MATHEMATICS COMMON CORE CURRICULUM UNIT*
North Smithfield Public Schools

TITLE OF UNIT: Statistics and Probability **COURSE OR GRADE : Math 7**

DATE PRESENTED: _____DATE DUE: _____ LENGTH OF TIME: 24 days

OVERVIEW OF UNIT:

Students will use sample data and probability concepts to make predictions and decisions.

ESSENTIAL QUESTION, PROMPT, PROBLEM/UNIT
How can we use data and an understanding of probability to make decisions?

STANDARDS: Common Core Math Standards – Grade level domains 6-8

Ratios and Proportional Relationships RP	The Number System NS	Expressions and Equations EE	Functions (grade 8)		Probability SP
□	□	□	□	□	□
□	□	□	□	□	□
□	□				
□	□				

: Mathematical Practices grades K-12

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics ★
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

FOCUS MATHEMATICS STANDARDS: see curriculum _____ for specific standards, e.g. (CUT AND PASTE FROM MAP)

- Analyze proportional relationships and use them to solve real-world and mathematical problems. 7.RP.3
- Use random sampling to draw inferences about a population. 7.SP.1,2
- Draw informal comparative inferences about two populations. 7.SP.3, 4
- Investigate chance processes and develop, use, and evaluate probability models. 7.SP.5, 6, 7,8

Applied Learning Standards:

problem solving communication critical thinking research reflection/ evaluation

ENDURING UNDERSTANDING: (CUT AND PASTE FROM CURRICULUM – ESSENTIAL KNOWLEDGE)

*Referenced templates from *Common Core Curriculum Maps, English Language Arts* and *The Understanding By Design Guide to Creating High Quality Units*

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PRIOR KNOWLEDGE:

STUDENT OBJECTIVES, SKILLS and/or NEW KNOWLEDGE: (CUT AND PASTE FROM CURRICULUM – ESSENTIAL KNOWLEDGE)

7.RP.3
- Ratio can be extended into solving single and multi-step proportionality problems and percent problems.

7.SP.1
- Random samplings create sample populations, which mimic the demographics of a larger population, that are used to collect and generalize information.

7.SP.2
- Data from random samplings can be used to create valid inferences about an unknown characteristic of interest.

7.SP.3
- Measures of center and measures of variability are used to determine informal (generalizations) or formal (numerical) differences between two data sets with similar variability.

7.SP.4
- Measures of center and measures of variability are used to determine informal (generalizations) or formal (numerical) differences between two data sets with similar variability.

7.SP.5
- A number between 0 and 1 represents the probability of the likelihood of an event occurring, where 0 is impossible and 1 is certain the event will occur.

7.SP.6
- Experiments and simulations are used to collect data to determine the chance probability.

7.SP.7
- Actual probabilities, simple or compound, are the fraction of outcomes in the sample space for which the event or compound event occurs.
- The more times an experiment or simulation is done the closer the chance probability should be to the actual probability, simple or compound

7.SP.8
- Sample spaces for compound events are represented using organized lists, tables and tree diagrams.

ACTIVITIES, PRODUCTS, PERFORMANCE, and ASSESSMENTS: see curriculum introduction

1. Application to real world problems
2. Creating charts/collecting data
3. Collaboration - interpersonal
4. Conferencing
5. Exhibits
6. Graphic organizers
7. Graphing
8. Interviews
9. Journals
10. KWL charts
11. Mathematical Practices
12. Modeling ★
13. Oral presentations
14. Problem/Performance based/common tasks
15. Real-life applications involving graphing
16. Represent numbers
17. Rubrics/checklists (mathematical practice, modeling)
18. Technology
19. Summarizing and note-taking
20. Tests and quizzes
21. Writing genres
    Arguments/ opinion
    Informative

