Here $\eta = \dfrac{U_0}{\sqrt{2}\,\sigma}$ - the ratio of the effective voltage signal and the noise at the output of the system.

In the absence of a signal ($\eta = 0$), the expression (1.31) becomes.

Increasing the amplitude of the signal causes the concentration of the most probable phase values near $\theta=0$. This means that the phase of the resulting oscillation is increasingly determined by the phase of the signal (Fig. 2).
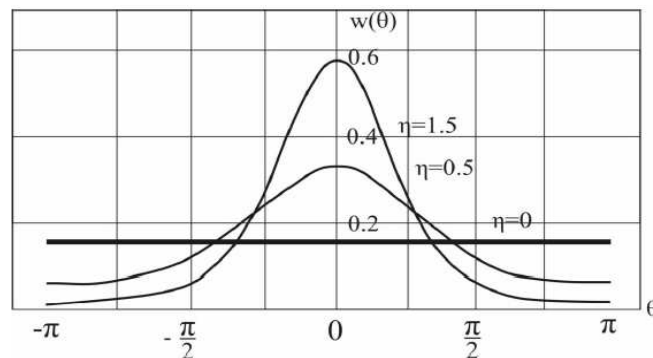

Fig. 2. Graph of the probability density at different phases of signal/noise ratio

To conclude it is necessary to say that using quadrature harmonic measurement signal solved the problem of separating amplitude and phase modulation of the measurement signals in the channel leakage speech information on optoelectronic channel.

Correlation method for determining the normalized value of speech is applied in the channel of information leakage. The energy index defined as the carrying-on signal / noise ratio is depending on the phase of the resulting fluctuations.

A mathematical model of signal processing, modulated in amplitude, phase and frequency estimates optoelectronic channel for leaks of information on the total effect. The amplitude-phase modulation is acting on the directional beam.

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USING TESTS TO CHECK STUDENTS' KNOWLEDGE
IN THE AREA OF DISCRETE MATHEMATICS

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Tests can be classified according to various criteria. The main classification is based on the purpose of the test. It can evaluate a person's abilities, their personal qualities, intelligence, certain mental functions (attention, memory, imagination, knowledge). Since we are considering the specific use of tests in the area of discrete mathematics, we will talk about the test of knowledge.

All tests are divided into 2 groups: conventional and unconventional.

Conventional tests

A conventional test has a certain structure and integrity. It consists of tasks, the rules of their implementation, estimates for each task and recommendations on interpreting test results. The result of a traditional test depends on the number of questions that are answered correctly.

Unconventional tests

Unconventional tests include such tests as integrative, adaptive, multi-stage and criterion-oriented.

1. **Integrative tests.**

The integrative test is a test consisting of a system of tasks aimed at a generalized final diagnosis of the preparation of graduates of educational institutions. The diagnosis is carried out with the help of the tasks, the correct answers to which require integrated knowledge of two or more disciplines.

2. **Adaptive tests.**

The adaptive test is a variant of an automated testing system, in which the parameters of the level of difficulty and differentiating ability of each task are known in advance. This system is created as a computer bank of tasks arranged in accordance with the characteristics of tasks you are interested in. The main feature of the adaptive test task is a level of difficulty, obtained by experience, which means that before each task gets to the bank, it takes an empirical approbation among a sufficiently large number of students.

The appearance of adaptive control derives from the necessity to rationalize the traditional test. Every teacher knows that a well-prepared student doesn't need light and very easy tasks, because there is a high probability of a correct solution. Besides, simple assignments do not have a notable developmental potential. Symmetrically, there is no point in giving a difficult task to a badly prepared student because of a high probability of a wrong solution. It is known, that too difficult tasks reduce a motivation of many students to study.

If the answer is correct a computer picks up the next task to be more difficult, if not – an easier one follows. Using tasks corresponding to the level of preparation, significantly increases accuracy and minimizes the time of individual testing up to 5-10 minutes. Adaptive testing allows you to issue computer tasks at an optimal, approximately 50% level of probability of correct answers for each student.

In foreign sources three variants of adaptive testing are mentioned.

The first is called pyramidal testing. On account of the absence of preliminary assessment all test subjects are given tasks oa medium difficulty and only afterwards, depending on their answer, each of them gets either easier or more complicated assignments.

The second variant is flexilevel. The check begins with the level of difficulty chosen by a test subject himself or herself, with gradual approximation to the real level of knowledge.

The third variant is stradaptive (от анг. Stratified adaptive), where testing is conducted by the Bank of tasks stratified according to the level of difficulty. The next task is taken from the top level if the answer is correct, from the bottom - if the answer is wrong.

So, the adaptive test is a variant of the automated test system with the parameters of difficulty known beforehand and a differentiating ability of each task. This system is created as a computer bank of tasks arranged in accordance with the characteristics of assignments needed.

The main feature of the adaptive test task is that each level of difficulty is obtained by experience, which means that, before getting to the bank, it takes an empirical approbation on a sufficiently large number of students of a certain group.

