COMBINATORICS AND THEIR APPLICATIONS

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Abstract
Combinatorics is a branch of discrete mathematics that deals mainly with finite sets.
Combinatorics is divided into recurring and non-recurring types:
Permutation, Permutation, Grouping. Examples and solutions to problems related to combinatorics, which consist of the above, are given in detail.

Keywords: Combinatorics, set, permutation, permutation, grouping, construction

Introduction

Combinatorics is one of the main branches of discrete mathematics, and is a term that is often used in probability theory, mathematical logic, number theory, computing, and cybernetics. Humanity often faces problems such as counting the number of ways to combine certain objects or determining the total number of ways to perform a task.
For example: 100 cars have to be placed at a gas station in several different ways. In how many different ways can medals be distributed: gold, silver, bronze medals in the world and republican tennis championships? Combinatorics as an independent subject was studied and studied for many years by the outstanding German mathematician Leibniz, who published his article "On the Art of Combinatorics" in 1666.
Such problems are called combinatorial problems. Because they involve a very important rule in combinatorial calculations. The complex of sciences that deals with combinatorial problems is called combinatorics as a mathematical discipline.
The science that deals with the structures (combinations) of elements and issues related to determining their number is called combinatorics.
The science of combinatorics is widely used in solving many problems. Modern combinatorics, as the main method of discrete mathematics, plays a key role in probability theory, mathematical logic, number theory, computing, and cybernetics, due to its many uses. A number of scientific works are being carried out in this direction.
In many practical examples and problems, it allows us to select elements from a given set that share a certain property or characteristic and combine them in a certain order.
Determining the answer: It is known that the number of ways to get from Kashkadarya region to Bukhara region is $3\times2 = 6$, since there are 3 ways to get from Samarkand region to Tashkent city, and 2 ways to get from Tashkent to Chiqchiq. These arguments prove the following simple statement,

which is called the main rule of combinatorics. Rule 1 of combinatorics: if it is possible to choose an arbitrary A in m ways, and to choose B in n ways, then it is possible to choose A and B in m× n ways.

If A Given a set, then the new set is the set of all its subsets. We can look at M(A). Let Mk (A) be the set of all k-element subsets of a set A. For example. Let us say that we are given a set A={a, b, c, d,}. Then all subsets are as follows: M(A)={{Ø}, {a}, {b}, {c}, {d}, {a,b},{a, c}, {a, d}, {b, c}, {b,d}, {c, d}, {a,b,c}, {a,b,d}, {a,d,c}, {b,d,c}, { a, b, c, d,}}. Thus, if B ⊂M(A) and N(B)=k, then B⊂Mk (A). The number of k-element subsets of the given set. The 2-element subset of the whole problem is M2 (A)={{a,b},{a,c},{a,d},{b,c},{b,d},{c,d}}. N (M(A)) =24 =16, N (M2 (A))=6.

If we look at these results, in the process of obtaining subsets with 2 elements from sets with 4 elements, that is, in the process of obtaining the 1st element, we have 4 different possibilities, and in the process of obtaining the 2nd element, we now have 3 different possibilities. As a result, we will have 4*3=12 sets with all 2 elements, but since the elements {a,b} and {b,a} are considered one element in the sets and there is a rule that an element can be written only once in a set, the number of such 2 sets is reduced by half: 6 2 12 2 4*3 different subsets of 2 are found. Here we will try to derive the correct rule: 2!* (4 - 2)! 4! 2!* 2! 4! 1* 2 *1* 2 4 *3* 2 *1 2 4 *3. A natural question arises for everyone: how many k-element subsets does an n-element set have?

For example, how many different ways can 4 out of 10 players form groups (organization of classes), how atoms can be combined in a molecule (chemistry), how amino acids can be arranged in proteins (biology), how to combine these blocks in a mechanism consisting of different blocks in different orders (construction), how to alternately plant different trees in several fields (agronomy), and how to distribute the state budget according to the production sectors (economics) are combinatorial problems and practical examples, and show the use and application of combinatorics in various aspects of human history.

