7th Grade Mathematics

Statistics and Probability - Unit 4b Curriculum Map
March 24th – May 2nd

ORANGE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

Table of Contents

Unit Overview

In this unit, students will ….

- Apply the concepts of measures of center to real-world context
- Use data from a sample to draw information about a population
- Use tree diagrams and arrays to discover the outcomes of a sample space
- Model situations to predict the outcome of events

Enduring Understandings

- The sum of the probabilities of every outcome in a sample space should always equal 1
- The probability of an event can be represented as a fraction between 0 and 1
- The probability of an event not happening is equal to 0 or 0%. The probability of an event definitely happening is equal to 1 or 100%.

Common Core Standards

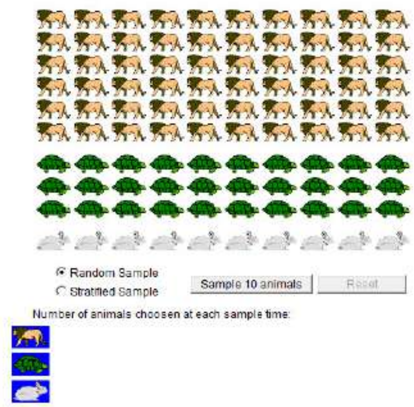
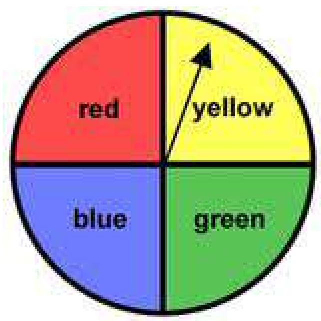
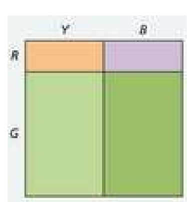
COMMON CORE STANDARDS	
7.SP.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends 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*.
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*.
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 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
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. 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* 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 frequencies?
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. 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. 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. 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?*

Curriculum Guide

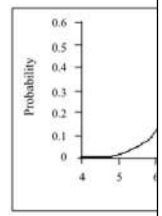
Activity	Common Core Standards	Estimated Time
Samples and Populations Investigations 1.1, 1.2, 1.3, 1.4 (not B3)	7.SP.3, 7.SP.4	2 days
Samples and Populations Investigations 2.1, 2.2, 2.3 (A and B only)	7.SP.1, 7.SP.2	2 days
Samples and Populations Investigations 3.2, 3.4	7.SP.3	3 days
What Do You Expect? Investigation 1.1, 1.2, 1.3, 1.4	7.SP.6, 7.SP.7, 7.SP.8	3 days
What Do You Expect? Investigation 2.2, 2.3	7.SP.5-8	1 day
What Do You Expect? Investigation 3.1, 3.2	7.SP.6, 7.SP.7, 7.SP.8	1 day
What Do You Expect? Investigation 4.1, 4.2, 4.4	7.SP.5, 7.SP.6, 7.SP.8	3 days
Illustrative Math Task – Offensive Linemen	7.SP.3, 7.SP.4	1 day
Unit Assessment	All Standards	3/21 *Data Due, 3/28*

Teaching to Multiple Representations – Review Content

Concrete Representations	
Population Simulation (Manipulatives)	
Survey Questions	
Data Collections	
Spinners	
Random Sampling Activities	
Number Cubes and Dice	
Area Models	
Pictorial Representations	

