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APPLICATION OF ADVANCED STATISTICAL SOFTWARE IN RESEARCH AND EDUCATION

ЗАСТОСУВАННЯ СУЧАСНОГО СТАТИСТИЧНОГО ПРОГРАМНОГО ЗАБЕЗПЕЧЕННЯ В ДОСЛІДЖЕННЯХ ТА ОСВІТІ

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Abstract. *The purpose of this article is to analyze the potential of modern software tools to enhance the quality of statistical research. In light of the growing volume of data and the increasing demand for its rapid processing, the application of advanced statistical analysis technologies in scientific and educational processes is becoming increasingly relevant. This study presents a comparative analysis of software used by researchers and students of the National University "Yuri Kondratyuk Poltava Polytechnic" in conducting statistical research and studying the discipline "Statistics". The functional capabilities and application features of XLSTAT, Minitab, and Wizard in various fields of data analysis are examined, along with examples of their practical use. Particular emphasis is placed on the comparative analysis of the key characteristics of these programs, allowing for the identification of their advantages and limitations depending on the specifics of research. The findings contribute to an informed selection of appropriate software for statistical analysis in scientific work and education. Future research may focus on evaluating the effectiveness of XLSTAT, Minitab, and Wizard in different subject areas and developing recommendations for their optimal application.*

Key words: *statistical analysis, software, XLSTAT, Minitab, Wizard, data processing, educational process, scientific research, comparative analysis, efficiency, modern technologies.*

Introduction.

Statistical research has always been the basis for making management decisions at different levels: at the level of business entities and at the state level. The quality, reliability, accuracy, and timeliness of information support determine the effectiveness of managing business processes and socio-economic development [1]. In the context of growing data volumes, the analysis of which is necessary for making effective management decisions, the issue of using the latest technologies in statistical research is becoming relevant. Global digitalization, characterized by the intensification of the use of modern information technologies in all industries, has led to a decrease in the

effectiveness of traditional methods of substantiating management decisions. This requires researching the capabilities of modern technologies to improve the efficiency of statistical research.

Main part.

1. Literature review

The relevance of the issue of conducting effective statistical research as the basis for high-quality information support at various levels is confirmed by active research by scientists. The issue of using statistical tools in financial (crypto) markets is discussed in [2]. The authors of the study [3] prove that statistics plays an important role in decision-making, including in the development of pharmaceutical products. Scientists pay great attention to ensuring the confidentiality and integrity of information as the basis for the reliability of statistical research. The paper [4] focuses on the formation of an effective mechanism for countering threats in the information sphere. The study presents a model of effective management based on the protection of information resources using advanced technologies. The problem of protecting business information resources is revealed in the works of foreign scientists [5].

Ukrainian scientists are actively researching the issues of information support for the functioning of business and the state. As noted by the authors [6], the process of digitalization is an innovative element in improving the information and analytical support of the management system of business structures. In the context of the development of the global digital ecosystem, scientists are considering the problem of increasing the level of management efficiency by identifying strategic tools for improving information support processes [7, 8].

Noting the role and importance of existing scientific research on information support for statistical research, it is quite obvious that in modern conditions, increasing the level of efficiency of statistical data processing is indisputable. The purpose of the study is to investigate the possibilities of using the latest technologies to improve the quality of statistical research.

2. Research methodology

The research is based on the analysis of the software used by scientists and

students of National University "Yuri Kondratyuk Poltava Polytechnic" in the process of research and education. In particular, the tools XLSTAT, MiniTab, Wizard for conducting statistic research in different fields will be considered in detail.

3. Research results

Advanced technologies are significantly changing the landscape of statistical research by helping scientists and analysts discover relationships, make predictions, and use large amounts of data more efficiently. In particular, machine learning methods, such as neural networks, decision trees, and others, allow analyzing large amounts of data to identify complex relationships and patterns that may go unnoticed using traditional analysis methods [9]. NLP technologies allow analyzing textual data, such as customer reviews, social media, news, etc., to obtain insights, thematic analysis, and sentiment detection. With the help of Big Data processing technologies such as Hadoop and Spark, researchers can efficiently analyze large amounts of data from various sources, including structured and unstructured data. Blockchain technology can ensure the security and integrity of data, which is an important aspect in statistical research, especially when it comes to handling sensitive or personal data.