The branch of mathematics that deals with combinatorial problems and examples is called combinatorics.

We can conduct a competition between ten individual wrestlers (boxing, wrestling, fencing, etc.) using several methods:

combining physical qualities (strength, speed, agility, flexibility, endurance) in various orders;

developing physical qualities (strength, speed, agility, flexibility, endurance) in various sports.

When two sets intersect, the addition rule is also valid in the form of the addition formula (1) in Theorem 2.

Combination is one of the basic concepts of combinatorics. This concept is used to represent divisions consisting of a certain number of elements of any set. Combinatorics studies such structures in their important forms, known as permutations; permutations, and groupings.

Let's consider the most commonly used concepts in solving combinatorial problems.

The formation of a subset of a finite set of n elements by perfecting the order in which all elements are arranged at one point is called a permutation of n elements.

The number of permutations of the given n elements is expressed as Pn. P is the first letter of the French word "Permutation", that is, permutation.

In determining these formulas, we introduce the following choices: αk={it is necessary to choose the k-element of the permutation, k=1,2,3,……, n.

In the equation here, n is an arbitrary natural number (numbers used in counting are called natural numbers), which is the number used in the short multiplication formulas learned in grades 7-8 at school. $(a+b)^2$ and $(a+b)^3$ describes a generalization of short multiplication formulas and is called Newton's binomial in mathematics (binomial means two terms), where the numbers entering are called binomial coefficients. It should be noted that the formula here was later unified by Newton for arbitrary rational powers.

(a + b)^n = ∑_(k = 0)^n▒ 〖(C k¦n) a^(n − k) b^k 〗

The process of finding and showing subsets of a finite set of n elements that differ from each other either in their elements or in the location of their elements and consist of k elements is called permutation of n elements by k.

Number of placements of k out of n elements to be moved A_n^k It is expressed as, A is the first letter of the French word "Arrangement", which means placement, and its value can be proven to be calculated by the following formula.

$$A_n^k = \frac{n!}{(n-k)!}$$

This is given by the formula.

For example, from the set {a,b,c} there are n=3 elements and k=2 permutations {a;b},{a;c},{b;c},{b;a},{c;a},{c;b}, and their number is

$$A_3^2 = \frac{3!}{(3-2)!} = \frac{6}{1} = 6$$

$$A_7^4 = \frac{7!}{(7-4)!} = \frac{7!}{3!} = 4 \cdot 5 \cdot 6 \cdot 7 = 840$$

In what ways can it be divided.

This is a very basic and important concept, which is inextricably linked with experience. One of the important parts of probability theory is the random part. We will consider the issue of probability theory during the study of experiments that are artificially created or depend on the will of the experimenter. They are called random (stochastic) or probability experiments. Such a variety of examples can be found in the failure of light bulbs, when elementary particles collide with them, when rats are observed in the reaction to a medical drug, and so on. It is assumed that such experiments can be repeated as often as desired.

REFERENCES

1. Jo'rayev T., Sadullayev A., Khudiyberganov G., Mansurov H.T., Borisov A.K., Fundamentals of Higher Mathematics, parts 1, 2. T. "Uzbekistan", 1995, 1998.
2. Akhtyamov A.M. Mathematics for sociologists and economists: Uchebyuposobie.- M: FIZMATLIT 2004.-464 p.
3. Jabbarov N.M. Higher mathematics. Parts 1, 2. 2014 Textbook.
4. Erovenko V.A. Osnovy visshey mathematiki dlya filologov: metodicheskie zamechanie i primer: course lecture. Minsk: BGU 2006. -175p.
5. Gree P.V. Mathematics for humanitarians. Uchebnoe posobie. M.: Universitetskaya kniga Logos 2007.- 160syu

6. Jabbarov N.M. Higher mathematics. Tashkent, "Universitet", 2004.
7. http://www..allmath.ru/
8. http://www.mcce.ru/
9. http://lib.mexmat.ru/
10. http://www.webmath.ru/
11. http://www.exponenta.ru/