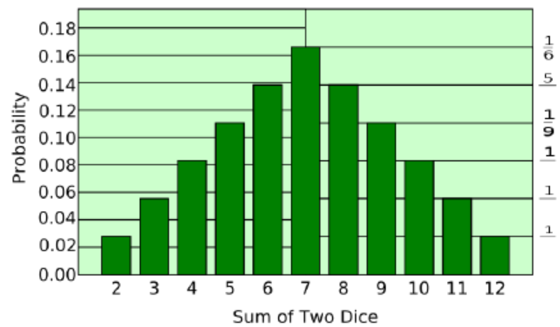
Tabular Representation

x	1	2	3	4
y	2.5	5	7.5	10

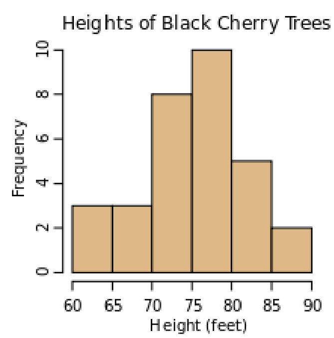


Graphical Representation

Bar Graphs



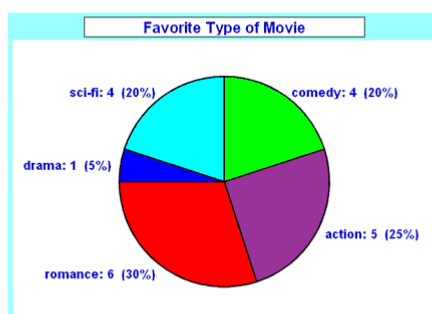
Histogram



Stem and Leaf

Line Graph/Plot

Pie Graphs/Charts



Abstract Representations

Experimental and Theoretical Probability

Algorithm	$\frac{\#\ of\ favorable\ outcomes}{\#\ of\ total\ outcomes}$

Connections to the Mathematical Practices

1	**Make sense of problems and persevere in solving them** - Students make sense of probability and sampling as a rational number, percentage, or as a visual model
2	**Reason abstractly and quantitatively** - Students reason about probabilities as values between 0 and 1. - Students are able to predict an outcome based on given information - Students reason about values in a data display
3	**Construct viable arguments and critique the reasoning of others** - Students question each other about a prediction or probability - Students use data to make inferences
4	**Model with mathematics** - Students model probabilities using area models, rational numbers, and in visual displays - Students construct arguments using given or calculated evidence
5	**Use appropriate tools strategically** - Students simulate and approximate probabilities
6	**Attend to precision** - Students use precise language to discuss and present probabilities and outcomes
7	**Look for and make use of structure** - Students represent probabilities as a rational number, percentage, or as a visual representation
8	**Look for and express regularity in repeated reasoning** - Students use proportional reasoning to predict a population characteristic using a random sample

Vocabulary

Term	Definition
Sample	A part of the population that we actually examine to gather information about the whole
Mean Absolute Deviation	The average distance of each data value from the mean. The MAD is a gauge of "on average" how different the values are from the mean value
Mean	A measure of center in a set of numerical data, the sum of the values in a data set divided by the number of values in the data set
Event	Any possible outcome of an experiment in a probability
Experimental Probability	The ratio of the number of times an outcome actually occurs to the number of trials performed
Probability	It can be listed as a number between 0 and 1
Sample Space	All possible outcomes of a given experiment
Theoretical Probability	The expected outcome of an experiment in a probability

Potential Student Misconceptions

- Students assume that all events have an equally likely chance of occurring
- Students assume that sample size is irrelevant
- Students struggle to make connections between graphs and other representations
- Students are unable to distinguish between a histogram and bar graph

Associated Illustrative Math Tasks

College football teams are grouped with similar teams into "divisions" (and in some cases, "subdivisions") based on many factors such as game attendance, level of competition, athletic department resources, and so on. Schools from the Football Bowl Subdivision (FBS, formerly known as Division 1-A) are typically much larger schools than schools of any other division in terms of enrollment and revenue. "Division III" is a division of schools with typically smaller enrollment and resources.

One particular position on a football team is called "offensive lineman," and it is generally believed that the offensive linemen of FBS schools are heavier on average than the offensive linemen of Division III schools.

For the 2012 season, the University of Mount Union Purple Raiders football team won the Division III National Football Championship while the University of Alabama Crimson Tide football team won the FBS National Championship. Below are the weights of the offensive linemen for both teams from that season.

(Accessed at http://athletics.mountunion.edu/sports/fball/2012-13/roster, http://www.rolltide.com/sports/m-footbl/mtt/alab-m-footbl-mtt.html on 1/14/13)

Alabama
277
265
292
303
303
320
300
313
267
288
311
280
302
335
310
290
312
340
292

Mount Union
250
250
290
260
270
270
310
290
280
315
280
295
300
300
260
255
300

a. Based on visual inspection of the dotplots, which group appears to have the larger average weight? Does one group seem to have greater variability in its weights than the other, or do the two groups look similar in that regard?

b. Compute the mean and mean absolute deviation (MAD) for each group. Do your measures support your answers in part (a)?

c. Choose from the following to fill in the blank: "The average Alabama offensive lineman's weight is about __________ than the average Mount Union offensive lineman's weight."

i. 20 pounds lighter

ii. 15 pounds lighter

iii. 15 pounds heavier

iv. 20 pounds heavier

"This difference in average weights is approximately ____________ of either team"

v. About Half of the MAD

vi. Slightly more than 1 MAD

vii. Twice the MAD

d. The offensive linemen on the Alabama team are not a random sample from all FCS offensive linemen. Similarly, the offensive linemen on the Mount Union Team are not a random sample from all Division III offensive linemen. However, for purposes of this task, suppose that these two groups can be regarded as random samples of offensive linemen from their respective divisions/subdivisions. If these were random samples, would you think that offensive linemen from FBS schools are typically heavier than offensive linemen from Division III schools? Explain your decision using answers to the previous questions and/or additional analysis.

Extensions and Sources

Online Resources

http://www.illustrativemathematics.org/standards/k8

- Performance tasks, scoring guides

https://www.khanacademy.org/math/

- Interactive, tracks student points, objective descriptive videos, allows for hints

http://www.doe.k12.de.us/assessment/files/Math_Grade_7.pdf

- Common Core aligned assessment questions, including Next Generation Assessment Prototypes

http://www.learnzillion.com

- Videos organized by Common Core Standard presented with visual representations and student friendly language

https://www.georgiastandards.org/Common-Core/Pages/Math-6-8.aspx

- Common Core assessment resources, tasks designed for students with special needs

http://www.parcconline.org/sites/parcc/files/PARCCMCFMathematicsGRADE8_Nov2012V3_FINAL.pdf

- PARCC Model Content Frameworks Grade 8

http://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf

- Progressions of Expressions and Equations from grades 6-8