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DEVELOPMENT OF SPECIAL MATHEMATICAL AND SOFTWARE SYSTEMS ANALYSIS

Abstract. The development of special mathematical and software analysis systems is a very topical issue, since our society is rapidly developing under the influence of heterogeneous information resources, in the mutual exchange of information through web technologies. The authors presented options for mathematical and software analysis systems, as well as considered problems arising in the way of introducing new developments. For example, the manufacturer of the program and its users have extensive information about it, and even if the manufacturer knows the logic of the program and sometimes it can accurately predict the results of launches with other source data. However, the question of assessing the reliability of software does not attract proper attention, which is also presented in a study on the development of special mathematical and software analysis systems.

Keywords: development, special, mathematical, software, systems analysis, Internet, information .

In recent years, web technologies have rapidly developed, by which they mean a group of formats and technologies for transmitting multimedia documents used in the largest electronic information system World Wide Web, which is part of the global Internet. WWW is a distributed medium of existence of heterogeneous information resources, the exchange of information between them is possible only thanks to web-technologies. The rapid development of the Web has led to the fact that web-technologies are increasingly associated with the Internet. Web technologies have found application in local networks and integrated multi-user information systems, where they act as a universal intermediary between various types of information resources.

Improvement of computer technology math and software contributes to the development of information technologies for distributed data management in real time. These technologies and related software products are becoming more widely used, including within the framework of modern traffic management systems in urban areas, providing an operational mode for identifying mobile objects, controlling their position, and also routing mobile objects of the patrol service.

According to the Address of the President of the country, the modernization of education should be understood as a large-scale program of the state with the active participation of Kazakh society, the implementation of which should lead to the achievement of a new quality of education and expansion of its accessibility for young people. And the main factor in the renewal of vocational education should be the demands of the economy and social sphere, science, technology, technology, territorial labor markets, as well as the future needs of their development, on which the Head of State focuses attention. A system of constant monitoring of the current and future labor market needs in high-quality personnel of various qualifications, as well as the training of a qualified political class of managers as the basis of the “new management elite, which Kazakhstan will adequately lead in the 21st century,” should be created.

High-performance computing is gaining ever stronger positions in solving various kinds of tasks (including tasks in which simulation methods are applied), using the resources of several performers to perform calculations. The main purpose of using these tools is to optimize computation time. However, the heterogeneity of executors (computing nodes have different performance, communication lines between nodes have different bandwidths), the heterogeneity of the parallel application itself (the application is a set of logical processes located on different computing nodes and interacting by sending messages to each other) on computing nodes.

As a result, the benefit from the use of several performers when performing calculations is reduced to zero. In order to avoid undesirable consequences of an imbalance, special software is used that implements a balancing algorithm. The balancing algorithm is designed to evenly distribute the load on the compute nodes. If at any computational node the load exceeds the permissible one, then, following the balancing algorithm, part of the load is transferred to another, less loaded node. In this case, the application costs for communication between compute nodes should be taken into account.

At present, a characteristic feature of the information society should be the intensive introduction of lifelong education, regarded as a step-by-step and lifelong process, ensuring a constant replenishment and expansion of knowledge, that is, “life-long teaching”. The main goal of lifelong education is strengthening the ability of a person to adapt to changes in the economy, professional life, culture and society. Continuing education can be viewed as a process of growth of the educational potential of an individual over the course of a lifetime, organizationally supported by a system of state and public institutions and corresponding to the needs of the individual and society. It should involve a lot of educational structures - basic and parallel, basic and additional, state and public, formal and informal, using traditional and non-traditional forms and teaching methods, which the President of Kazakhstan focuses on.

It is known that one of the six principles for the development of lifelong education, as defined by the European Union Memorandum, is distance education (DL), one of the important global trends in the field of education, aimed at the use of so-called non-traditional forms and teaching methods. And here I would like to pay special attention to this form of education. This format of education is very important for Kazakhstan and it is in favor of the learner, since the branch education system in our country is strictly regulated, correspondence education is reduced, people should not have to leave their hometown or village to get a quality education. Information technology in this regard provides tremendous opportunities. This is especially important in the conditions of Kazakhstan: uneven resettlement of the population, weak urbanization of the country's settlements, etc.

