JOURNAL OF UNIVERSAL SCIENCE RESEARCH

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023 SJIF 2024 = 5.073/Volume-2, Issue-7

COMBINATORY PROBLEMS AND THEIR SOLUTION METHODS

Sultonqulova Nargiza Bobonazarovna

Mathematics teacher of school 36

Annotation: this article reveals the features of teaching students methods of solving problems in combinatorics when studying a school course in mathematics, and also considers methods for solving historical combinatorial problems, problems on the multiplication rule, developing skills in solving problems on the formation of combinatorial concepts, tree of options, factorial, application to solving equations and simplifying expressions. When discussing formulas for figured numbers, it is proposed to give students tasks to independently find a pattern and verify their correctness for specific values of a natural variable, and then solve problems using a formula to find a certain number by location and type of number; inverse problems by number to find what type a given number belongs to, when discussing solving problems similar to the well-known problem, in which it is required to find the number of possible seating positions by people, the number of which is equal to the number of seats, it is indicated to first number the seats, and then find the number of permutations of seating of these seats by people.

Keywords: combinatorics, permutations, placement, combinations, tasks, multiplication rule, skills, thinking, development, skills, concepts, tree of options.

Introduction. Each combinatorial problem is different, and there is no single method suitable for any of them. You always have to think and look for solutions. At the same time, many problems, although different in content, are similar in the approach to solving them and allow the use of similar reasoning techniques. This makes it possible to pay attention to a number of typical situations, to give a certain set of “keys” that can be tried in order to “unlock” the problem. Although, of course, there is no guarantee of success: for another non-standard task, not a single key from the existing set may be suitable, and a new one will have to be “made.” Tasks can be divided into elementary and combined. Elementary ones are those that are solved in one action; To solve them, it is enough to select the appropriate formula and carry out calculations. In these problems, the most important thing is to analyze the condition and correctly determine

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023 SJIF 2024 = 5.073/Volume-2, Issue-7

the type of combinations [2]. In combined problems of placement, permutation, and combinations turn out to be components of more complex combinations. The usual approach to combination problems is to break them down into elementary ones, find the answer in each such part, and then look for a way to count those more complex combinations that meet the conditions of the problem.

The principle of sum and product. At the final stage of solving combinatorial problems, the following situations often arise: - to implement a complex combination, each of the elementary situations that form it must take place; - to carry out a complex combination, it is enough that at least one of the elementary combinations that form it takes place. Let's consider an example, which at the same time will allow us to detect patterns that arise in each of the noted situations.

In the first case, we reason like this: since the order of choice does not matter, we assume that we choose the apple first. This can be done in three ways. For each of the selected apples, you can attach any of the two pears. Each choice of an apple leads to the formation of 2 “apple-pear” pairs, and there are 3 such choices, which means that there will be all ways to choose an apple and a pear. If we started by choosing a pear, we would end up with ways to choose a pear and an apple, i.e. the same result. Answer to the question “In how many ways can you choose an apple and a pear?” we got it this way: we found separately the number of choices for an apple and the number of choices for a pear, and since the question required choosing an apple and a pear, we multiplied the found numbers. In the second case, we start with the fact that an apple can be selected in three ways, and a pear in two. But now we need to choose an apple or a pear, that is, one fruit. It is clear that there will be ways to do this. Thus, to determine the number of choices of an apple or a pear, the number of choices of an apple and the number of choices of a pear should be added. It is necessary to pay attention: during the final calculation of the number of combinations corresponding to the conditions of the problem, the logical connective “and” led to finding the answer by multiplication, and the logical connective “or” - by addition.

Product principle: if combination A can be accomplished in ways, and combination B (regardless of A) in ways, then both combinations together can be accomplished in ways. Indeed, in each of the ways of implementing combination A,

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023 SJIF 2024 = 5.073/Volume-2, Issue-7

pairs are formed consisting of combinations A and B. This means that there will be a total of such pairs “A and B”. Other formulations of the product principle are also useful: - if the choice of object A can be made in ways, and the choice of object B (regardless of A) in ways, then the choice of both objects, i.e., the pair “A and B” can be made in ways; - if any object A can be in states, and object B (regardless of A) is in states, then the entire system consisting of A and B can be in states. For the sake of simplicity, the product principle is formulated for two combinations (objects), but it is clear that it is valid for any number of them.

When studying combinatorics, you must first give students the historical aspects of the emergence of this branch of mathematics. Therefore, students can be told that 91 initial concepts developed in Ancient China, and then in Europe, during the Roman Empire. Finally, as one of the branches of mathematical science, it arose in the 18th century. This was also facilitated by scientists’ research into methods for solving problems related to finding the probability of events. At that time, mathematicians were interested in the problem of finding formulas for calculating the so-called figured numbers, i.e. numbers that represented a specific geometric figure. For example, square numbers (1, 4, 16, 25, ...) could be represented using dots in the form of a square. So mathematicians found a formula for calculating such numbers. In the same way, formulas for triangular numbers were found (1, 3, 6,10,15, ...)

