How Odd? Learning Task **Name ____________________________**

2019

Part 1 – For this task you will need a pair of six-sided number cubes. In Part 1, you will be concerned with the probability that one (or both) of the number cubes show odd values.

1. Roll your pair of number cubes 36 times, each time recording a success if one (or both) of the cubes show an odd number and a failure if the cubes do not show an odd number.

Number of Successes	Number of Failures

2. Based on your trials, what would you estimate the probability of two number cubes (or dice) showing at least one odd number?

3. You have just calculated an ***experimental probability***. Now, let's calculate the ***theoretical probability***.

a. How many possible outcomes are there for rolling two different colored number cubes?

b. A **lattice diagram** is useful in finding the theoretical probabilities for two number cubes (or dice) thrown together. Each possible way the two dice can land, also known as an **outcome**, is represented as an ordered pair. (1, 1) represents each die landing on a 1, while (4, 5) would represent the first die landing on 4, the second on 5. Complete the lattice diagram for rolling two dice.

Dice Lattice

(1,1)	(1,2)	(1,3)	(,)	(,)	(,)
(2,1)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)

The 36 entries in your dice lattice represent the ***sample space*** for two dice thrown. The sample space for any probability model is ALL the possible outcomes.

c. Using your lattice, determine the theoretical probability of having at least one of the two dice show an odd number.

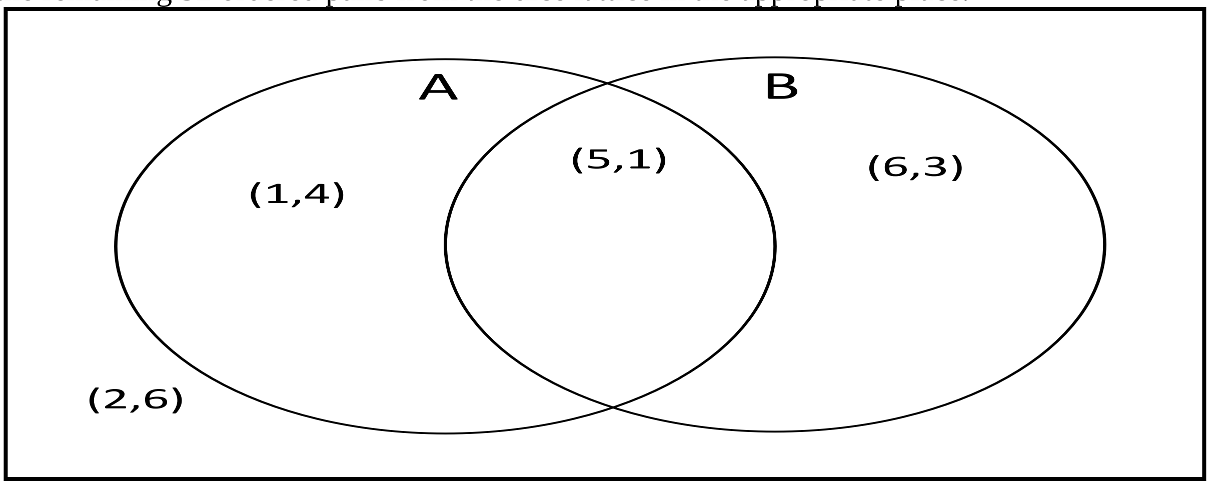
d. It is often necessary to list the sample space and/or the outcomes of a set using ***set notation***. For the dice lattice above, the set of all outcomes where the first roll was a 1 can be listed as: {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)}. This set of outcomes is a ***subset*** of the set because all of the ***elements*** of the subset are also contained in the original set.

e. Give the subset that contains all elements that sum to 9.

f. What is the probability that the sum of two die rolled will be 9?

4. The different outcomes that determine the probability of rolling odd can be visualized using a ***Venn Diagram***. Each circle represents the possible ways that each die can land on an odd number. Circle A is for the first die landing on an odd number and circle B for the second die landing on odd. The circles overlap because some rolls of the two dice are successes for both dice.

a. One ordered pair has been placed in each area of the Venn Diagram. Finish the Venn Diagram by placing the remaining 32 ordered pairs from the dice lattice in the appropriate place.



Cardinality is the number of outcomes in a set. The cardinality of set A is denoted |A|.

b. How many outcomes appear in set A? |A| = __________

c. How many outcomes appear in set B? |B| = __________

d. The portion of the circles that overlap is called the ***intersection***, denoted with the symbol $\cap$. How many outcomes are in the intersection? $|A \cap B| =$ __________

e. When you look at different parts of a Venn Diagram together, you are considering the ***union*** of the two outcomes, denoted with the symbol $\cup$. How many outcomes are in the union? $|A \cup B| =$ __________

f. Record your answers to b, c, d, and e in the table below.

Circle A	Circle B	$A \cap B$	$A \cup B$

g. How is your answer to e related to your answers to b, c, and d?

h. Based on what you have seen, make a conjecture about the relationship of A, B, $A \cup B$ and $A \cap B$ using notation you just learned.

i. What outcomes fall outside of $A \cup B$ (outcomes we have not yet used)? Why haven't we used these outcomes yet?

j. In a Venn Diagram the set of outcomes that are *not* included in some set is called the ***complement*** of that set. The notation used for the complement of set A is $\overline{A}$, read "A bar", or ~A, read "not A". For example, in the Venn Diagram you completed above, the outcomes that are outside of $A \cup B$ are denoted $\overline{A \cup B}$. $|\overline{A \cup B}| =$ __________