THEORETICAL PROBABILITY AND COUNTING

Theoretical probability is the probability that a certain outcome will occur based on all the possible outcomes. An event that is certain to occur has a probability of 1. An event that cannot occur has a probability of 0. Therefore, the probability of an event occurring is always between 0 and 1.

- The closer a probability is to 1, the more certain that an event will occur.
- Theoretical probability is the chance of an event occurring divided by the total number of possible outcomes.
- Just as probability refers to the possibility of an event happening, **c**

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- I en.
- S nds on t
  - A **permutation** is an arrangement of objects in which order matters.
  - A **combination** is a set of objects in which order does <u>not</u> matter.
- Probability is also based on whether events are dependent or independent of each other.
  - An **independent event** refers to the outcome of one event <u>not</u> affecting the outcome of another event.
  - A **dependent event** is when the outcome of one event does affect the outcome of the other event.

How to use theoretical probability and counting

Theoretical probability is the probability that a certain outcome will occur based on all the possible outcomes.

- *For example, the probability of picking a 3 out of the numbers 1 - 10 is 1/10. Even if the numbers were picked 10 times, the probability would be 10/100 or 1/10.*

Since probability is divided by total outcomes, it is useful to be able to figure out the total outcomes. With the **Counting Principle**, the number of different event choices is multiplied to get the different outcomes.

- *P* *ick a* *s* *there* *a*

Per *ut in* the

- *P* *n be* *a*

Ex.
There are 3 students to choose from for the first chair, _3_, ___, ___.
There are 2 students to choose from for the second chair, _3_, _2_, ___.
There is one student left for the last chair,_3_, _2_, _1_.

The number of ways the 3 students can be arranged in 3 chairs is $3 \cdot 2 \cdot 1$ or $3! = 6$ ways. The notation, a!, means **factorial**, which is the product of the consecutive numbers from a to 1.

A **combination** is another way to figure out total outcomes, but in the case of combinations, order does not matter.

- *For example, how many different combinations can be made when picking 2 letters out of the word DOG? There are 3 outcomes, DO, DG and OG. Since order does not matter, DO and OD are considered the same.*

Probabilities of **independent or dependent events** are based on how one event affects the other event, if at all.

- *For example, if there are 10 marbles in a bag with 4 blue and 6 red marbles, the probability of picking a red marble, putting it back and then picking another red marble is 6/10 · 6/10 = 36/100 or 9/25. This probability is **independent** because what happened the first time does not affect what happens the second time. The probability of picking a red marble and then another red marble without replacing the first is 6/10 ·5/9 = 30/90 or 1/3. This probability is **dependent** because the first event affects the second event.*

Another concept with probability is **odds**. Odds refer to the odds against an event happening. Odds are used to compare unfavorable possibilities with favorable possibilities.

Try

1. V 52 c

2. U r a p t

3. H in the w

4. How many **combinations** can be made from picking two flavors of ice cream out of the flavors, strawberry, vanilla, chocolate, and mint?

5. What is the **probability** of picking a red card out of a deck of 52 cards, replacing it and then picking out an ace?

6. There are 4 red, 6 yellow and 5 blue marbles in a bag. What is the **probability** of picking a red marble, and without replacing it, then picking out a blue marble?

7. What are the **odds** against rolling the number 5 on a die?