When discussing the formulas of these numbers, it is advisable to find the pattern of this numerical sequence yourself and verify their correctness for specific values of the natural variable and then invite students to solve the following types:

1. Using a formula, finding a specific number by location and type of number; there are two parameters here: location and type of number.

2.Solve the inverse problem of a number to find what type a given number belongs to. Then tell students that in practical activities sometimes there are moments or situations in which a person has to find the right choice from possible options. At the same time, he needs to make a choice so that it contributes to solving the proposed problem. In this case, all possible solutions to the problem are checked.

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023 SJIF 2024 = 5.073/Volume-2, Issue-7

When solving, for example, a problem with students, you can count how many two-digit numbers using 2, 3 and 5, they will find with the help of selection that there are exactly 9 such numbers: 22, 23, 32, 33, 25, 35, 52, 53, 55. Therefore, it is important for students to understand that in order to find the number of all possible options in the process of carrying out two independent experiments, it is necessary to find the product of the number of these two experiments.

For example, to compose from several different digits, four-digit odd numbers in which the digits can be repeated, first all possible options are counted for the digit in first place, and then for the digit in second place, etc. At the end, all these possible options are multiplied and a solution to the problem is obtained. For example, when finding the number of two-digit numbers made up of the numbers 1,3,5,7,9, we find: for number 1: 11, 13,15, 17,19, for number 3: 31,33,35, 37,39 , for number 5: 51,53,55,57,59, etc. those. for each digit there are 5 two-digit numbers and there will be 25 such numbers in total. This pattern can be seen 52=25. Therefore, to continue this pattern, check how many three-digit numbers can be made from these five digits, the digits of which can be repeated. Hypothesis 53=125. Will it be true? Now it will be clear to students that testing this hypothesis will involve them in a way to test the multiplication rule for any number of experiments that are looking for different options for solving the problem. When discussing the solution to a well-known problem in which it is required to find the number of possible seating positions by people, the number of which is equal to the number of seats, first the seats are numbered, then the number of permutations of seating by people is found. Using the above rule for searching for various options, we will find the total number of boardings depending on the number of boarding seats and people, i.e. the following hypothesis is obtained: the total number of permutations is equal to the product of all numbers from one to the total number of seats. To test this hypothesis, students are asked to solve problems with specific content. For example, the layout of some the number of different letters one at a time in envelopes or the number of handshakes of a certain number of friends, etc.

The process of studying methods for solving problems shows that the plot and plot of the problems are different, but the resulting solutions are presented according to the same pattern. This is how students are introduced to the concept of factorial, i.e. the product of the first numbers of the natural series $n! = 1 \cdot 2 \cdot 3 \cdot \ldots (n-2) \cdot (n-1) \cdot n$ and the

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023 SJIF 2024 = 5.073/Volume-2, Issue-7

notation n!. It is important to emphasize that in mathematics it is accepted that 0! =1. Then it is proposed to calculate the first few values 1!=1, 2! =1·2=2, 3! =1·2·3=6, 4! =1·2·3·4=24 .

Conclusion. When formulating a general definition of permutations, students must pay attention to two features of these permutations: firstly, they are composed of all elements once, and, secondly, these connections differ in the order in which the elements are placed. Sometimes they are called combinations, sometimes compounds, but their meaning equally expresses the essence of this concept. In addition, you need to find out with students that the number of permutations is based on the multiplication rule. By consolidating this concept with students, they can solve problems of a life nature, i.e. tasks that occur in everyday life, when solving problems of other subjects, for example, tasks of determining the number of queues at a particular cash desk to receive goods, a ticket, or to see a doctor.

Reference

1. Vasilenko Yu. K. Beginnings of combinatorics. How to teach them to students. - Belgorod: BelSU, 1993. Vilenkin N.V. Induction. Combinatorics. - M.: Education, 1976.

2. Petrushenko, S. Yu. Techniques for solving combinatorial problems / S. Yu. Petrushenko. — Text: immediate // Young scientist. - 2023. - No. 28 (475). — pp. 142-144. — URL: https://moluch.ru/archive/475/104891/ (date of access: 07/05/2024).

3. Vilenkin N.Ya. Induction. Combinatorics / N.Ya. Vilenkin. M.: Education, 1976. 46 p.

4. Ezhov I.I., Skorokhod A.V., Yadrenko M.K. Elements of combinatorics, transl. from Ukrainian M.: Nauka, 1977. 80 pp.