Today, informatization of education on the basis of world achievements in the field of IT-technologies is a means of innovative, advanced development of Kazakhstan's education. With this in mind, a consistent system policy in the main areas of informatization of education in Kazakhstan is defined as a strategic goal. These areas include: regulatory support; computerization and updating of the computer park; software; Internetization of educational and management organizations; the creation of domestic digital educational resources; automation of monitoring, analysis and management of educational organizations; teacher training and management training.

Thus, the analysis of forms of education shows that distance learning is one of the forms of education (as well as full-time, part-time), in which the educational process uses traditional and specific methods, means and forms of education based on computer and telecommunication technologies. The basis of the educational process at DL is purposeful and controlled intensive independent work of the student, who can study in a convenient place, on an individual schedule, having a set of special teaching aids and a coordinated opportunity to contact the teacher and other students by phone, fax, email and regular mail, as well as in the contact format. Currently, distance learning, as a technological, organic part of education, as well as a new, effective form of education, is the optimal means of implementing the idea of continuing education in modern teaching practice. However, the effectiveness of the use of distance learning in the system of continuous education depends to a large extent on the quality of the informative educational information used; professional skills of teachers; effective management of the educational process; quality hardware and software support; Readiness of students to work with modern information technologies and means of communication.

It should also be noted that if the number of errors is considered as a measure of reliability, then in the terminology of the theory of probability, this number is a random variable, but the main question - in what space of elementary events it was set - was not affected anywhere.

Finally, it is important to emphasize that, from the point of view of reliability, as a result of correcting an error or any other correction, a new program is obtained with a different reliability indicator than before the correction.

Thus, the number of errors in the program is characterized, rather, not by the program, but by its manufacturers and tools used.

For simplicity, we consider a class of programs having a single input and output, i.e. not containing infinite loops. The program execution phase from the beginning to the end will be called the launch. All

possible results of the launch will be divided into two classes: correct and incorrect (erroneous). We assume that any result can always be attributed to one of these classes (it is clear that there may be disagreements between program makers and users on this issue, but we will assume that there is some common criterion, for example, “the customer is always right”). Consider the classical probabilistic model of the Bernoulli test sequence. The space of elementary events in this model contains 2n points, where n is the number of tests (in this case, testing means starting a program). Each program launch has two outcomes: right and wrong. Denote the probability of an incorrect outcome by p, and the probability of correct R = (1 - p). The probability that k of n starts will lead to an incorrect result is expressed by the well-known formula for the binomial distribution [4].

B (p, n, k) = C (n, k) * pk * (1-p) (n-k), (1) where C (n, k) is the number of combinations. The probability of p is a priori unknown, but n and k are known from the results of the launches. The value of B as a function of p has a maximum at

$$p = k / n, \quad (2)$$

As a measure of the reliability of the program, you can take the value

$$R = 1 - k / n = (nk) / n, \quad (3)$$

The values of which (from 0 to 1) are consistent with the generally accepted meaning of the term reliability: for example, if all starts ended with an erroneous result (k = n), then reliability is zero.

The most significant assumption in this model is that program launches are considered independent. This means that the results of previous launches do not give any information about the results of the following. It is clear that this assumption is not always fulfilled in practice: for example, restarting with the same input data will obviously give the same result.

It should be noted that the manufacturer of the program and its user have different information about it. For example, the manufacturer knows the program logic, so that based on the results of starting with some source data, he can sometimes accurately predict the results of launches with other source data (any testing methodology is ultimately based on this), and in this sense the independence test not performed. However, the user is rarely interested in the device of the program, only one thing is important for him: whether it performs the required functions, so the user has no reason to consider the launches dependent. If there is a desire to use information about the program's device when evaluating its reliability, then you should think up some more complex probabilistic model that would take it into account.

