Laboratory of «Information technologies in learning and computer vision systems»

Program environment for learning and testing any discipline

Estimation of quality analysis of test items and definition of the item discrimination and ability parameters

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Chief of the laboratory: Bilous Natalie, Ph.D., Professor of Software Department

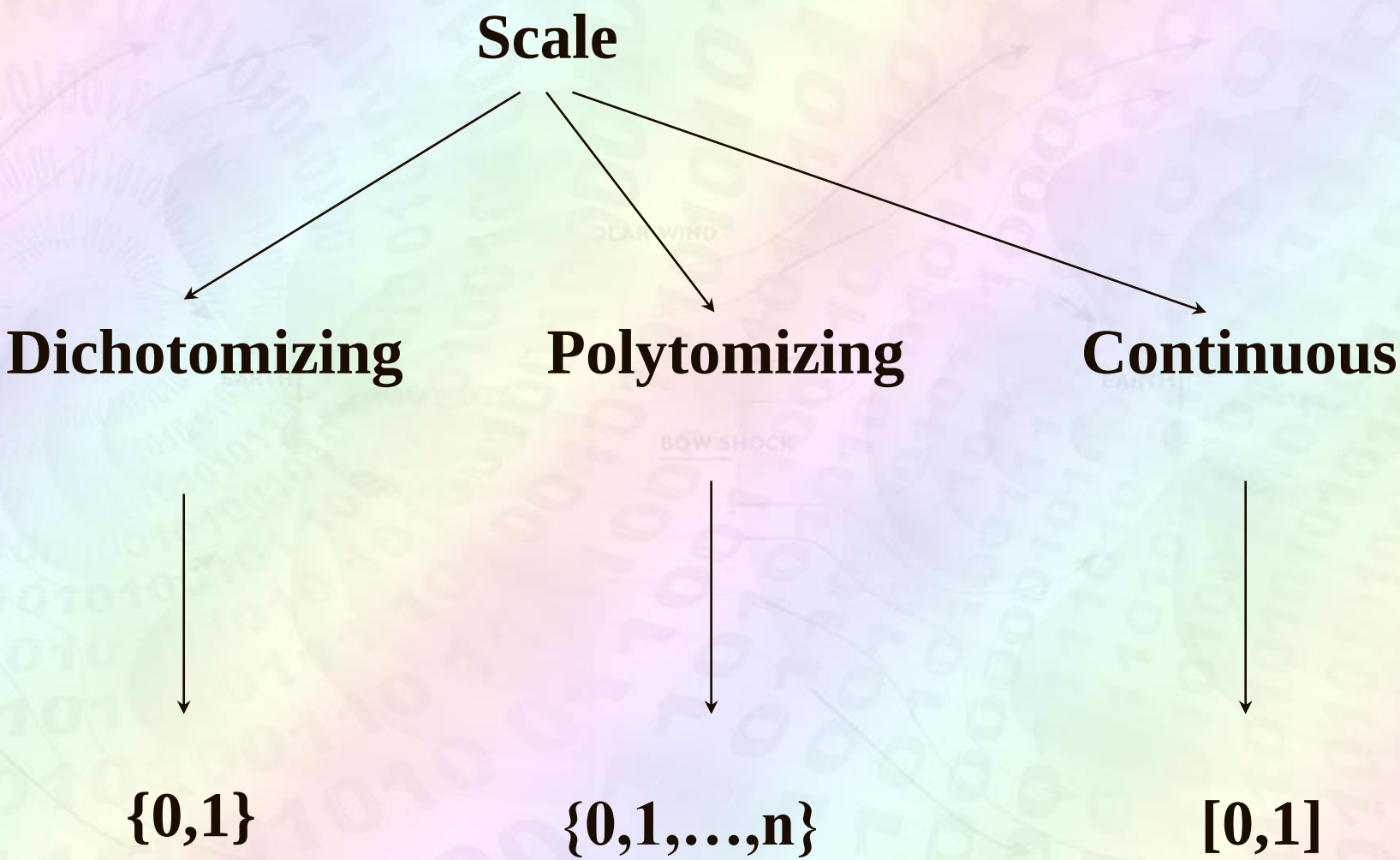
European education

Entrance of Ukraine into European (Bologna) educational space required development of complete sets of test items for initial, in-progress and final knowledge control.

The purpose of work

Development of technology for carrying out of testing, an estimation of test items quality and distributions of test items on complexity levels for the tests estimated on a continuous scale.