Lack of awareness of the actual level of the knowledge of students and natural differences in their abilities to assimilate knowledge provided have become the main reason for the appearance of adaptive systems based on the principle of individualization of learning.

3. **Criterion-oriented tests.**

The main objective of the subject-pedagogical approach to the interpretation of test results is to find out what aspects of a discipline have been learned by test subjects. Thus it is discovered what the subject knows and what they do not know. Interpretation of the results is carried out by teachers in the language of the discipline. Such tests require a large number of assignments and a fairly complete determination of the contents of subjects in question.

The conclusion is built along a logical chain: the contents of a discipline ->a general set of tasks for assessing knowledge ->a test as a sample from this set of tasks, a test subjects' answers ->a probabilistic inference about their knowledge of the discipline.

This approach is exposed to disputing over the validity of assessment of knowledge of the whole subject on the grounds of the results, obtained from a limited number of test assignments.

In fact, it is a question of justification of the preciseness of an inductive inference of knowledge of a large number of issues, based on the answers to a small number of test questions.

Criterion-oriented tests focus on such specific goals and objectives as assessment of the level of mastering of a relatively small volume of required knowledge and number of skills, acting as a given standard or criterion of the assimilation of issues. For example, it is important to have such tasks for certificating graduates of educational institutions, which allows to draw a conclusion about their minimum acceptable competence. They are called Minimum Competency Tests in foreign sources. In this case checking is much easier.

This approach has been developed for educational authorities, facing the need to check the level of education in a large number of educational institutions in a comparatively short time and not to allow the latter to fall below the maximum permissible level of requirements.

All types of tests are compared in table 1.

Table 1 – Comparative table of types of tests for a given topic

Criteria for evaluation	Traditional tests	Integrative tests	Adaptive tests	Criterion-oriented tests
Optimal results	Standard questions and calculation of results based on the percentage of correct answers to the questions of all levels of difficulty. The result - the average assessment of knowledge of the overall theme	The correct answer to the question will touch upon not only the knowledge of a particular topic, but also the one previously studied, which will give an idea of the student's knowledge of the whole course. However, the assessment of knowledge of a particular issue is not precise as the data embraces several themes	The actual level of knowledge of a particular student and knowledge of the topic at this level becomes known as a result of the test. The student finds out by himself/herself the level of their knowledge and compares it to the possible levels of complexity as well as the expected level	Data about sub-themes, which students know well, not well or unsatisfactorily, data about the number of students who do not possess the minimum required information and data about the levels of mastering of each sub-theme in the group are obtained as a result of the test The final picture completely discloses the student's knowledge of each subtheme
Time to create a bank of tasks. Possible difficulties	Bank of tasks is created quickly without requiring a lot of time to assess the importance and complexity of each question. Particular difficulties do not arise during the creation	Bank of tasks must be created so that the questions will cover all the knowledge of the subject	All tasks are to be divided into several levels of difficulty, which is necessary to determine the value of each question	The whole topic is to be divided into sub-themes, for each of which a certain number of assignments of different level of complexity must be selected
The accuracy of the separation of tasks	Tasks are selected on the main aspects and notions of the subject. The result does not take into account the level of complexity of the issues, but the percentage of correct answers	Accuracy of the evaluation of questions is reduced through the use of the information received earlier, which forces the student to be proficient not only at the given topic to get a correct answer	The necessity of dividing questions into different levels of complexity requires preliminary approbation of tests before their distribution	Questions need to be divided into several sub-groups, in each of which it is necessary to highlight the main points at different levels of complexity. The testing tasks are not mandatory since priority is given to the division into sub-topics, but not to the level of complexity
The accuracy of calculation of results	The percentage of correct responses from the total number of questions is counted	The percentage of correct answers, as well as in conventional tests, is taken into account but the result is generalized, because it covers a lot of information	As a result you define a level of knowledge at which a test object copes with most tasks correctly.	We get the overall result of the test and the results for each sub-topic separately, which can be obtained from the percentage of correct answers

Types of tasks

Let us consider the most popular classification of tests. Within this classification test tasks can be divided into two groups:

− closed test tasks - each question is accompanied by answer options from which need to select one or more correct answers;

− open task test – to each question a test subject must add a word, phrase, sentence, symbol, formula, etc.

The selection of the type and kind of a test task is predetermined, first of all, by objectives, according to which the test is conducted, the nature of the material, the assimilation of which is necessary to identify, and the age of test objects. The financial, staff and resource provision, as well as time available to the developer of the test are of great importance.

Assignments of the closed type:

− multiple choice;

− an alternative choice;

− establishment of conformity;

− sequencing.

Assignments of the open type:

− Free presentation.

− Addition.

Multiple choice - the subject needs to select one or more correct answers from the list.

An alternative choice - the subject must answer "yes" or "no".

Establishment of conformity - the subject is asked to set the conformity between the elements of two lists.