Formula (3) makes it possible to evaluate the reliability of a program based on the results of its launches. It is necessary to dwell on two limiting cases: k = n (zero reliability) and k = 0 (absolute reliability). In both cases, the results should not be interpreted literally: there is no guarantee that the next launch will lead to the same result as the previous ones. However, from the user's point of view, these cases are completely different. If zero reliability indicates that the program is clearly unsuitable for operation, then the absolute reliability indicator should not be misleading: such a conclusion cannot be made from the results of even a very large number of launches. It should be emphasized that to assess the reliability in this case it is necessary to consider other probabilistic models.

The developers' desire to create binary-compatible microprocessor families finds an additional explanation from the standpoint of software reliability: if this were fully possible, then the operating experience of the programs would not have to be canceled when switching to a new type of processor, which would contribute to a significant increase in the reliability of the programs used.

It is interesting to compare the reliability characteristics of the hardware and computer program. As you know, the reliability of a physical device changes with time: at the beginning of operation, it grows (the item is “burned in”), then remains constant for a while and finally begins to decrease (the effect of wear or “aging”). Speaking about the reliability of the equipment, they mean the middle phase, on which the reliability is constant. Everyone notes the fact that the computer program does not wear out, so the last phase for it does not exist. However, it is important to emphasize that the first phase (“run-in” of the program) is also absent: program correction (regardless of the reasons for which it was performed) is similar to making changes in the design of a physical device, resulting in a new device with a different reliability index.

Despite the obvious relevance, the issue of assessing the reliability of the software does not attract proper attention. At the same time, even a superficial analysis of the problem from a probability-theoretic point of view makes it possible to reveal some regularities.

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АРНАЙЫ МАТЕМАТИКАЛЫҚ ЖӘНЕ БАҒДАРЛАМАЛЫҚ ЖҮЙЕЛЕРДІ ТАЛДАУДЫ ДАМЫТУ

Аннотация. Арнайы математикалық және бағдарламалық қамсыздандыру жүйелерін дамыту өте өзекті мәселе болып табылады, өйткені біздің қоғамымыз біртұтас ақпараттық ресурстардың әсерінен, веб-технологиялар арқылы өзара ақпарат алмасу кезінде қарқынды дамып келеді. Авторлар математикалық және бағдарламалық қамтамасыз етуді талдау жүйелеріне нұсқалар ұсынды, сондай-ақ жаңа әзірлемелерді енгізу жолында туындаған проблемаларды қарастырды. Мысалы, бағдарламаның өндірушісі және оның пайдаланушылары туралы кең ақпарат бар, тіпті егер өндіруші бағдарламаның логикасын білсе де, кейде ол басқа дерек көздерімен ұшыру нәтижелерін нақты болжай алады. Дегенмен, бағдарламалық қамтамасыз етудің сенімділігін бағалау мәселесі ерекше назар аудармайды, ол сонымен қатар арнайы математикалық және бағдарламалық қамсыздандыру жүйелерін дамыту бойынша зерттеуде ұсынылған.

Түйін сөздер: әзірлеу, арнайы, математикалық, бағдарламалық қамтамасыз ету, жүйелерді талдау, интернет, ақпарат

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РАЗРАБОТКА СПЕЦИАЛЬНОГО МАТЕМАТИЧЕСКОГО И ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ СИСТЕМ АНАЛИЗА

Аннотация. Разработка специального математического и программного обеспечения систем анализа весьма актуальная тема, так как наше общество стремительно развивается под влиянием разнородных информационных ресурсов, во взаимном обмене информации благодаря web-технологиям. Авторами представлены варианты математического и программного обеспечения систем анализа, а так же рассмотрели проблемы возникающие на пути внедрения новых разработок. К примеру, изготовитель программы и ее пользователи располагают широкой информацией о ней и даже если изготовителю заведомо известна логика программы и иногда он может точно предсказать результаты запусков с другими исходными данными. Однако, вопрос оценки надежности программного обеспечения не привлекает должного внимания, о чем так же представлено исследование по разработке специального математического и программного обеспечения систем анализа.

Ключевые слова: разработка, специальный, математический, программное обеспечение, систем анализ, Интернет, информация.

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