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Lessons	Resources	Timeframe
Mean, Median, Mode and Range	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 7 Lesson 1**	**1**
Populations and Samples	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 7 Lesson 3**	**1**
Examining Samples	**Joss-Bass *Teaching the Common Core Math Standards with Hands-On Activities* p. 129 (requires poll results to be collected prior to activity)**	**1**
How Many Cubes?	**Joss-Bass *Teaching the Common Core Math Standards with Hands-On Activities* p. 131**	**1**
How Well Did They Do?	**Joss-Bass *Teaching the Common Core Math Standards with Hands-On Activities* p. 133**	**1**
Box-and-Whisker Plots	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 7 Lesson 2**	**1**
What Can We Say?	**Joss-Bass *Teaching the Common Core Math Standards with Hands-On Activities* p. 136**	**1**
Quiz on Interpreting Information		**1**
Probability	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 1**	**1**
Experimental Probability	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 2**	**1**
Sample Spaces	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 3**	**1**
Theoretical Probability	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 4**	**1**
Making Predictions	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 5**	**1**
Quiz		**1**
Probability of Independent and Dependent Events	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 6**	**1**
Combinations	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 7**	**1**
Permutations	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 8**	**1**
Probability of Compound Events	**Holt McDougall Mathematics *Explorations in Core Math Grade 7* Chapter 10 Lesson 9**	**2**
Working With Sample Space	**Joss-Bass *Teaching the Common Core Math Standards with Hands-On Activities* p. 136**	**1**
Additional Practice		**3**
Unit Assessment		**1**

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HIGHER ORDER THINKING SKILLS: Web's Depth of Knowledge 2 – 4 or Bloom's Taxonomy

Web's Depth of Knowledge	Bloom's Taxonomy
• skill/conceptual understanding • strategic reasoning • extended reasoning	• apply • analyze • synthesize/create • evaluate

ADDITIONAL RESOURCES: see curriculum for specifics

- Holt McDougall Mathematics *Explorations in Core Math Grade 7*
- Jossey-Bass Teaching the Common Core Math Standards with Hands-On Activities
- Holt Course 2
- Holt Course 3
- McDougall Littell Pre-Algebra

VOCABULARY (CUT AND PASTE FROM CURRICULUM)

7.RP.3

- Dependent
- Equivalent ratios
- Independent
- Linear relationship

7.SP

- Area model
- Binomial probability
- Categorical data
- Deviation
- Distribution
- Expected value
- Experimental
- Inference
- Mean absolute deviation (MAD)
- Measures of center
- Measures of variability
- Outcome
- Probability
- Random
- Random sample
- Sample space
- Theoretical probability
- Variability of a set of numerical data

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OBJECTIVES:

Lessons	Objective
Mean, Median, Mode and Range	Students will determine the measures of center of a data set.
Populations and Samples	Students will use a sample to gain information about a population and compare predictions about a population.
Examining Samples	Students will use random sampling to draw inferences about a population.
How Many Cubes?	Students will use random sampling to draw inferences about a population.
How Well Did They Do?	Students will draw informal comparative inferences about two populations.
Box-and-Whisker Plots	Students will use measures of center and variability to compare two populations.
What Can We Say?	Students will draw informal comparative inferences about two populations.
Quiz	
Probability	Students will describe the likelihood of an event.
Experimental Probability	Students will find the experimental probability of an event.
Sample Spaces	Students will use simulations to estimate probabilities.
Theoretical Probability	Students will find the theoretical probability of an event.
Making Predictions	Students will make decisions based on predictions.
Quiz	
Probability of Independent and Dependent Events	Students will find probability with and without replacement.
Combinations	Students will use Pascal's Triangle to solve problems involving probability.
Permutations	Students will determine probability using permutations. (uses graphing calculator – may need to replace this if we cannot find an online graphing calculator)
Probability of Compound Events	Students will find the probability of a compound event.
Working With Sample Space	Students will investigate chance processes and develop, use and evaluate probability models.
Additional Practice	
Unit Assessment	

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- **Assessments:** see curriculum introduction
  - **Formative**
  - **Summative**

SUGGESTED PROBLEMS: (CUT AND PASTE FROM CURRICULUM TEACHING PROBLEMS OR ASSESSMENTS)

7.RP.3

- Gas prices are projected to increase 124% by April 2015. A gallon of gas currently costs $4.17. What is the projected cost of a gallon of gas for April 2015?
- A student might say: "The original cost of a gallon of gas is $4.17. An increase of 100% means that the cost will double. I will also need to add another 24% to figure out the final projected cost of a gallon of gas. Since 25% of $4.17 is about $1.04, the projected cost of a gallon of gas should be around $9.40."

$$\$4.17 + \$4.17 + (0.24 \bullet \$4.17) = \$2.24 \times \$4.17$$

100%	100%	24%
$4.17	$4.17	?

- A sweater is marked down 33%. Its original price was $37.50. What is the price of the sweater before sales tax?

37.50 Original Price of Sweater	
33% of 37.50	67% of 37.50 Sale price of sweater

- The discount is 33% times $37.50. The sale price of the sweater is the original price minus the discount or 67% of the original price of the sweater, or Sale Price = 0.67 x Original Price.
- A shirt is on sale for 40% off. The sale price is $12. What was the original price? What was the amount of the discount?

