Unit 7- Data and Probability

Assignment:	Title:	Work to Complete:	Check when Complete:
7.1	Mean, Median, Mode and Range		
Quiz 1			
7.2	Probability		
Quiz 2			
Unit Test!			

Self-Assessment:

On the following chart, indicate how confident you feel about each statement.

1- I need more help 2- I need more practice 3- I could teach it!

Statement: *After completing this chapter I can:*	1, 2 or 3
• Calculate the measures of central tendencies for a given set of data (mean, median, and mode)	
• I can identify outliers and analyze how they may affect measures of central tendency	
• I can calculate theoretical probability of an event	
• I can conduct an experiment (or create a simulation) to determine the probability of an event happening	
• I can understand the difference between theoretical and experimental probability	

Vocabulary to know:

-mean
-median
-mode
-range
-measures of central tendency
-experimental probability
-theoretical probability

7.1- Mean, Median, Mode and Range

Statistics is a field of mathematics that deals with the collecting and summarizing of data. There are four measures of central tendency that we will be working with:

Mean (sometimes called average). To calculate the mean we add up all the values and then divide by the number of values we have.

Median is the center or middle value. To find the median we order all the numbers from smallest to largest and then pick the middle number.
(If there are two numbers in the middle we take the mean of those two numbers.)

Mode is the most frequent value. To find the mode we look for the value that occurs most often.

Range is the difference between the highest and lowest values. (Subtract the lowest value from the highest value)

Example 1: Find the Mean, Median, Mode and Range of the following set of numbers:

32 , 33 , 34 , 33 , 23 , 26 , 34 , 34 , 3

Solution:

Mean: Add all up & divide by 9 (there are 9 numbers)

32 + 33 + 34 + 33 + 23 + 26 + 34 + 34 + 3 = 252

252 ÷ 9 = 28 | Mean = 28 |

Median: Order all numbers from smallest to largest.

3, 23, 26, 32, (33), 33, 34, 34, 34 Find middle number.

| Median: 33 |

Mode: Which number occurs the most? | Mode = 34 |

Range: Biggest Number - Smallest Number

34 - 3 = 31 | Range = 31 |

Example 1, part B.

Given the above set of numbers: 32, 33, 34, 33, 23, 26, 34, 34, 3, how does the 3 affect the data? What would this number be called? Calculate the mean, median and mode without the outlier, to compare your results.

Solution:

-since the 3 in the above set of numbers is drastically different from the rest, we can call it an outlier.

Mean:

With outlier:	Without outlier:
28	32+33+34+33+23+26+34+34 = 249 -then ÷ 8 since 8 numbers, not 9 249 ÷ 8 = 31.125

Median:

With outlier:	Without outlier:
33	23, 26, 32, 33, 33, 34, 34, 34 -mean of 33 and 33 is 33, so median is still 33

Mode:

With outlier:	Without outlier:
34	Still 34

Range:

With outlier:	Without outlier:
31	Biggest- smallest number 34-23 = 11

In this example, the removal of the outlier impacted the range greatly, and the mean slightly. It did not change the mode or median, but it could with different number sets.

Assignment 7.1

1) Find the Mean, Median, Mode and Range of the number set below. Show all of your work for each calculation.

4.2 , 10.3 , 11.3 , 5.0 , 60.5 , 35.2 , 21.7 , 24.0 , 4.9 , 18.9

2) The tuition costs for ten universities are given in a table:

University	UBC	UVIC	TRU	Waterloo	McGill	UFV	UNBC	SFU	UofA	Uo
Costs ($)	7568	8650	9225	5880	6720	8840	7820	8432	8990	8260

Find the Mean, Median, Mode and Range of the tuition prices, showing all of your work.

You are now ready for quiz 1!

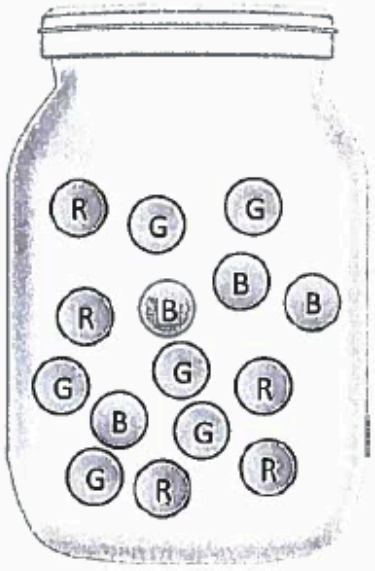
7.2- Probability

Theoretical Probability – Probability that a certain outcome will occur, based on reasoning or calculation (What we expect to happen)

$$P(A) = \frac{\text{Number of Favourable Outcomes for Event A}}{\text{Total Number of Outcomes in Sample Space}}$$

****always simplify your fractions!**

Example 1: A jar contains 5 red, 6 green and 4 blue marbles:



a) What is the probability of choosing a green marble?