Knowledge marking scale



Actuality of the work

- *Necessity of qualitative tests and the knowledge marking systems which is taking into account individual abilities of each testee development;*

- *Independent training of examinees causes of an estimation of right answers guessing probability at testing.*

- *For increase of objectivity a knowledge level marking of testee it is necessary to take into account the test items difficulty*

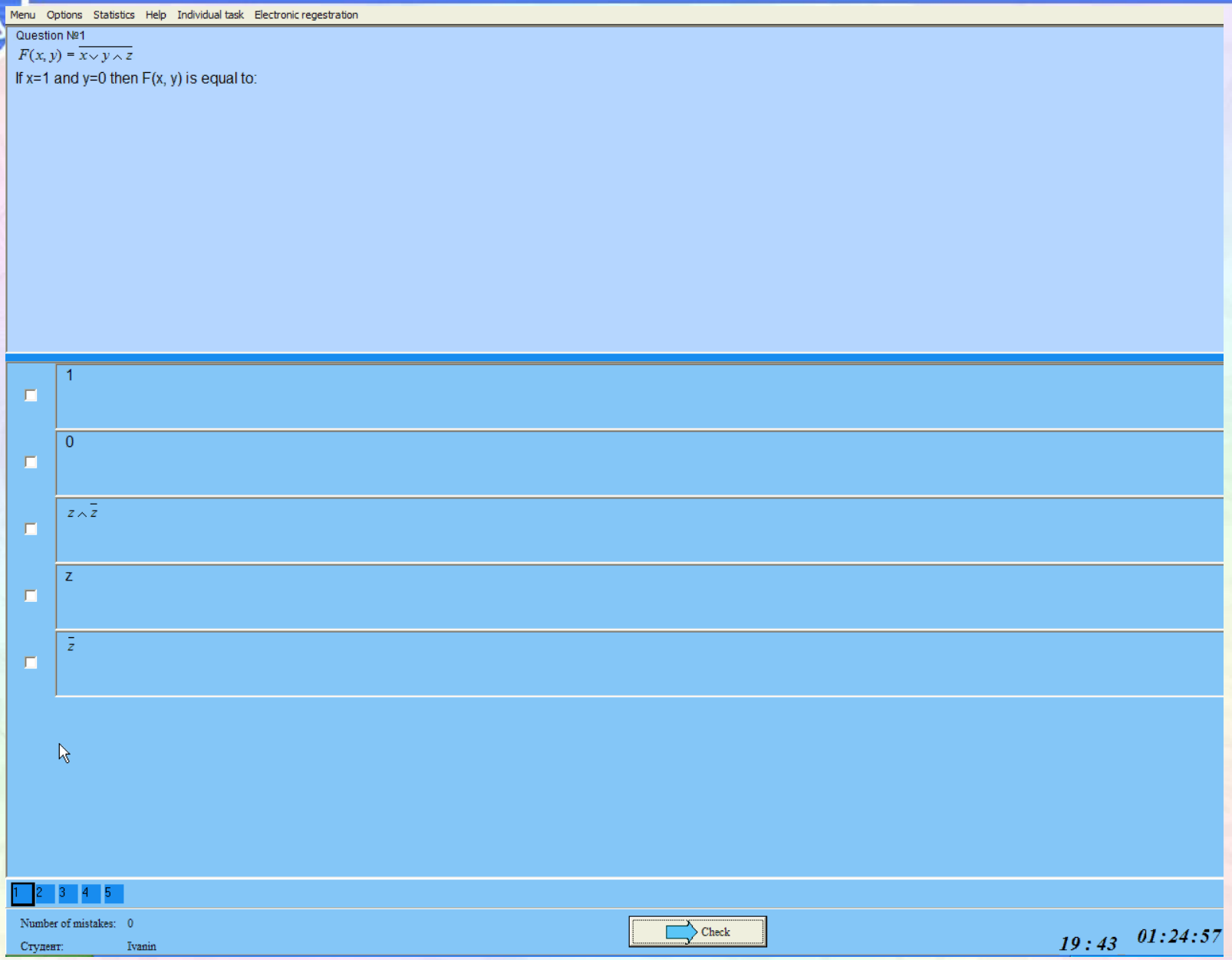
Abilities of programs

- Learning and testing of students for any disciplines
- Support of the any discipline for knowledge testing
- Support of all existing testing forms
- Author methodic for estimation of all forms of test items
- Objective estimation of students knowledge by automatically
- Saving of learning and testing results for all students with different parameters in module of results
- Definition of item difficulty, item discrimination and ability parameters by automatically
- Definition of test items quality

Forms of test tasks

- closed test items
  - onealternative test items
  - multialternative test items .
- conformity test items
- right consequence test items
- open test items
  - items that have arithmetically calculated result
  - answers formed as a freestyle textual data
  - table filling.
  - multistep items

Onealternative test items



Multialternative test items

Menu Options Statistics Help Individual task Electronic regestration

Question №5

Select formulas which correspond to the law of elimination

- [ ] $A \cap (A \cup B) = A$
- [ ] $A \cup (A \cap B) = A$
- [ ] $A \cap A = A$
- [ ] $A \cap U = A$
- [ ] $A \cup \varnothing = A$