These technologies help statisticians and researchers to get more information from data that was previously inaccessible or underestimated. They make analysis more accurate, faster, and more convenient, which contributes to the development of modern science and technology.

Modern computer classrooms were opened at National University "Yuri Kondratyuk Poltava Polytechnic", which allow using the latest technologies in statistical research [10].

In particular, researchers and students have the opportunity to use the XLSTAT program. In general, XLSTAT is a powerful tool for performing various statistical analyses and research and is widely used in scientific, business, and other fields. XLSTAT provides a wide range of statistical methods, including descriptive analysis, correlation analysis, analysis of variance, regression analysis, factor analysis, cluster analysis, and many others. XLSTAT allows you to efficiently analyze large amounts of data using optimized processing algorithms and built-in tools for processing Big

Data. The software provides user-friendly data visualization tools such as graphs, charts, histograms, and others to help analyze data and identify patterns and trends. One of the key features of XLSTAT is its ability to integrate with Microsoft Excel, which allows you to use the powerful features of Excel in combination with the wide range of statistical methods of XLSTAT [11]. Example of using XLSTAT for probability distribution is shown in Figure 1.

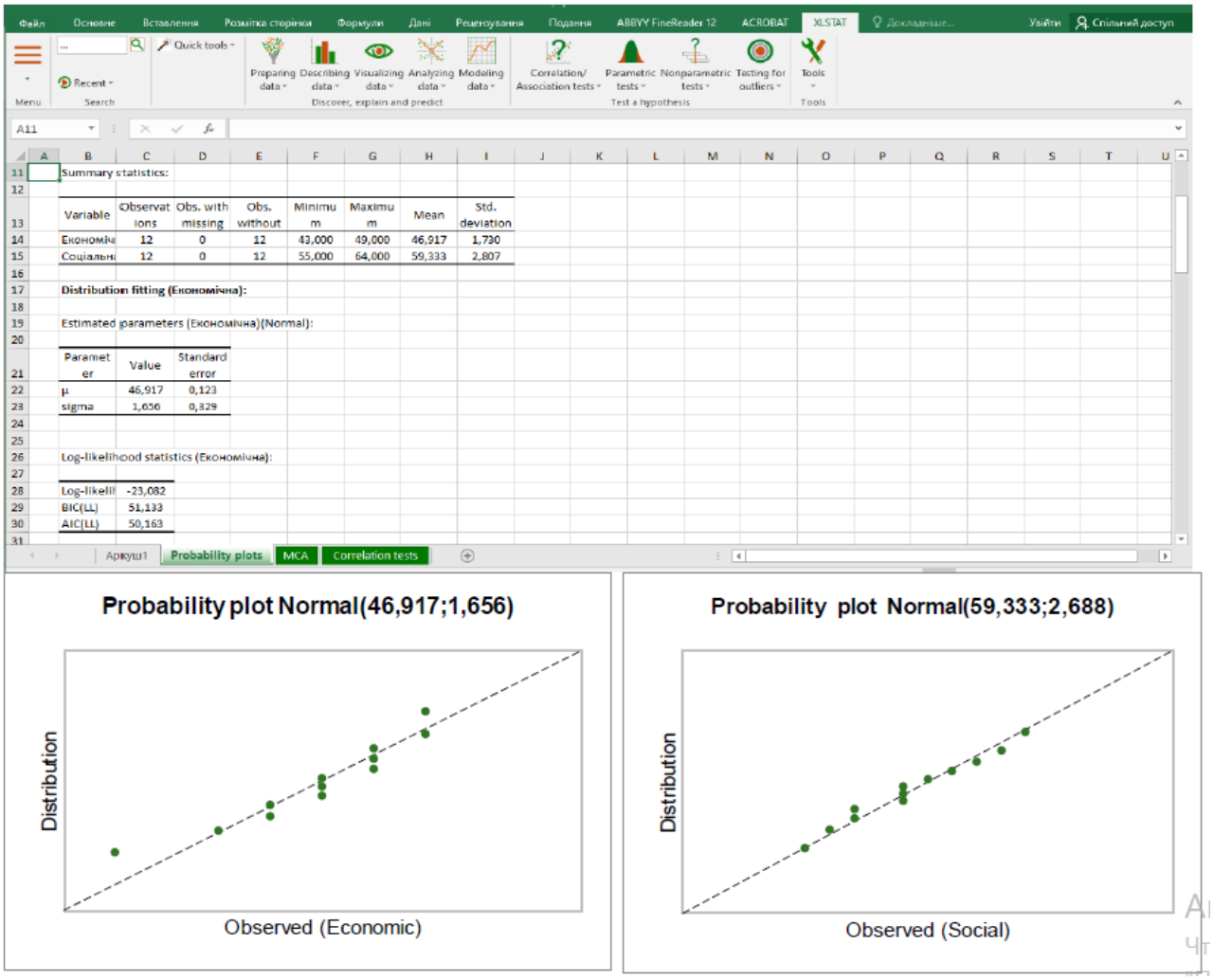

Figure 1 – Distribution of the normality of the distribution of values