Discount 40% of original price	Sale Price - $12 60% of original price
Original Price (p)	

- At a certain store, 48 television sets were sold in April. The manager at the store wants to encourage the sales team to sell more TVs and is going to give all the sales team members a bonus if the number of TVs sold increases by 30% in May. How many TVs must the sales team sell in May to receive the bonus? Justify your solution.
- After eating at a restaurant, your bill before tax is $52.60 The sales tax rate is 8%. You decide to leave a 20% tip for the waiter based on the pre-tax amount. How much is the tip you leave for the waiter? How much will the total bill be, including tax and tip? Express your solution as a multiple of the bill.
- The amount paid = 0.20 x $52.50 + 0.08 x $52.50 = 0.28 x $52.50
- Finding the percent error is the process of expressing the size of the error (or deviation) between two measurements. To calculate the present error, students determine the absolute deviation (positive difference) between an equal measurement and the accepted value and then divide by the accepted value. Multiplying by 100 will give the percent error. (Note the similarity between percent and percent of increase or decrease)

$$\% \text{ error} = \frac{|\text{estimated value} - \text{actual value}|}{\text{actual value}} \times 100\%$$

Example: A student measures the volume of a 2.50 liter container to be 2.38 liters. What is the percent error in the student's measurement?

- Answer: $\% \text{ error} = \frac{(2.50 \text{ liters} - 2.38 \text{ liters})}{2.50 \text{ liters}} \times 100\%$

$$= \frac{(.12 \text{ liters})}{2.50 \text{ liters}} \times 100\%$$

$$= .048 \times 100\%$$

7.SP.1

- The school food service wants to increase the number of students who eat hot lunch in the cafeteria. The student council has been asked to conduct a survey of the student body to determine the students' preferences for hot lunch. They have determined two ways to do the survey. The two methods are listed below. Identify the type of sampling used in each survey option. Which survey option should the student council use and why?
  1. Write all of the students' names on cards and pull them out in a draw to determine who will complete the survey.
  2. Survey the first 20 students that enter the lunchroom.

7.SP.2

- 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
- Below is the data collected from two random samples of 100 students regarding student's school lunch preference. Make at least two inferences based on the results.

Lunch Preferences

student sample	hamburgers	tacos	pizza	total
#1	12	14	74	100
#2	12	11	77	100

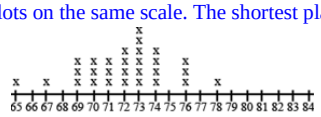
7.SP.3

- Jason wanted to compare the mean height of the players on his favorite basketball and soccer teams. He thinks the mean height of the players on the basketball team will be greater but doesn't know how much greater. He also wonders if the variability of heights of the athletes is related to the sport they play. He thinks that there will be a greater variability in the heights of soccer players as compared to basketball players. He used the rosters and player statistics from the team websites to generate the following lists.

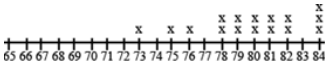
- Basketball Team – Height of Players in inches for 2010-2011 Season
  75, 73, 76, 78, 79, 78, 79, 81, 80, 82, 81, 84, 82, 84, 80, 84

- Soccer Team – Height of Players in inches for 2010
  73, 73, 73, 72, 69, 76, 72, 73, 74, 70, 65, 71, 74, 76, 70, 72, 71, 74, 71, 74, 73, 67, 70, 72, 69, 78, 73, 76, 69

- To compare the data sets, Jason creates a two dot plots on the same scale. The shortest player is 65 inches and the tallest players are 84 inches



Height of Soccer Players (in)



Height of Basketball Players (in)

- In looking at the distribution of the data, Jason observes that there is some overlap between the two data sets. Some players on both teams have players between 73 and 78 inches tall. Jason decides to use the mean and mean absolute deviation to compare the data sets. Jason sets up a table for each data set to help him with the calculations.

- The mean height of the basketball players is 79.75 inches as compared to the mean height of the soccer players at 72.07 inches, a difference of 7.68 inches.

- The mean absolute deviation (MAD) is calculated by taking the mean of the absolute deviations for each data point. The difference between each data point and the mean is recorded in the second column of the table. Jason used rounded values (80 inches for the mean height of basketball players and 72 inches for the mean height of soccer players) to find the differences. The absolute deviation, absolute value of the deviation, is recorded in the third column. The absolute deviations are summed and divided by the number of data points in the set.