1 2 3 4 5

Number of mistakes: 1

Студент: _

Check

19 : 21 00:54:03

Ph. D. Bilous Nataliya e-mail: belous@kture.kharkov.ua

Conformity test items

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Question №10

Set conformity between the laws of boolean algebra and their names

A) associative law	1) $x \wedge 0 = 0, x \wedge 1 = x$
B) commutative law	2) $x \wedge x = x$
C) idempotent law	3) $x \wedge (y \wedge z) = (x \wedge y) \wedge z$
D) identities with constants	4) $x \wedge y = y \wedge x$

Letter	Law
A	
B	
C	
D	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

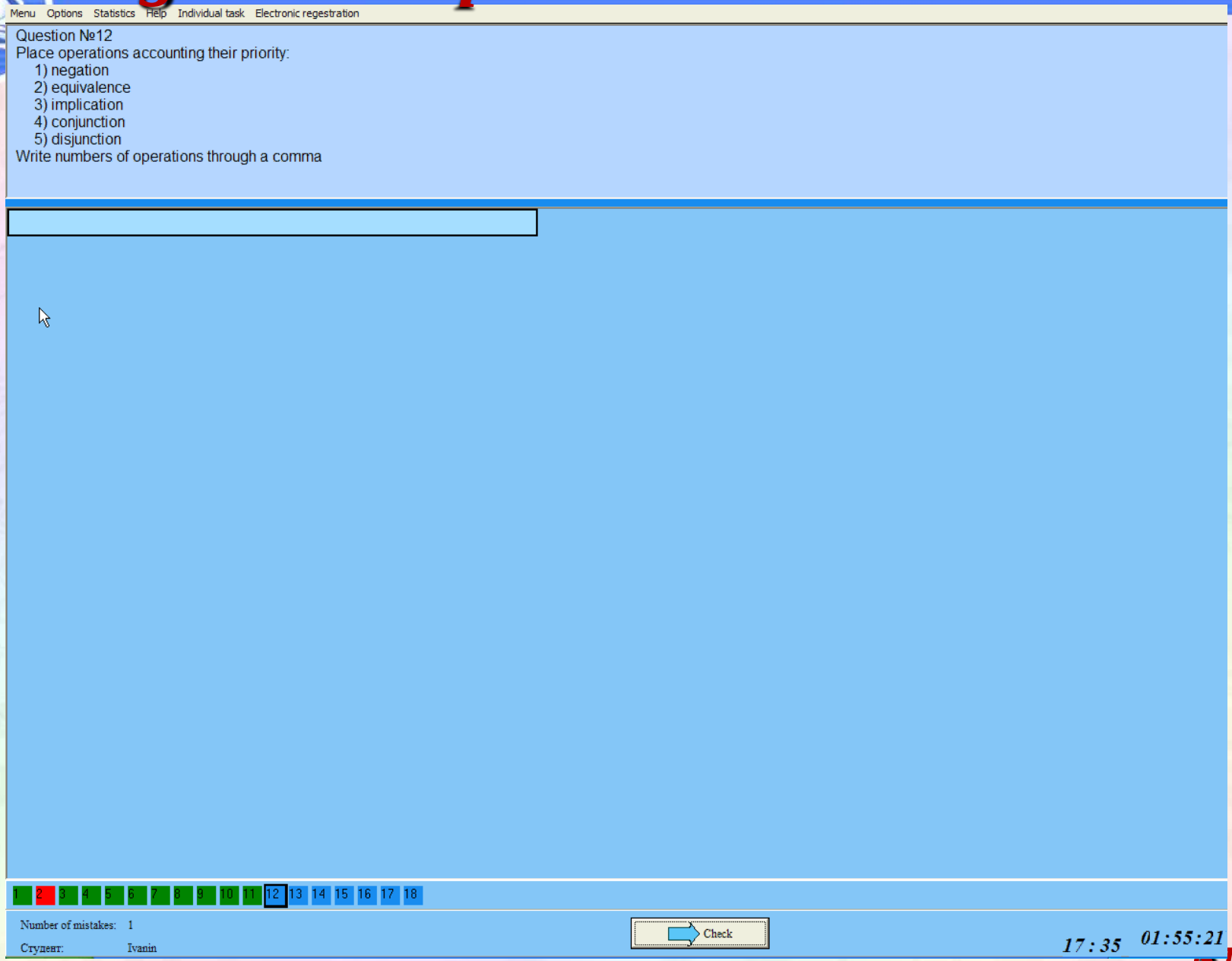
Number of mistakes: 3

Студент: Ivanin

Check

17 : 48 01:58:02

Right consequence test items



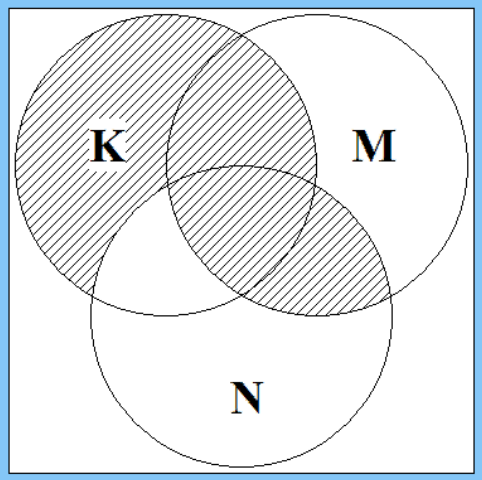
Ph. D. Bilous Nataliya e-mail: belous@kture.kharkov.ua

