

1) The multiplication rule is very useful for counting in stagewise experiments. Even sometimes the experiment does not look like stagewise, try to visualize it as a stagewise experiment.

$$N = n_1 \times n_2 \times \dots \times n_k.$$

2) Factorial: $n! = n \times (n - 1) \times \dots \times 1$. Note $0! = 1$.

3) Permutation: the number of ways of ordering k subjects out of n objects.

$${}_n P_r = n(n - 1) \dots [n - (r - 1)] = \frac{n!}{(n-r)!}$$

The important point about permutation is that the order matters.

4) Combination: the number of ways of choosing k subjects out of n subjects. The order does not matter.

$${}_n C_r = \frac{n!}{r!(n-r)!}.$$

Questions on permutation and combinations:

5) A vending machine has room 6 types of soda. There are 10 types of soda to choose. How many machine selection arrangements are possible?

6) The last season of the Big Bang Theory has 9 episodes. The student has only time to watch four episodes. Suppose he selects 4 shows at random. a) How many different ordered arrangements of episodes are possible? b) What is the probability that the season finale is selected and played last?

7) How many different ways of choosing 12 people out of 20 people to form a jury?

8) Suppose two out of 11 pieces of hardwood are defective. An installer randomly select five pieces. What is the probability that there are no defective ones in the selection? What is the probability that there is exactly one defective piece in the selection?

9) How many permutations of the letters in the word HISTOGRAM are possible?

10) How many different words (not necessarily in the dictionary) can be formed by shuffling the letters in the word MISSISSIPPI?

11) A disease is spreading in the neighborhood. There are 12 houses in a row and three households are affected. If the disease is not contagious, then the three house are randomly selected from the neighborhood. What is the chance that the three affected houses are adjacent to each other? Is there any evidence to suggest that the disease is actually contagious?

12) A television station is developing a new three-note theme. How many different three-note themes are possible if there are 20 notes to choose from and no note can be repeated?

13) A small basket contains 10 good apples and 10 bad apples. a) How many different handfuls of six apples are possible? b) How many possible different handfuls of 5 good apples and 1 bad apple? c) How many possible different handfuls of 3 good ones and 3 bad ones?

- 14) Consider a regular deck of 52 playing cards. For a five-card poker hand, find the probability of:
- a) One pair
 - b) Two pairs
 - c) Three of a kind (JJJ74, for example)
 - d) A straight: five cards in sequence, the ace can be either high or low.
 - e) A flush: fives cards of the same suit.