$P(\text{Green}) = \frac{\text{Number of green marbles}}{\text{Total number of marbles}} = \frac{6}{15} \div 3$

$P(\text{Green}) = \frac{2}{5}$

b) What is the probability of choosing a red marble?

$P(\text{Red}) = \frac{\#\text{ of red marbles}}{\text{Total \# of marbles}} = \frac{5}{15} \div 5$

$P(\text{Red}) = \frac{1}{3}$

c) What is the probability of choosing a blue marble?

$P(\text{Blue}) = \frac{\#\text{ of blue marbles}}{\text{Total \# of marbles}} = \frac{4}{15}$

$P(\text{Blue}) = \frac{4}{15}$

d) What do all the probabilities add up to?

$P(\text{Green}) + P(\text{Red}) + P(\text{Blue})$ * use fractions with denominator of 15 as easier to add up

$= \frac{6}{15} + \frac{5}{15} + \frac{4}{15} = \frac{15}{15}$ or 1 (they add up to 100%)

e) What is the probability of choosing a red or a green?

$P(\text{Red or Green}) = \frac{\#\text{ of red or green}}{\#\text{ total marbles}} = \frac{5+6}{15} = \frac{11}{15}$

f) What is the probability of not choosing a red or a green?

$P(\text{Not Red or Green}) = \frac{\#\text{ not red/green}}{\text{total marbles}} = \frac{4}{15}$

Fair Game – when all options are equally likely

Example 2: John and Mattie are playing a game. They roll a dice. If the number is a multiple of 3 then John wins, if not then Mattie wins. Is this a fair game?

3, 6 (only ones on die)

$P(\text{John Wins}) = \frac{\#\text{ of sides that are multiples of 3}}{\text{total possible outcomes (numbers)}} = \frac{2 \div 2}{6 \div 2} = \frac{1}{3}$

$P(\text{Mattie wins}) = \frac{\#\text{ of sides that are not multiples of 3}}{\text{total possible outcomes}} = \frac{4 \div 2}{6 \div 2} = \frac{2}{3}$ (2)

*They are not equal so this is NOT A FAIR GAME

Example 3: Brendan and Sally are playing a game. They roll a dice. If the number is a multiple of 2 then Brendan wins, if not then Sally wins. Is this a fair game?

2, 4, 6

$P(\text{Brendan Wins}) = \frac{\#\text{ sides that are multiples of 2}}{\text{number of sides (\# of numbers)}} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2}$

$P(\text{Sally Wins}) = \frac{\#\text{ of sides that are not multiples of 2}}{\text{total outcomes}} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2}$

these are equally likely

so this is a fair game

Experimental Probability – Probability based purely on actual trials
(What actually happens when we try it out).

$$P(A) = \frac{\textit{Number of Times Event A Occurs}}{\textit{Total Number of Trials}}$$

Example 4:

a) Roll a 6-sided cube (a die) 5 times and record the results. What is the Experimental Probability of rolling a 5? *Your results will most likely be different* (Write your answer as a fraction as well as a decimal rounded to 4 decimal places.)

Trial #	1	2	3	4	5
Outcome	1	3	1	4	5

$P(5) = \frac{\#\text{ of 5's}}{\#\text{ of trials}} = \frac{1}{5}$

Decimal $1 \div 5 = 0.2$

$P(\text{roll 5}) = \frac{1}{5}$ or 0.2

b) Roll a 6-sided cube (a die) 10 times and record the results. What is the Experimental Probability of rolling a 5?
(Write your answer as a fraction as well as a decimal rounded to 4 decimal places.)

Trial #	1	2	3	4	5	6	7	8	9	10
Outcome	1	2	1	6	5	3	6	4	3	1

$P(\text{roll 5}) = \frac{\#\text{ of 5's}}{\#\text{ of trials}} = \frac{1}{10}$

Decimal: $1 \div 10 = 0.1$

$P(\text{roll 5}) = \frac{1}{10}$ or 0.1

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c) Roll a 6-sided cube (a die) 20 times and record the results. What is the Experimental Probability of rolling a 5?
(Write your answer as a fraction as well as a decimal rounded to 4 decimal places.)