Next

Answers formed as a freestyle text data

Menu Options Statistics Help В электронный журнал

Select expression that corresponds to the given Venn diagram



K M N

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( )

Equation

Check the form

Table filling

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Question №3

Prove the 1-st Distributive Law:

$x \vee yz = (x \vee y)(x \vee z)$

x	y	z	yz	x v yz	x v y	x v z	$(x \vee y)(x \vee z)$
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

1 2 3

Number of mistakes: 0

Студент: Ivanin

Check

28 : 33 01:03:58

Multistep items

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Question №1

Find the Jegalkin polynomial for the following function:

$\overline{(xy)} \vee \bar{z}$

STEP 1: Change $\vee$ into $\oplus$

The right formula is:

- [ ] $xy\bar{z} \oplus xy \oplus \bar{z}$
- [ ] $xyz \oplus \overline{xy}\,\bar{z}$
- [ ] $xy\bar{z} \oplus \overline{(xy)}z$
- [ ] $\overline{xy}z \oplus \overline{xy} \oplus z$
- [ ] $\overline{(xy)}\bar{z} \oplus \overline{(xy)} \oplus \bar{z}$

1 2 3

Number of mistakes: 0

Студент: Ivanin

Check

19 : 47 01:43:00

Short result for every testee

Dear Vivir

Karnaugh maps

You have finished this work and showed the following results:

Stage:	*Ball*	*Mark:*	*Number of mistakes:*
	Vivir		
Access questions:	*60*	*3*	*2*
Practical:	*100*	*5*	*0*
Test questions:	*69*	*3*	*2*

Total number of mistakes: ***4***

Elapsed time: *0:03:02*

Percent of doing work ***74***

Rating ball ***6***

Your mark: ***4***

OK

Electronic journal

Menu Help

Surname	Laboratory work name	Percent	Access questions	Practical	Test questions	Mark	Numbe	Personal info	Time	Date	Elapsed time
test	test	100	100	100	100	**100**	100	test			
z	Karnaugh maps	0				**2**	0		13:59:53	02.04.2009	0:00:17
Ivanov	Karnaugh maps	0	2	0	0	**2**	5	CSN-08-1_2	11:04:41	11.09.2009	0:00:51
Petrov	Karnaugh maps	0	2	0	0	**2**	4	CSN-08-1_2	11:06:13	11.09.2009	0:01:03
Vivir	Karnaugh maps	74	3	5	3	**4**	4	CSN-08-1_2	11:09:36	11.09.2009	0:03:02

Mathematical model of testing theory

$$P_{ij} = f(\Theta_i - \beta_j)$$

Where

P_{ij} –probability of that i- th person will execute j-th item;

Θ_i – the ability parameter of i-th testee (i = 1, 2,...,N);

β_j –j-th item difficulty parameter (j = 1, 2,...,n).

Kind of the model:

- one-parametrical;
- two-parametrical;
- three-parametrical.

