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Introducing Students to Elements of Probability Theory and Mathematical Statistics

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Abstract

This article discusses the elements of mathematical statistics. Its role and importance in our daily life and task are explained through examples.

Keywords: Statistics, situation, situation, mass random events, observation, results, description, collection, systematization, analysis, interpretation, method, random variable, experiments, distribution function, evaluation, mathematical statistics, tasks, statistical hypotheses, hypothesis theory, sample set, set size, parametric estimation theory.

INTRODUCTION

The science of probability theory and mathematical statistics are inextricably linked with each other, the first of which studies the probabilistic laws of mass random events, and the second, that is, the science of mathematical statistics, examines the laws to which these random events are subject by experiment. collects and studies statistical data for the purpose of identification. The first task of mathematical statistics is to show the method of collecting and grouping statistical data, and its second task is to develop methods of statistical data analysis.

Thus, the task of mathematical statistics is to collect statistical data and create methods of their development in order to make scientific and theoretical conclusions.

LITERATURE ANALYSIS AND METHODS

The word statistics means state, situation. Mathematical statistics serves as a mathematical apparatus for the analysis of natural processes of public and social nature.

Russian mathematicians in the 20th century: V.I. Romanovsky, A.N. Kolmogorov, L.N. Bolg'shev, N.V. Smirnov; English scientists: Stgyudent, R. Fisher, E. Pearson; American scientists: Yu. Neiman, A. Valg'd and Uzbek scientist S. Kh. Sirojiddinov, as well as his students made a great contribution to the development of the science of mathematical statistics.

Below we will get acquainted with the main issues of mathematical statistics:

1. Suppose that the distribution function of a random variable is From the point of view of statistics, let us conduct n uncorrelated experiments on a random variable and obtain the values. Estimating the unknown distribution function of a random variable based on the results is one of the tasks of mathematical statistics. The branch of mathematical statistics dealing with solving this problem is called nonparametric estimation theory.

2. Let the random variable have a distribution function of a certain form depending on k unknown parameters. It is the task of mathematical statistics to estimate these unknown parameters based on observations on a random variable. In mathematical statistics, the branch dealing with solving this problem is called parametric estimation theory.
3. Any assumptions about distribution laws, some characteristics of observed quantities are called "statistical hypotheses".

Suppose, based on some considerations, that the distribution function of a random variable can be considered to be k, the question of whether this function is really a distribution function of k or not is a statistical hypothesis. In order to verify this or that hypothesis, it is necessary to collect data through observations or by conducting special experiments and compare them with theoretically observed data according to the hypothesis. If the obtained data really match the theoretically expected data, then this fact can be a basis for accepting the hypothesis, with confidence in the correctness of that hypothesis. If the received information does not correspond to the theoretically expected information, then there is no reason to accept the hypothesis.

In general, the difference between the observed results and the theoretically expected result can be different. As a result of the statistical evaluation of this difference, one or another hypothesis can be accepted with a certain probability, that is, if this difference is large, the hypothesis is not accepted, otherwise it is accepted, of course, the possibility of accepting the hypothesis depends on how much this difference is. will depend. The branch of mathematical statistics dealing with solving this problem is called the theory of statistical hypotheses.

Let's say that it is required to study a set of objects of the same gender according to its quality or number sign. For example, the quality indicator of the cotton crop grown in the association of farmers or companies is its variety (variety), number indicator, and its volume (weight) serves as productivity.

A master set is a set of objects of the same type that are allocated or presented for analysis. For example, the collection of agricultural products produced by the farm, the collection of students studying in Fergana, etc. are examples of the main collection.

Often, all the objects in a collection are examined in order to study them. But it will be economically and physically impossible to check all objects belonging to the collection (if their number is very large). In such cases, a specific subset of objects belonging to the parent set is checked.

It is known that a part of the set of objects randomly selected for learning from the main set is called a sample set or a sample.

The main group is a group of students studying at Fergana State University, in particular, students of the EK-4 group of primary education are a selective group.

The size of the main set or sample set is the number of objects in this set. For example, if 50 lamps are selected for inspection from 1000 electric lamps, then the size of the main set is equal to N_k=1000, and the size of the sample is equal to n_k=50.