Minitab is another popular statistical analysis software package that is widely used in research and education at National University "Yuri Kondratyuk Poltava Polytechnic" [12]. It has a number of tools and functions that allow you to analyze data, perform statistical tests, build models, and visualize data. For example, it has a module for Survival Analysis that allows you to estimate the time to event using methods such as Kaplan-Meier curves and the Cox model. Minitab includes tools for

working with the requirements of quality standards and regulations such as ISO, Six Sigma, and more. Using these tools helps ensure that production processes meet quality and efficiency requirements. To study trends and predict future values, Minitab provides time series analysis tools that help you identify seasonality, cyclicality, and other characteristics in time data [13]. Using the optimization methods available in Minitab, you can determine the optimal process parameters to achieve certain goals, such as minimizing costs or maximizing production capacity.

Minitab is easy to use for users of different levels: both for students who have just started studying statistics and do not yet have deep knowledge of statistics, and for advanced users. It provides an interface with graphical elements and reference materials that helps to perform complex statistical analyses without the need for programming or deep theoretical knowledge.

An example of using Minitab tools to perform correlation and regression analysis is shown in Figure 2.

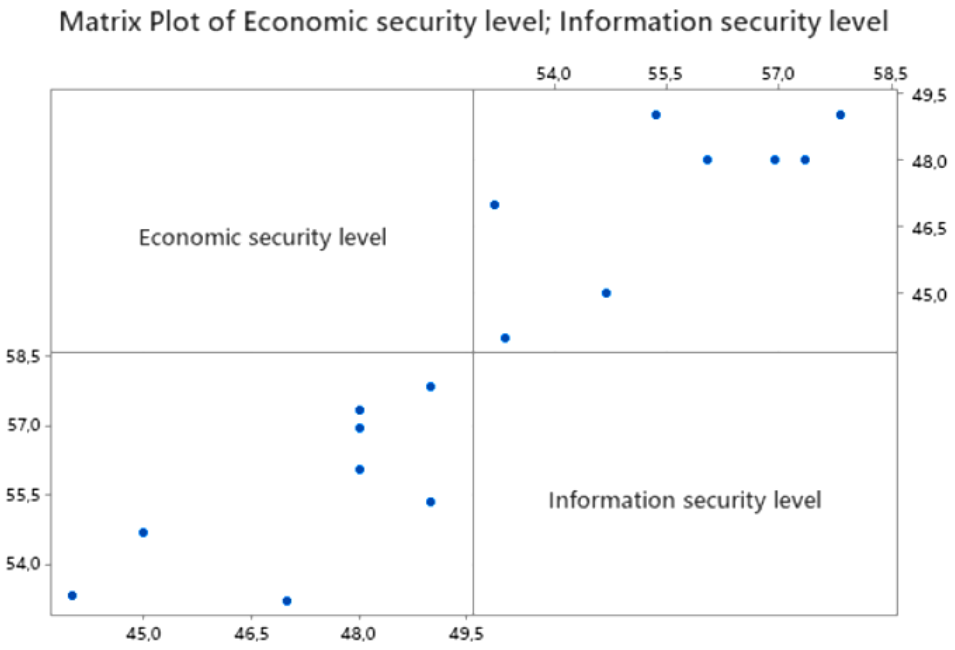

Figure 2 – The results of the correlation and regression analysis, presented in the form of a Matrix Plot