One-parametrical model

$$P_j(\Theta) = \frac{1}{1+e^{-1.7(\Theta-\beta_j)}}$$

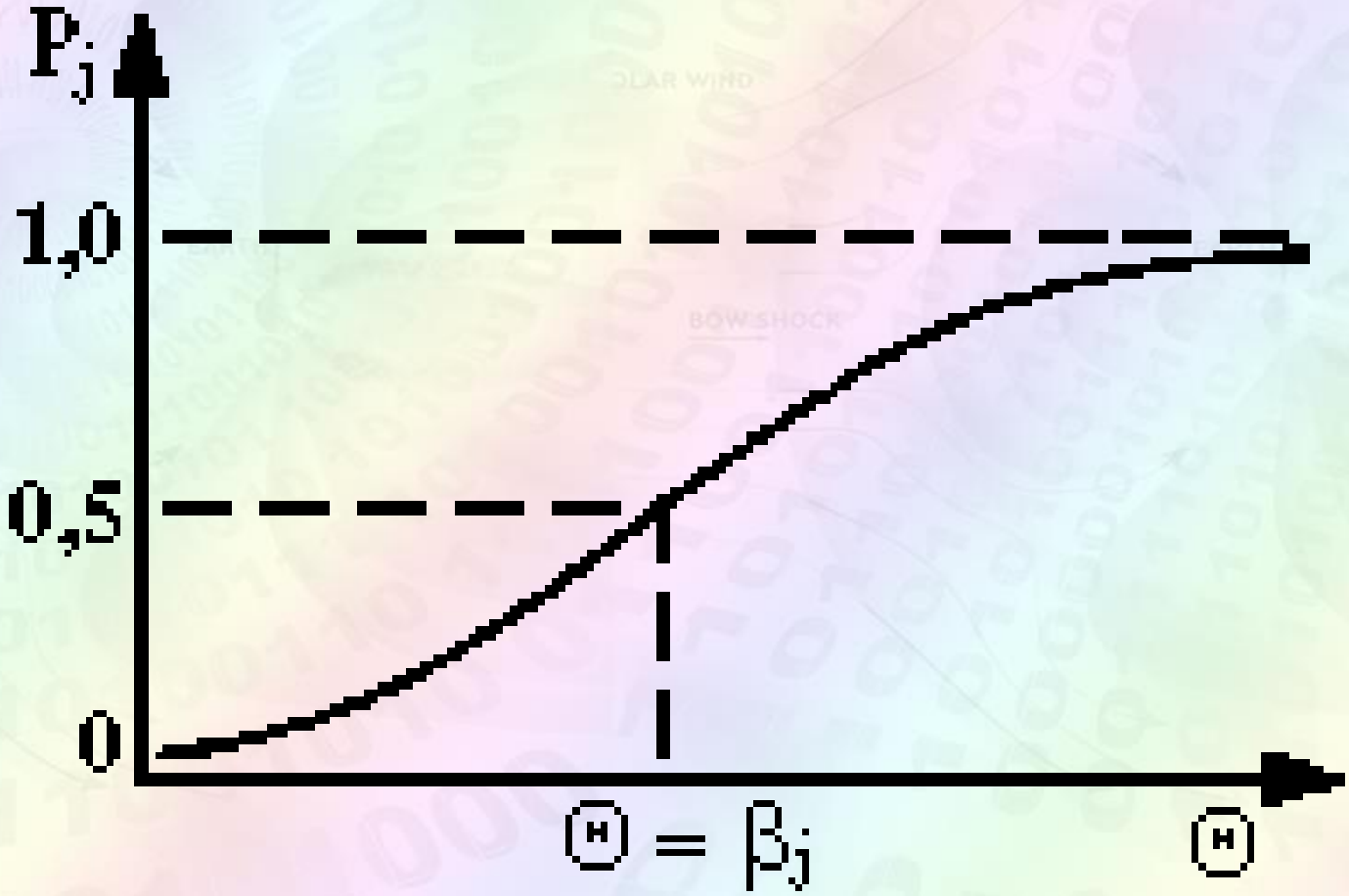
$$P_i(\beta) = \frac{1}{1+e^{-1.7(\Theta_i-\beta)}}$$

$P_j(\Theta)$ Probability of correct execution of the j-th test item by the testee with various knowledge level. *The above a level of testee knowledge , the above probability of a right answer on j-th test item.*

$P_i(\beta)$ – Probability of correct execution by the i-th testee of various difficulty test items. *Is decreasing function of variable β.*