If, after selecting a sample set from the main set and observing this set, this sample set is returned to the main set before the next selection, this method of selection is called repeated sampling.

A non-repetitive sample is formed in situations where a sample set is separated from the main sample, and after observation on this set, it cannot be returned to the main set. If the size of the main set is very large and the size of the sample set is not large, then the difference between repeated and non-repeated samples will not be significant. In practice, a non-repetitive sampling method is often used. Of course, in both of these sampling methods, the sample set should be taken while preserving all the characteristics of the main set, that is, it should be selected in such a way as to ensure that the sample set is "similar" to the main set. If the sample set contains

almost all the characteristics of the main set, then such a sample is called a representative (representative) sample.

To create a representative sample, we draw the sample randomly. The sampling method has no effect on the character of the parent set we are interested in, and ensures that each element of the parent set has an equal chance of participating in the selection. If the sample does not preserve the representativeness of the sample, then applying the inference made on the sample to the parent population may lead to an incorrect conclusion.

RESULTS AND DISCUSSION

In practice, various methods of selection are used, and they are mainly divided into two types:

1. Selection of the main set without dividing it into parts, which includes:

a) simple irreversible random selection;

b) simple reversible random selection.

2. Selection of the main set after disassembly, which includes:

a) typical selection;

b) mechanical selection;

c) serial selection.

Simple random selection is the selection of elements from the population.

A typical selection is a selection in which such objects are not taken from the entire main set, but from its "typical" parts. For example, if the parts are made on several machines, then the selection is made not from the entire set of parts, but from each product of each machine.

Mechanical selection is a selection in which the main set is mechanically divided into as many groups as there are objects to be included in the selection, and one object is taken from each group. For example, if it is necessary to separate five percent of the parts made on the machine, then every twentieth part is taken.

A serial selection is a selection in which the objects are not taken from the main set individually, but "serially" and they are checked as a whole. For example, if items are produced by a large number of machine tools, then only a few machine tools are grossly inspected.

Let's say that a sample set of size n is taken from the main set in order to study it according to X number or attribute. Here, the values x1, x2, ..., xk are observed n1, n2, ..., nk times, respectively, and let □ be kn. The observed xi values are called variants, and the sequence of variants written in increasing order is called a variational series. The number of observations ni lar are called the frequencies, and Wikni/n are the relative frequencies.

Description. The list of variants of a variational series and their corresponding frequencies or relative frequencies is called the statistical distribution of the sample and is

X_i	x_1	x_2	...	x_k
n_i	n_1	n_2	...	n_k

or

X_i	x_1	x_2	...	x_k
W_i	w_1	w_2	...	w_k

is defined in the form where $\sum n_i kn$; sample size $\sum W_i k1$.

If the character being studied consists of a continuous variant, or the number of discrete values is large (n>30), then it is appropriate to create an interval (divided into groups) variation series of the statistical distribution will be

Thus, in the theory of probability, distribution means the correspondence between the possible values of a random variable and their probabilities, and in mathematical statistics, the correspondence between the observed variants and their frequencies or relative frequencies.

Example 1. The frequency distribution of a sample size of 30 is given.

x_i	2	8	16
n_i	10	15	5

Construct a relative frequency distribution.

Solution: We find the relative frequencies. To do this, we divide the frequencies by the sample size.

$$W_1 = \frac{10}{30} = \frac{1}{3}, \qquad W_2 = \frac{15}{30} = \frac{1}{2}, \qquad W_3 = \frac{5}{30} = \frac{1}{6}.$$

then, the relative frequency distribution

x_i	2	8	16
w_i	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{6}$

Example 3. After the vacation, 5 friends returned to school and greeted each other by shaking hands. How many greetings will there be in total?

If we call them names Akmal, Sarvar, Sardor, Bahrom, Javohir

Akmal: Sarvar, Sardor, Bahrom, Javohir with a total of 4

Sarvar: Sardor, Bahrom, Javohir with a total of 3

Sardor: Bahrom, Javohir with a total of 2

Bahrom: Javohir with a total of 1 So, 4+3+2+1=10 answers are 10.

CONCLUSION

Working with such issues in elementary grades helps students to correctly assess daily life situations and make the right decisions in solving various problems.

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