"Wizard: Statistics & Analysis" is a statistical program designed to make the analysis of multidimensional data easier, more accurate, and more diverse. You don't need to put much effort into analyzing a set of information because this program

automatically reports on a large number of indicators. In addition, these statistical reports are accompanied by interactive graphics. Wizard is built on the basis of images of statistical values. Innovative graphics help to quickly understand the data and explain statistical concepts. Wizard is convenient for students who do not yet have in-depth knowledge of statistics or programming, as it provides the ability to perform data analysis without having to manually configure each step of the process. The Wizard's multi-core processor delivers results in a flash. You can compare averages using the t-test or curves using the log-rank, check the distribution for normality using the Shapiro-Wilk test, and more [14]. Wizard is used in many fields. Medical scientists can predict key probabilities using logistic, negative binomial, and proportional hazards models. Marketers can predict consumer choices using multinomial regression.

To make it easier to work with statistical indicators, Wizard supports both independent data entry and import of data from other programs, including the following file formats: Microsoft Excel (.xls/.xlsx), Numbers (.numbers), JSON (.json), SQLite (.sqlite), DBF (.dbf), Microsoft Access (.mdb/.accdb), and others.

An example of using the Wizard program when grouping a statistical population is shown in Figure 3.

An overview of the latest software for statistical research is the basis for the following review. First of all, for the purpose of grading the degree of expediency of use in a particular area. Let us emphasize the key differences between XLSTAT, MiniTab, and Wizard programs identified in the course of the study. First, it is the interface. XLSTAT integrates with Excel, so users who are accustomed to the Excel environment can easily adapt to using XLSTAT. Minitab has its own graphical interface and sophisticated tools.

The Wizard is characterized by an interactive graphical interface that guides the user step by step through the data analysis or analytical task. Secondly, the programs differ in terms of the appropriateness of their use, taking into account the tasks to be solved. XLSTAT is appropriate for use in research and education to perform various types of statistical analysis in the Excel environment. Minitab is often used in industrial engineering research, as well as in industries where complex statistical analysis is

required. Wizard is characterized by a simple interface for users with different levels of expertise in statistics and therefore can be used with equal effectiveness both in the educational process and in conducting complex statistical research. In general, each of these programs has its own features and advantages, and the choice between them depends on the specific needs of the user and the context of use.