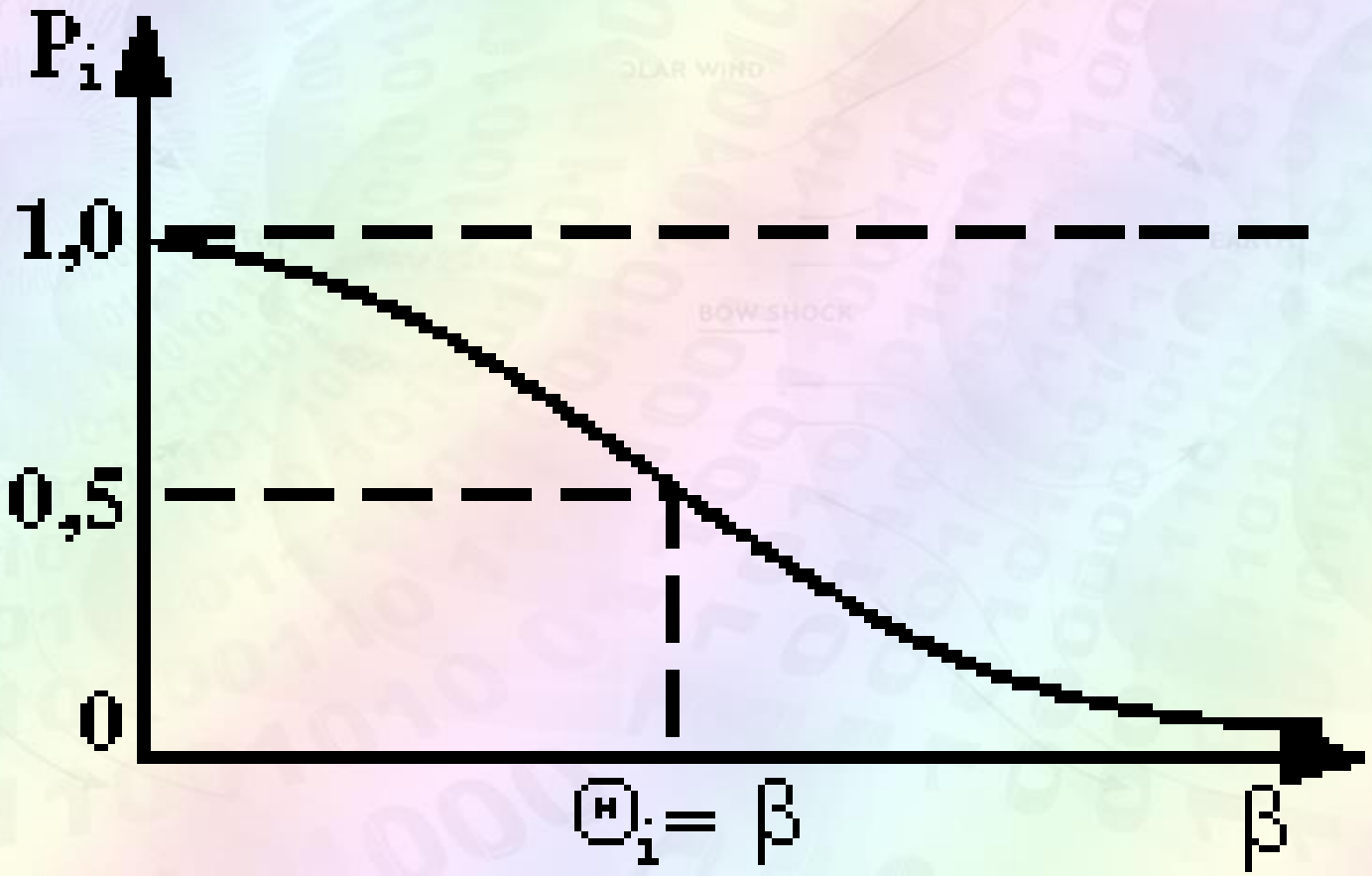
One-parametrical model

The graph of a characteristic curve for j-th test item



One-parametrical model

The graph of an individual curve for i-th testee



