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INNOVATIVE APPROACH TO SOLVING COMBINATIC ELEMENTS AND SOME PROBLEMS OF NEWTON BINOMY IN SCHOOL MATHEMATICS COURSE

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INNOVATIVE APPROACH TO SOLVING COMBINATIC ELEMENTS AND SOME PROBLEMS OF NEWTON BINOMY IN SCHOOL MATHEMATICS COURSE

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Abstract: This article provides information on the elements of combinatorics in the school mathematics course and solutions to some problems related to the Newtonian binomial. This article is also aimed at solving problems related to the in-depth study of the elements of combinatorics in the school course, the creation of a sufficient basis for the study of probability theory and mathematical statistics in the future.

Keywords: mathematics, elements of combinatorics, Newton's binomial, problems, mathematical statistics, probability theory, combinations, combinatorics, formula, set, element.

Introduction. At a time of rapid development of information and communication technologies in our country, globalization, increasing competition in the world market, the most important value and decisive force in achieving the goals of democratic development, modernization and renewal is an educated and decisive force. As a result of the rapid development of society, the information environment and the situation in the labor market, the system of reproductive education did not meet the requirements of the times. This requires the development of new approaches to teaching mathematics. [12]

Reforming and improving the system of continuing education in our country, which is rapidly advancing on the path of independent development, raising it to a new level of quality, introducing it to advanced pedagogical and new modern information technologies, and through them, the effectiveness of modern education. The task of school education today is to provide students with accurate and understandable information through the effective use of new innovative information technologies in the classroom. Therefore, it is expedient to organize and teach lessons using new innovative modern information technologies, both during the lesson and when the teacher understands the subject of mathematics.

Mathematics has long been used in human history to solve various problems in life. Simple calculations and measurements related to the practical needs of man have been made. Mathematical problems, such as the selection of objects and their arrangement in a certain order, have always been considered areas of human interest. The branch of mathematics that teaches the formation of combinations that satisfy certain conditions from given objects is called combinatorics. [2]

A mathematical model of the phenomena studied is created with the help of combinatorics. It is known that the probability of an event is expressed by mathematical formulas. This is a mathematical model of the process being studied. When studying the probability of an event, first of all, it is necessary to introduce the concept of combinatorics. In the study of probability theory and mathematical statistics, combinatorics is one of the main motives of interest to the student in these disciplines.

Elements of combinatorics were first taught in the school mathematics course (where the elements of combinatorics are aimed at engaging students in science). However, the curriculum does not consider the elements of combinatorics as a basis for the study of mathematical applications, probability theory and mathematical statistics. Therefore, elements of combinatorics were not taught in school until later. [15]

Literature review. Our updated curriculum requires the creation of a new content of mathematics and the use of modern methods for its study. If we look at the history of combinatorics, a few thousand years ago in China they studied the construction of magic squares, in ancient Greece they studied the construction of the theory of figurative numbers. Later, games such as checkers, cards, checkers, and dominoes created combinatorial problems.

The problems of combinatorics were solved by Giyosiddin Jamshid Koshi, a well-known mathematician of the Ulugbek school in Samarkand, Umar Khayyam, who lived in the 10th century, and later by European scientists, including B. Pascal, J. Cordano, G. Leibniz, J. Bernoulli, P. Ferma, L. Ferma, L. Ferma, L. Ferma. occurs in their work. In the seventeenth century, combinatorics emerged as an independent science in connection with the creation of probability theory. [16] Probability theory and mathematical statistics are taught in lyceums and vocational colleges in all developed countries of the world in order to master the profession and choose the right profession. [1]

Research Methodology. At present, the elements of combinatorics are being studied in the educational institutions of the republic. However, the content of the study of the elements of combinatorics and its methods of study do not fully meet today's requirements.