Trial #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outcome	5	2	6	2	4	1	6	4	5	2	6	5	2	3	6	1	3	1	4	6

$P(\text{rolling 5}) = \frac{\#\text{ of 5's}}{\text{total trials}} = \frac{3}{20}$

Decimal: $3 \div 20 = 0.15$

$P(\text{rolling 5}) = \frac{3}{20}$ or 0.15

d) Roll a 6-sided cube (a die) 40 times and record the results. What is the Experimental Probability of rolling a 5?
(Write your answer as a fraction as well as a decimal rounded to 4 decimal places.)

Trial #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outcome	2	3	4	1	2	1	1	1	5	4	2	1	1	2	1	2	1	4	4	5

Trial #	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Outcome	1	5	3	1	4	3	6	6	3	3	3	6	5	1	2	1	2	3	3	2

$P(\text{rolling 5}) = \frac{\#\text{ of 5's}}{\text{total trials}} = \frac{4 \div 4}{20 \div 4} = \frac{1}{5}$

Decimal: $1 \div 5 = 0.2$

$P(\text{rolling 5}) = \frac{1}{5}$ or 0.2

e) What is the Theoretical Probability of rolling a 5?

$P(\text{rolling 5}) = \frac{\#\text{ of 5's on dice}}{\#\text{ of possible outcomes}} = \frac{1}{6}$

P(rolling 5) = $\frac{1}{6}$ or 0.17

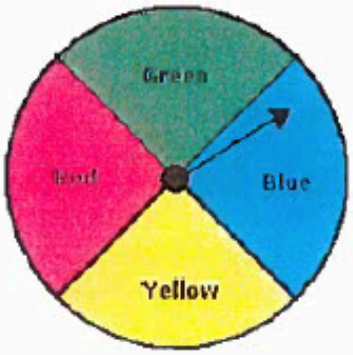
Decimal: $1 \div 6 = 0.166666666 = 0.17$

f) What do you notice when you compare your experimental probabilities and the theoretical probability?

As you complete more & more trials the experimental probability should get closer to the theoretical probability

Assignment 7.2

1. A spinner has 4 equal sections as shown. One is green, one is blue, one is red, and one is yellow.

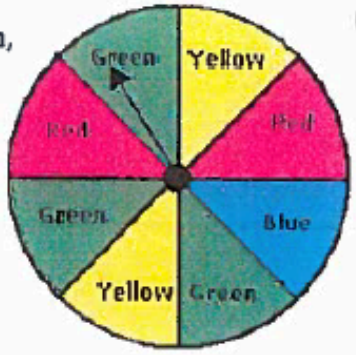


a) What is the Theoretical Probability of spinning a red?

b) What is the Theoretical Probability of spinning a green or yellow?

c) What is the Theoretical Probability of spinning a red, green, yellow, or blue?

2. A spinner has 8 equal sections as shown. Three sections are green, one is blue, two are red, and two are yellow.



a) What is the Theoretical Probability of spinning a red?

b) What is the Theoretical Probability of spinning a green or yellow?

c) What is the Theoretical Probability of spinning a purple?

3. A jar contains 5 red, 6 green and 4 blue marbles. Brenda and Bobby are playing a game. They pick one marble out of the jar. If the marble is green then Brenda wins, if not Bobby wins. Is this a fair game? (Explain your answer)

4. Carly and Court are playing a game. A 6-sided die is rolled. If the number is **Less than 4** then Carly wins. Otherwise Court wins. Is this a fair game? (Explain your answer).

5. Flip a coin 5 times and record the results. What is the Experimental Probability of getting a Heads? (Give your answer as a fraction **AND** as a decimal to 4 places)

Trial #	1	2	3	4	5
Outcome					

6. Flip a coin 10 times and record the results. What is the Experimental Probability of getting a Heads? (Give your answer as a fraction **AND** as a decimal to 4 places)

Trial #	1	2	3	4	5	6	7	8	9	10
Outcome										

7. a) What is the theoretical probability of getting a heads?

b) What could you do to try to make your experimental probability closer to your theoretical probability?

You are now ready for quiz 2!

Answer Key:

7.1

1) Mean: 19.6 Median: 15.1 Mode: no mode Range: 56.3

2) Mean: $8038.50 Median: $8436.00 Mode: none Range: $3345.00

7.2

1) a. ¼ b. ½ c. 1 or 100%

2) a. 1/4 b. 5/8 c. 0/8 or 0

3) P(Brenda Wins): 2/5 P(Bobby Wins): 3/5, therefore not a fair game as unequal theoretical probabilities

4) P(Carly Wins): ½ P(Court Wins): 1/2 , so since these probabilities are equal, it is a fair game

5) Answers will vary

6) Answers will vary

7) P(heads)= ½

   b. Increase the amount of trials