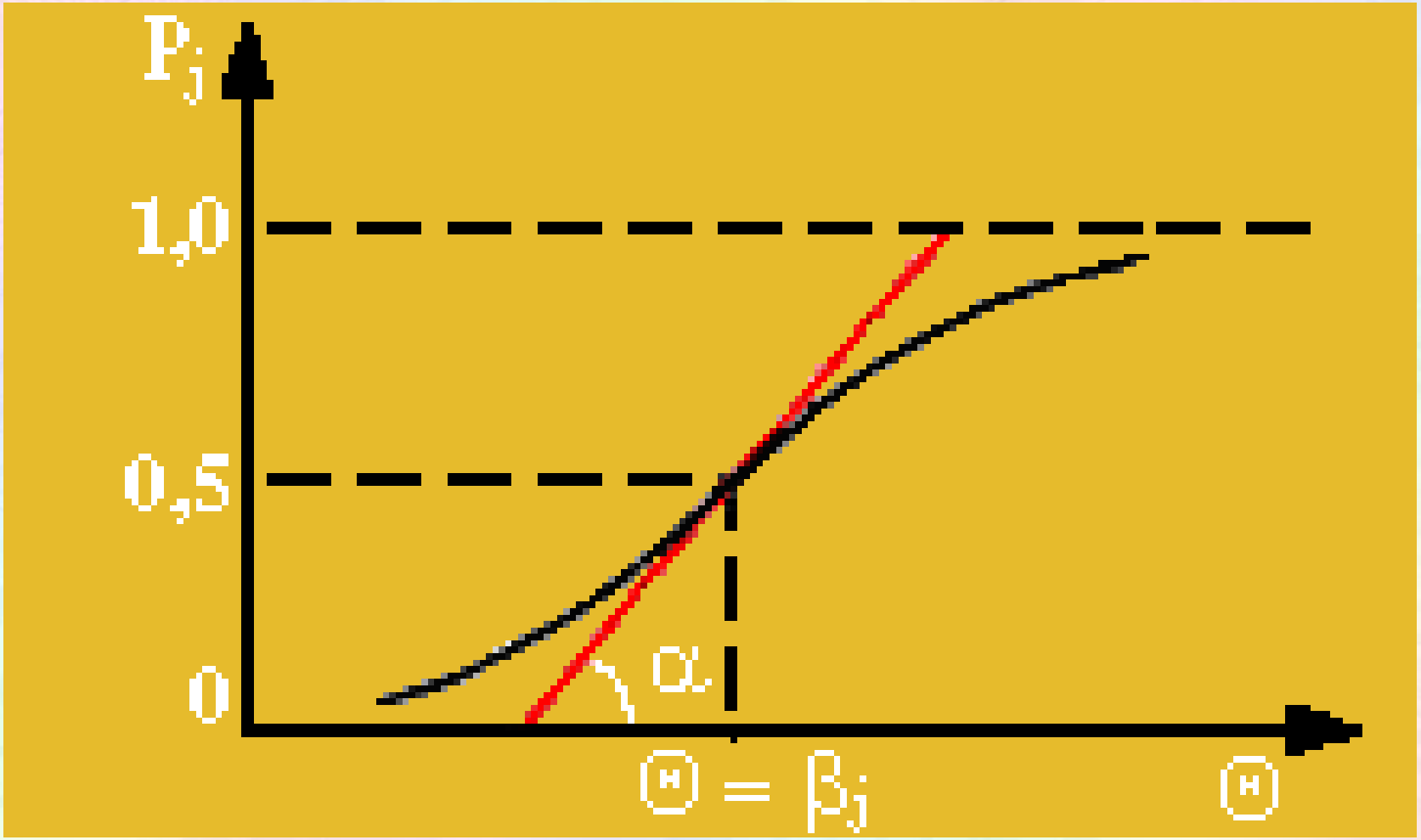
Two-parametrical model

$$P_{ij}(\Theta) = \frac{1}{1 + e^{-1.7 a_j (\Theta_i - \beta_j)}}$$

where a_j – the item discrimination parameter.