Sequencing - you need to arrange list elements in sequence

Free presentation - you need to formulate the answer; no restrictions in the test

− Completion - you need to formulate answers taking into account the restrictions given in the test (e.g., complete a sentence).

All types of tasks in tests are compared in table 2.

Table 2 – Comparative table of types of tasks in test.

Kind of tasks	Ability to implement	Advisability of use and the subject of application	Ease of use	Quantity of required information	Correctness of the results
Multiple choice	+	Good for tasks, where you need to enumerate points of a certain defini-tion. Multiple choice tasks are pre-vailing	+	Each question requires knowledge of several definitions, elements of the list, etc.	+
Alternative choice	+	Convenient to check knowledge of definitions and algorithms of solving problems	+	One answer reveals the knowledge of one defi-nition, example, etc.	+
Establishment of conformity	+	Checking knowledge of definitions and reference of a certain set of con-ditions to particular graphs.	+	Each question requires knowledge of several sub-questions	+
Sequencing	+	Checking knowledge of interconnec-tion of definitions	+	It allows to define only the order of sequencing	+
Free presenta-tion	−	Matching examples to definitions or their explanations. Introduction of the solution to a problem	−	The answer refers only to one particular ques-tion	−
Completion	+	Completion of the definition with the key word. Naming of the defini-tion corresponding to the descrip-tion. Entering the answer to the task	+	The answer to a certain question	−

Conclusion. Our analysis shows that the best test is the adaptive test, which has a lot of advantages. Firstly it provides the most optimum results, as it makes it possible to define a real level of knowledge of a student ac-cording to his answers and also the level of knowledge of subtopics at a certain level of difficulty. Secondly, a student has an opportunity to compare the supposed level of knowledge with the real one. Thirdly, it doesn't take long to do. The only problem that arises is the correct distribution of tasks according to levels of difficulty. Of all types of test tasks multiple choice, alternative choice, establishment of conformity, sequencing and comple-tion appear to be the most appropriate. However, not every test task equally suits all sub-topics. For example, it

is useful to apply the 'establish conformity' tasks to reveal the knowledge of definitions, because one question helps reveal the knowledge of several definitions. Also it's better to reduce the number of tasks of the completion type, because the check is performed automatically and there is high risk of correct answers, but in the wrong form, with misprints, connected with the usage of synonymous, etc.

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CONTENT RECOGNITION OF BANK CARDS IN iOS MOBILE DEVICES

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In this article we propose research for existing recognition methods of text fields on documents with flexible forms. Description of adaptability of flexible forms processing from different spheres for bank card details recognition is presented. This approach will allow us to recognize all the information fields by a bank card image with minimum user contribution. This will get rid a user of routine procedures.

M-banking takes a special place among innovative systems and gives an opportunity to manage banking account with the help of a mobile device (smartphone or tablet computer). Full access to the personal account for the client gives a bank card. It is very important and frequently used instrument and it is necessary to rise its usability convenience in the process of mobile applications development. Many M-banking apps require manual entry of bank card details (all information fields data applied on the card) into the system for payment transactions and it is not an easy task for the user. This process is time-consuming, it requires attentiveness and diligence. This article is to help to solve this problem.

Many bank cards have a size of special standard ISO 7810 ID-1. Card design has some restrictions. In a specified place there is a payment system logo to which a card belongs and bank card details information fields. The other card space design is decided by the bank. Card number is embossed a bit lower of the card center and it contains 16 numbers. There is a validity period under its number. Beginning date is not an obligatory field while an expiration date is an obligatory element. Cardholder's name and surname are embossed on the line below. Embossers with Cyrillic script are used in Russian and Belarusian systems, international payment systems use Latin characters. Cards with microchips have a standard microchip place – in the left part, over the first numbers of the card number. On the other side there is a magnetic strip with the main identification information. Lower there is a stripe for the cardholder's subscription.

Plastic bank card design is an important carrier of bank brand and it gives freedom and unpredictability for the card-issuing bank designers' and marketing specialists' invention. That's why it is impossible to rely on any graphic characteristics of the card. It can have any background color. Its color can coincide with the ground color on which it is placed (camouflage effect). It leads to the insufficient contrast at the card borders and "false" borders or gaps. The same effect can be observed when for the card backgrounds such textures as leather or wood are used. Taking it into account, there can be a problem with bank card recognition when a cardholder places a card on the wooden table ground (fig. 1a) or leather wallet. Glossy surface plastic is the main material of which bank cards are made. It has strong reflective characteristics and with the bright light it gives highlights and flashings (fig. 1b). And vice versa, if there is not enough light, and imagination can be soft or unexposed. A mobile device will perform card details recognition and it imposes strict requirements for the computational complexity and algorithms implementation period.

a   *b*   *c*   *d*

Fig. 1. Bank card problem spots examples:
a – coincidence of the card background color andbackground color of the image; *b* – highlights and flashings;
c – insufficient contrast with the card background color; *d* – complete color coincidence of the card details and its number