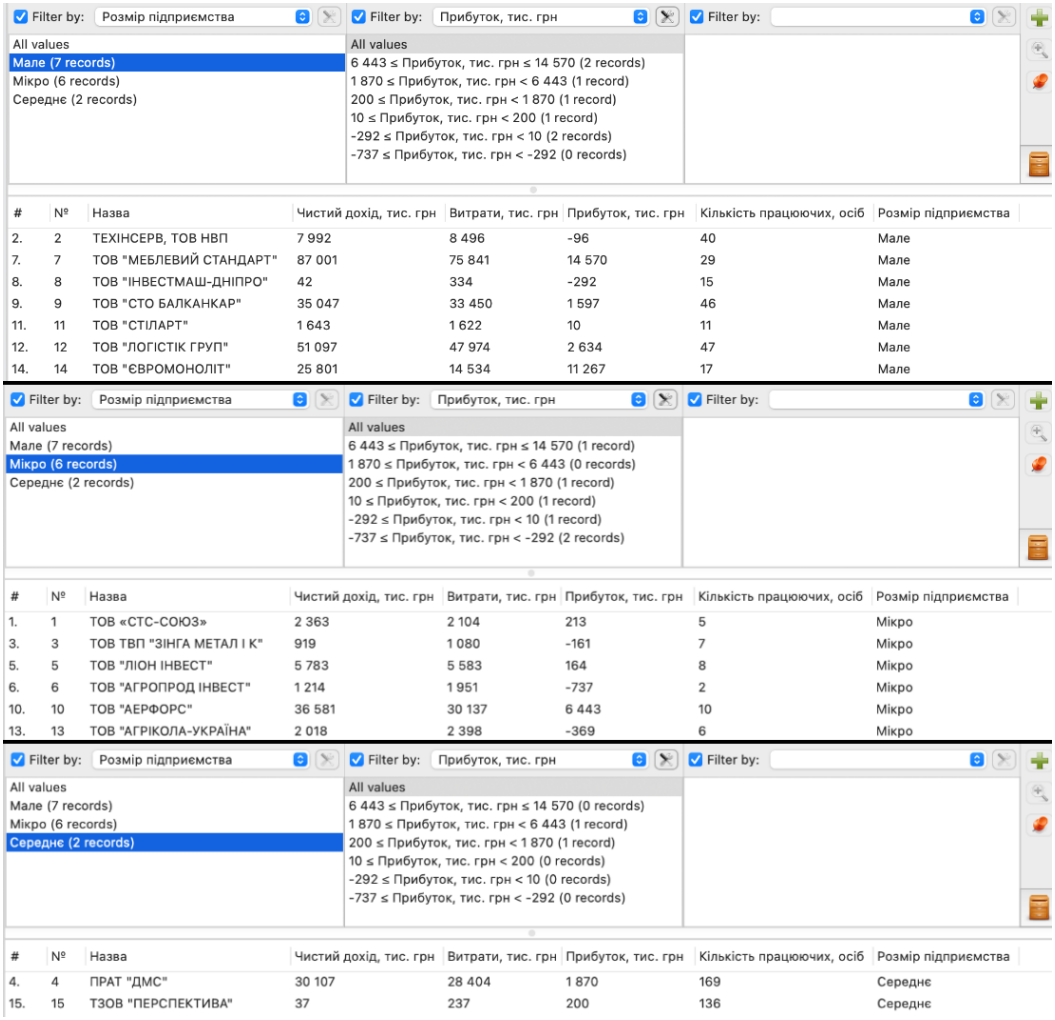

Figure 3 – Grouping data with the Wizard tool

Conclusions.

In summary, the deepening of digitalization processes creates a number of undeniable opportunities, including for statistical research. The need to ensure the efficiency of processing large amounts of information actualizes the issue of using the latest technologies for statistical analysis and research in various fields. The given description of the programs used in the educational process of National University

"Yuri Kondratyuk Poltava Polytechnic" will allow the interested peoples to make a choice about their application in their own activities. Prospects for further research are to grade the XLSTAT, MiniTab and Wizard programs according to the degree of expediency of their use in a particular field.

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Анотація. *Метою статті є аналіз можливостей використання сучасних програмних засобів для підвищення якості статистичних досліджень. В умовах зростаючих обсягів інформації та необхідності її оперативної обробки актуальним є застосування передових технологій статистичного аналізу в наукових і освітніх процесах. У дослідженні здійснено порівняльний аналіз програмного забезпечення, що використовується науковцями та студентами Національного університету «Полтавська політехніка імені Юрія Кондратюка» під час виконання статистичних досліджень. Розглянуто функціональні можливості та особливості застосування програм XLSTAT, Minitab і Wizard у різних сферах аналізу даних, наведено приклади їх практичного використання. Особливу увагу приділено порівнянню ключових характеристик зазначених програм, що дає змогу визначити їх переваги та обмеження залежно від специфіки досліджень. Отримані результати сприятимуть усвідомленому вибору відповідного програмного забезпечення для статистичного аналізу в науковій діяльності та освітньому процесі. Подальші дослідження можуть бути зосереджені на оцінці ефективності використання XLSTAT, Minitab і Wizard у різних предметних галузях та розробленні рекомендацій щодо їх оптимального застосування.*

Ключові слова: *статистичний аналіз, програмне забезпечення, XLSTAT, Minitab, Wizard, обробка даних, освітній процес, наукові дослідження, порівняльний аналіз, ефективність, сучасні технології.*

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