Associations (combinatorics). What is studied in combinatorics? When calculating the number of possible variants of problems of a combinatorial nature, "how many?" or "in how many ways?" You will be asked to answer questions such as: [14]

Collections that are made up of different things and that differ from each other in the order of these things or in themselves are called combinatorics. [18] The things that make up a union are called elements. In combinatorics the following are studied:

- Installations
- relocations
- groupings
- binomial formula

Analysis and results. From the elements of the sets A = {6,7,9} and B{a,b,c} we create such pairs that the first element in them is the orderly element *A* and the second element is the order element *B*. If we determine the set of possible pairs by $A\times B$,

$A\times B$ ={(6;a),(6;b),(6;c),(7;a),(7;b),(7;c),(9;a),(9;b)(9;c)}

If elements *B* are placed in the first place, the spelling and order will be different from the previous one $B\times A$ = {(a;6),(a;7),(a;9),(b;6),(b;7),(b;9),(c;6),(c7;),(c;9)} the collection is formed.

(6,*a*), (6,*b*),...... the elements in pairs (binaries) are called components or coordinates of the pair (Latin componentis-component). [13]

Similarly, a set of triads arranged from the elements of sets *A, B, C,* in general, a set of *k* wires arranged from elements of *k* sets. The set length of *k* different elements is called $n = k$. For example, the trinities (4; 12; 13) and ($\sqrt{16}$; $\sqrt{144}$; $\sqrt{169}$) are equal and of the same length (n = 3), the components of which are: $4 = \sqrt{16}; 12 = \sqrt{144}; 13 = \sqrt{169}$. However, although the lengths and coordinates of the triangles *(a; b; c*) and (*c; a; b*) are the same, they are not equal because their coordinates are in different order. [11]

A *k* string that has no component (i.e., 0 lengths) is called an empty *k* string. The order of the elements in the set does not play a role, the coordinates can be repeated in *k*.

We denote the number of elements of sets *A* and *B* by *n (A), n (B),* respectively, and the total number of pairs by $n\,(A\times B)$. [8]

Theorem. The number of pairs composed of elements of finite sets *A* and *B* is equal to the product of the numbers of elements of these sets.

$$n(A\times B) = n(A) \bullet n(B)$$

Each concept of combinatorics can be derived using the following basic rules.

Addition rule: If *X* and *Y* are non-intersecting sets, the number of elements belonging to the combination of these sets is equal to the number of elements in each of them. If an *X* object can be selected in *n* ways and an *Y* object can be selected in *m* ways, and if these methods are different or unrelated, the *X* or *Y* object selection can be done in $n + m$ ways. [3]

Rule of multiplication: If the element X_1 is selected by n_1 methods, the element X_2 by the method n_2, and h..o, the end, ... X_1 X_2 X_{k-1} after selection the element X_k is selected in n_k ways, then the pair (X_1, $X_{2,......}$ X_k) can be selected in $n_1 * n_2 * ....* n_k$ ways.

In the current era of rapid introduction of new technical means of teaching mathematics, including computer and other information technologies, the use of the achievements of computer science in order to ensure interdisciplinary integration is one of the most pressing issues. [3] The introduction of computer technology in educational institutions opens a wide way to optimize the learning process. In the last decade, the use of computers in the teaching of mathematics has been carried out in several main directions. These include computer-based knowledge assessment, the development and delivery of various types of educational programs, the development of cognitive math games, and more. Another aspect of the convenience of computers in teaching mathematics is the modeling of some learning situations. The purpose of using modeled programs is to ensure that materials that are difficult to visualize are understandable when other teaching methods are used. Using modeling, students can present information in graphical mode in the form of computer multimedia. Therefore, they tend to show significant independence in the in-depth study and learning process of mathematics. In many cases, a professional mathematician is required to know a certain algorithmic language and programming at the same time as his profession in order to solve a mathematical problem that arises quickly and with a given accuracy. It would be useful to explain the following examples and issues using computer multimedia. Because this method of teaching allows the imagination to be understood in materials that are difficult to imagine.

1-for example. It is possible to create several four-digit numbers with different numbers.

Solution: We match a pair (a_1, a_2, a_3, a_4) to a number with numbers a_1, a_2, a_3, a_4 in which case the element a_1 is used in 9 ways (between numbers 1,2,3,… .9), and the element a_2. there are 9 methods for selection (0.1,2, …… .9 is an arbitrary one of the numbers different from a_1), there are 8 options for selecting a_3 after selecting elements a_1 and a_2, and 7 options for selecting element a_4. According to the multiplication rule, the number of numbers sought is $9 \cdot 9 \cdot 8 \cdot 7 = 4536$.