The mean absolute deviation is 2.14 inches for the basketball players and 2.53 for the soccer players. These values indicate moderate variation in both data sets. There is slightly more variability in the height of the soccer players. The difference between the heights of the teams is approximately 3 times the variability of the data sets (7.68 ÷ 2.53 = 3.04).

Soccer Players (n = 29)			Basketball Players (n = 16)		
Height (in)	Deviation from Mean (in)	Absolute Deviation (in)	Height (in)	Deviation from Mean (in)	Absolute Deviation (in)
65	-7	7	73	-7	7
67	-5	5	75	-5	5
69	-3	3	76	-4	4
69	-3	3	78	-2	2
69	-3	3	78	-2	2
70	-2	2	79	-1	1
70	-2	2	79	-1	1
70	-2	2	80	0	0
71	-1	1	80	0	0
71	-1	1	81	1	1
71	-1	1	81	1	1
72	0	0	82	2	2
72	0	0	82	2	2
72	0	0	84	4	4
72	0	0	84	4	4
73	+1	1	84	4	4
73	+1	1			
73	+1	1			
73	+1	1			
73	+1	1			
73	+1	1			
74	+2	2			
74	+2	2			
74	+2	2			
74	+2	2			
76	+4	4			
76	+4	4			
76	+4	4			
78	+6	6			
Σ = 2090		Σ = 62	Σ = 1276		Σ = 40

Mean = 2090 ÷ 29 =72 inches Mean = 1276 ÷ 16 =80 inches
MAD = 62 ÷ 29 = 2.13 inches MAD = 40 ÷ 16 = 2.5 inches

7.SP.4

- Measures of center include mean, median, and mode. The measures of variability include range, mean absolute deviation, and interquartile range.

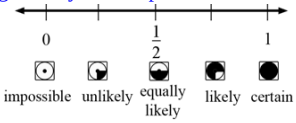
Example:

- The two data sets below depict random samples of the housing prices sold in the King River and Toby Ranch areas of Arizona. Based on the prices below which measure of center will provide the most accurate estimation of housing prices in Arizona? Explain your reasoning.
    - TBD current RI data {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000}
    - TBD current RI data {5million, 154000, 250000, 250000, 200000, 160000, 190000}
- 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

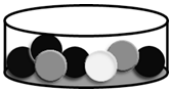
- Probability can be expressed in terms such as impossible, unlikely, likely, or certain or as a number between 0 and 1 as illustrated on the number line. Students can use simulations such as Marble Mania on AAAS or the Random Drawing Tool on NCTM's Illuminations to generate data and examine patterns.

- Marble Mania http://www.sciencenetlinks.com/interactives/marble/marblemania.html
- Random Drawing Tool - http://illuminations.nctm.org/activitydetail.aspx?id=67



Example:

- The container below contains 2 gray, 1 white, and 4 black marbles. Without looking, if you choose a marble from the container, will the probability be closer to 0 or to 1 that you will select a white marble? A gray marble? A black marble? Justify each of your predictions.

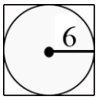


7.SP.6

- Each group receives a bag that contains 4 green marbles, 6 red marbles, and 10 blue marbles. Each group performs 50 pulls, recording the color of marble drawn and replacing the marble into the bag before the next draw. Students compile their data as a group and then as a class. They summarize their data as experimental probabilities and make conjectures about theoretical probabilities (How many green draws would you expect if you were to conduct 1000 pulls? 10,000 pulls?).
- Students create another scenario with a different ratio of marbles in the bag and make a conjecture about the outcome of 50 marble pulls with replacement. (An example would be 3 green marbles, 6 blue marbles, 3 blue marbles.)
- Students try the experiment and compare their predictions to the experimental outcomes to continue to explore and refine conjectures about theoretical probability.
- 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

- 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.
- If you choose a point in the square, what is the probability that it is not in the circle?



- 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

- Students conduct a bag pull experiment. A bag contains 5 marbles. There is one red marble, two blue marbles and two purple marbles. Students will draw one marble without replacement and then draw another. What is the sample space for this situation? Explain how you determined the sample space and how you will use it to find the probability of drawing one blue marble followed by another blue marble.
- 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?
- Show all possible arrangements of the letters in the word FRED using a tree diagram. If each of the letters is on a tile and drawn at random, what is the probability that you will draw the letters F-R-E-D in that order? What is the probability that your "word" will have an F as the first letter