unit, students will be asked to calculate the likelihood of a compound event occurring in addition to comparing two different populations using a box and whisker plot.

## Suggested Activities

- Digits launch activities (Topics 14 - 17).
- Review games using communicators.
- Student centered SMART Board lessons: students will roll number cubes and flip coins to simulate experiments so students can see the differences between experimental probability and theoretical probability.
- Quarterbacks Project (see description in assessments).
- Survey Project (see description in assessments).
- Counting chip activity: to introduce the students to experimental and theoretical probability have students flip a counting chip 20 times and record the results. Explain in the context of the experiment the differences between their experimental results and the theoretical probability. Also use this time to make a prediction if you were to flip the coin 100 times.

## Activities to Differentiate Instruction

**Differentiation for special education:**

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Position student near helping peer or have quick access to teacher
    - Break tests down in smaller increments
- **Content specific modifications may include:**
    - Personal handout for remembering integer rules (can be taped to desk).
    - Graphic organizer for remembering integer rules.
    - Provide completed examples for practice work and homework.
    - Calculator to assist with calculations.

**Differentiation for ELL's:**

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan
- **Content specific vocabulary important for ELL students to understand include:**
  - Probability, likelihood, expected value, predicitions, experimental, theoretical, compound probability, independent events, dependent events, sample, population, biased/un-biased, box and whisker, variation, measure of center, median

**Differentiation to extend learning for gifted students may include:**

- Self directed lesson for students to calculate the permutations/combinations for a given situation.
- When dealing with compound events give students three or 4 events seperate events instead of just two.

## Technology Integration

- iPads or Chromebooks as appropriate to the activity.
- Online learning components including use of the Digits digital textbook and resources.
- Teacher integration of the SMART board to facilitate active student engagement throughout the course of the lesson.
- Software or online programs that teachers may use to create students materials or generate problems such as Kuta software.
- Additional practice provided through the use of IXL.

## Integrated/Cross-Disciplinary Instruction

**ELA:** Practice formulating complete and grammatically correct responses to open-ended questions.

**Game Design:** Have students come up with a game in which they need to calculate the probability of winning. Make them come up with different variations of the game to elicit different outcomes.

**Math, Science, History, Social Studies:** Students can research and discuss the mathematical evidence supporting the idea that Gregor Mendel falsified his data (experimental vs. theoretical probability, the reasons he may have falsified the data, the historical implications of his actions, and the effective use of probability to identify false or misleading claims.

## Resources

Digits teacher materials and support: www.pearsonrealize.com

Digits student access and support: www.mymathuniverse.com

IXL practice: www.ixl.com

Digits video examples

SMART Board lessons

Kuta software generated worksheets

## 21st Century Skills

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| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP6 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP7 | Employ valid and reliable research strategies. |