Issue 2. The group consists of 15 boys and 17 girls. The group leader must select a student from among them for the chess tournament. After this selection, 1 boy and 1 girl will be selected for the drafts competition. He can do this in several different ways.

Solution: According to the rule of addition, there are 15+17 = 32 options in the first selection. After this selection, the number of students in the group will be reduced to one.If this sample is a boy, according to the rules of multiplication it can be done by 14·17 = 238, if the sample is a girl by 15·16 = 240.

Placements. Let $n = 3$ elements X = {3; 4; 5} compose two-digit numbers, ie pairs, from a set of elements: 34,35,45,43,53,54. These numbers consist of ordered sets. [20] We define the total number of them as $A^2{}_3$ (read: "The number of placements made from 2 out of 3 elements"). We have $A^2{}_3$ =6. Let us find the formula for calculating this number for an arbitrary n. The first component of each pair can be chosen as either 3, or 4, or 5, i.e., $n = 3$. If the first component is selected, n - 1 = 2 different choices 8 are left to select the second component.

Hence, the total number of pairs is $A^2{}_3$ = 3· (3- 1), ie $A^2{}_3$ = 3 · 2= 6 [7]

Definition: Substitution of k $(k \leq n)$ from n elements refers to combinations in which each of the given n elements contains k elements, which differ from each other in the order of the elements or elements. [15]

The number of placements made from n elements k is denoted by the symbol $A^k{}_n$ (*A* French "arraguument" - the first letter of the placement).

The arrangement of n elements from k elements of set X is said to be a set of ordered parts of length k of set X.

Number of them: A_n^k= n·(n –1)· .... ·(n – (k –1)) (1)

It can be written as follows: $A_n^k = \frac{n!}{(n-k)!}$. Here, each pair differs from each other in terms of composition and order.

In fact, n types are randomly selected for component 1. In that case n –*1* is a different choice for component 2 and so on for the last n component n – *(n –1)* remains selectable and no component is re-selected. The number of positions of all lengths k is found according to formula (1) according to the rule of multiplication. [4]

1-for example. The group teaches 8 subjects and 3 different classes every day. How many different ways can a daily lesson schedule be distributed?

Solution: This distribution method is equal to the number of permutations made from 3 of the 8 elements. Hence, it is possible to distribute lessons in A_8^3 = 8·7·6 =336 methods.

2- example. Find the number of part sets of the set A = {1,2,3}?

Solution: It can be proved by the **method of mathematical** induction that the number of part sets of a set of *k* elements is 2^k. The number of part sets of a given set is $2^3 = 8$. They are: {1},{2},{3},{1,2},{1,3},{2,3},{1,2,3} and an empty set. [19]

Binomial formula

The arbitrary natural degree of an arbitrary sum can be calculated using the binomial formula. [10]

$(x+a)^n = C_n^0\ x^n + C_n^1 x^{n-1}\ a + \ldots\ldots + C_n^k\ x^{n-k} a^k + \ldots + C_n^n a^n = \sum_{k=0}^{n} C_n^k x^{n-k} a^k$

If $x = a$,

$C_n^0 + C_n^1 + C_n^2 + \ldots + C_n^n = 2^n$ arises.

$C_n^k = C_n^{n-k}$ this $C_n^k \frac{n!}{(n-k)!*k!} = \frac{n!}{(n-k)!*(n-(n-k))!} = C_n^{n-k}$ from

can prove. The binomial formula can also be written as follows.

$(x+a)^n$=P(n,0)x^n+P(n-1,1)$x^{n-1}a + \ldots + P(n.0)a^n = \sum_{k=0}^{n} P\ (n-k.k) x^{n-k} a^k$

Here $P(n-k.k) = \frac{n!}{(n-k)!*k!} = C_n^k$

The formula in general

$(x_1 + x_2 + \ldots + x_i)^k = \sum P\ (k_{1,} k_2 \ldots k_i) x_1^{k_{1_1}} x_2^k \ldots\ldots x_i^k$ can write.

Where k and i are arbitrary numbers, $k_1 + k_2 + \ldots\ldots\ldots\ldots + k_i = k$ is the sum of non-negative integers. [6]

Properties of the binomial formula:

1. The exponent of *x* decreases and the exponent of *a* increases. The sum of their exponents is *n*.

2. The propagation consists of *n* +1 extremes.

3. The sum of the binomial coefficients is 2^n.

$$C_n^0 + C_n^1 + C_n^2 + \ldots + C_n^n = 2^n$$

4. The desired value of the distribution is $T_{k+1} = C_n^k x^{n-k} a^k$

5. The coefficients of the terms at equal distances from the edges of the distribution are mutually equal.

6. The sum of binomial coefficients in odd places is equal to the sum of binomial coefficients in even places. [17]

1- example. $(a + b + c + d)^5$ Spread the expression using **Newton's binomial formula.**

Solution: $(a + b + c + d)^5 = \sum P\left(k_{1,}k_{2,}k_{3,}k_{4,}\right)a^{k_1}b^{k_2}c^{k_3}d^{k_4}$ in this $\left(k_{1,}k_{2,}k_{3,}k_{4,}\right)$ is a sum of $k = k_1 + k_2 + k_3 + k_4 = 5$ with respect to the quartet.

Quartets (5,0,0,0)..(2,1,1,1)..........(2,2,1,0).....

Number of their repetitions:

P(5,0,0,0).=.................$=\frac{5!}{5!} = 1$

P(4,1,0,0).=.................$=\frac{5!}{4!} = 5$

P(3,1,1,0).=.................$=\frac{5!}{3!} = 20$

P(2,1,1,1).=.................$=\frac{5!}{2!} = 60$

P(2,2,1,0).=.................$=\frac{5!}{2!*2!} = 30$

The resulting expression has this appearance.

$$(a + b + c + d)^5 = (a^5+b^5 + c^5+d^5) + 5(a^4b + \cdots + cd^4) +$$
$$20(a^3bc+\ldots+bcd^2) + 60(a^2bcd+\ldots abcd^2) + 30(a^2b^2c+\ldots+bc^2d^2$$

2- example. $(\frac{5}{\sqrt{x}} + x^{\frac{2}{3}})^{18}$ Find the mean of the binomial distribution.

Solution: $(\frac{5}{\sqrt{x}} + x^{\frac{2}{3}})^{18} = C_{18}^{0}(\frac{5}{\sqrt{x}})^{18} + C_{18}^{1}(\frac{5}{\sqrt{x}})^{17}x^{\frac{2}{3}} + \ldots\ldots\ldots + C_{18}^{18}(x^{\frac{2}{3}})^{18}$

Medium limit $C_{18}^{10}(\frac{5}{\sqrt{x}})^{8}(x^{\frac{2}{3}})^{18} = 5^8 * 43785x^{\frac{8}{3}}$

Conclusion. In order to deepen the knowledge and talents of young people, to ensure their participation in the further development of Uzbekistan as qualified personnel, modern approaches to the educational process are being introduced, in response to which we focus on efficiency and effectiveness in implementing our knowledge and work. The prosperity and sustainable development of our country depends to some extent on the deep knowledge, strong beliefs and, in general, the perfection of young people. [5] Our society needs people who can take an active part in solving the problems that arise, who have a good understanding of the situation, who think comprehensively, who understand the daily and professional problems encountered in life, who can analyze, compare, and solve practical problems.

Nowadays, natural science and practice are making more and more extensive use of the achievements of mathematics, making them a tool of scientific research and an important tool for the effective solution of complex economic problems. The use of mathematics in the natural sciences allows us to distinguish and formally describe the most important, significant connections of change and objects, to clearly and succinctly state the rules, concepts and conclusions of the theory of natural sciences. [14]

Improving the methodology of in-depth teaching and modeling to schoolchildren about the elements of combinatorics and solutions to some problems related to Newton's binoculars is one of the most pressing issues today.

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