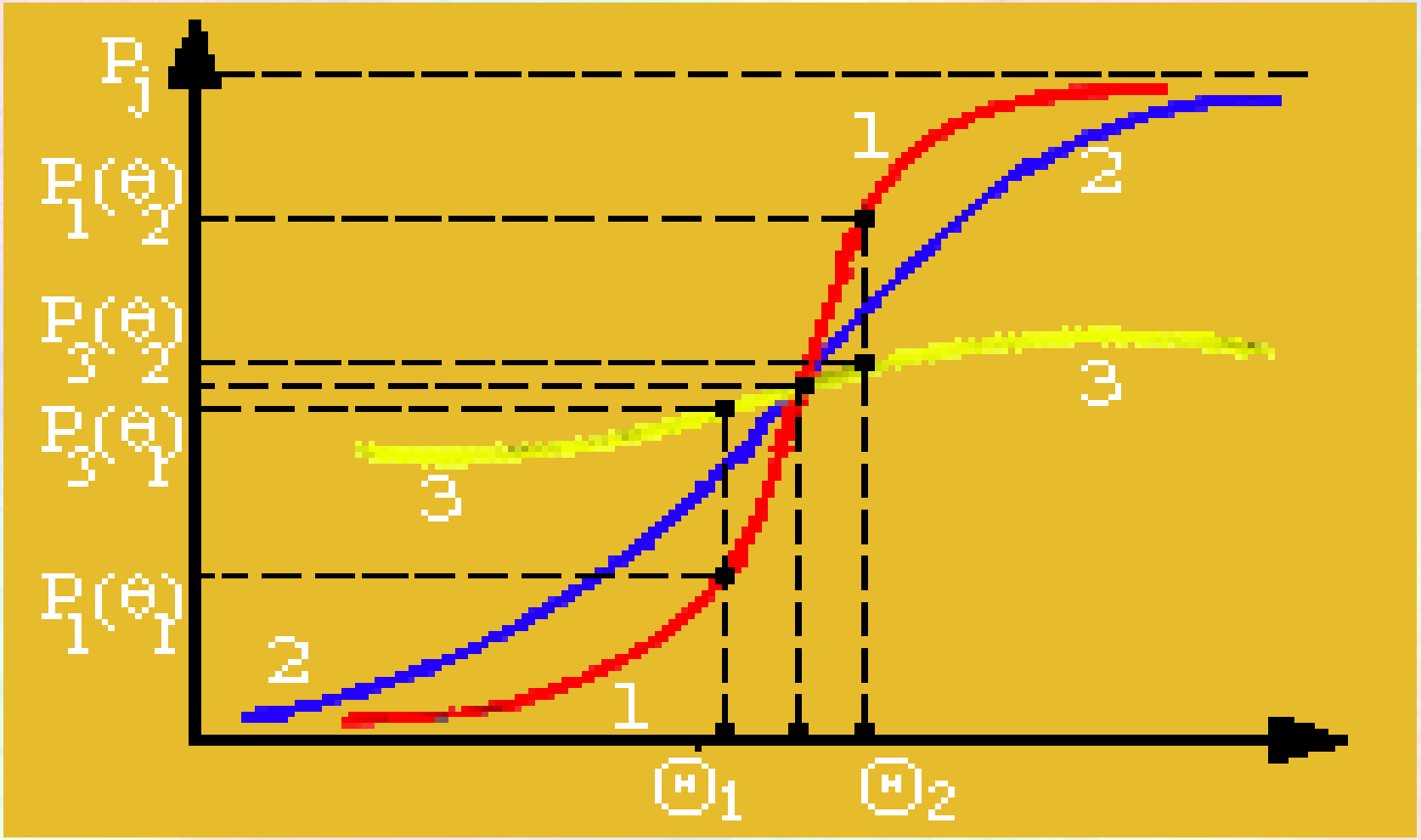
Two-parametrical model

The graph of a characteristic curve for j-th test item



Two-parametrical model

Characteristic curves of three test items of equal difficulty



Three-parametrical model

$$P_{ij}(\Theta) = c_j + \frac{(1 - c_j)}{1 + e^{-1.7 a_j (\Theta_i - \beta_j)}}$$

где P_{ij} – probability of that i- th person will execute j-th item;

Θ_i – the ability parameter of i-th testee (i =1, 2,...,N);

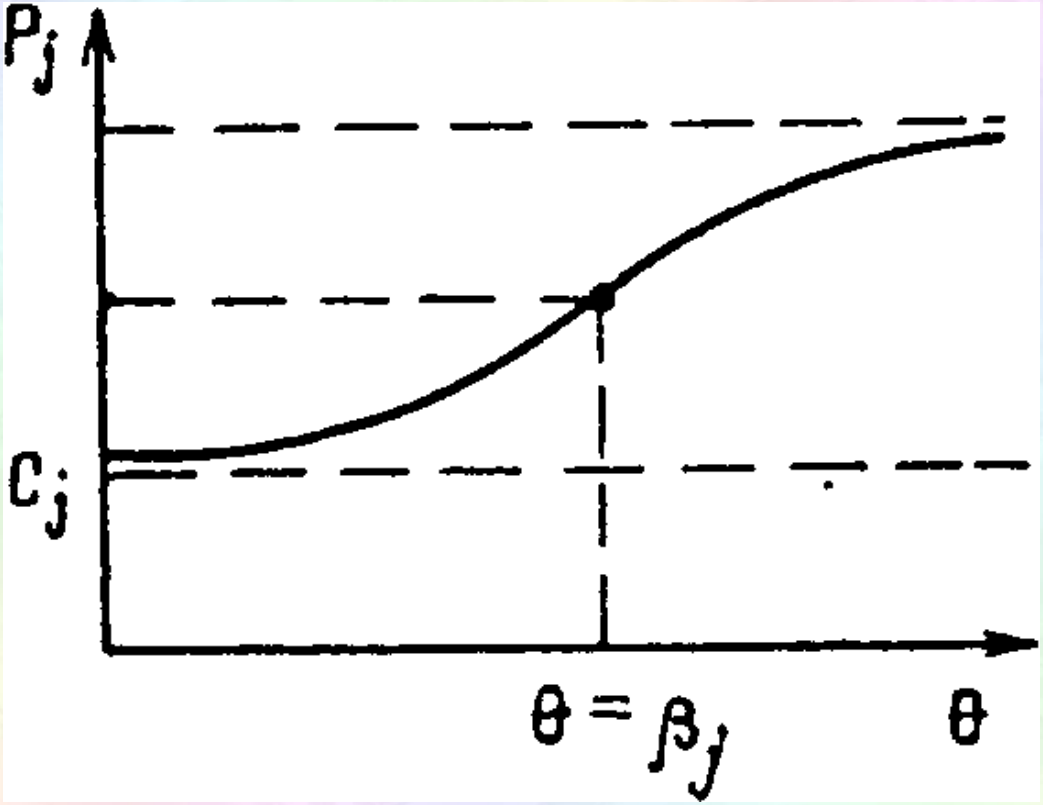
β_j – the j-th item difficulty parameter (j = 1, 2,...,n);

a_j – the item discrimination parameter;

c_j – the guessing parameter ($\Theta \rightarrow -\infty$).

Three-parametrical model

The graph of a characteristic curve for j-th test item



The integrated functional model of a complexity level definition of test items

$$\beta_j = f(P_{1j}(\Theta_i, res_{ij}), P_{2j}(\Theta_i, a_j, res_{ij}), P_{3j}(\Theta_i, a_j, c_j, res_{ij}))$$

where β_j – j-th item difficulty parameter ;

$P_{1j}(\Theta_i, res_{ij}), P_{2j}(\Theta_i, a_j, res_{ij}), P_{3j}(\Theta_i, a_j, c_j, res_{ij})$ – modified one-, two- and three-parametrical models constructed on continuous scale;

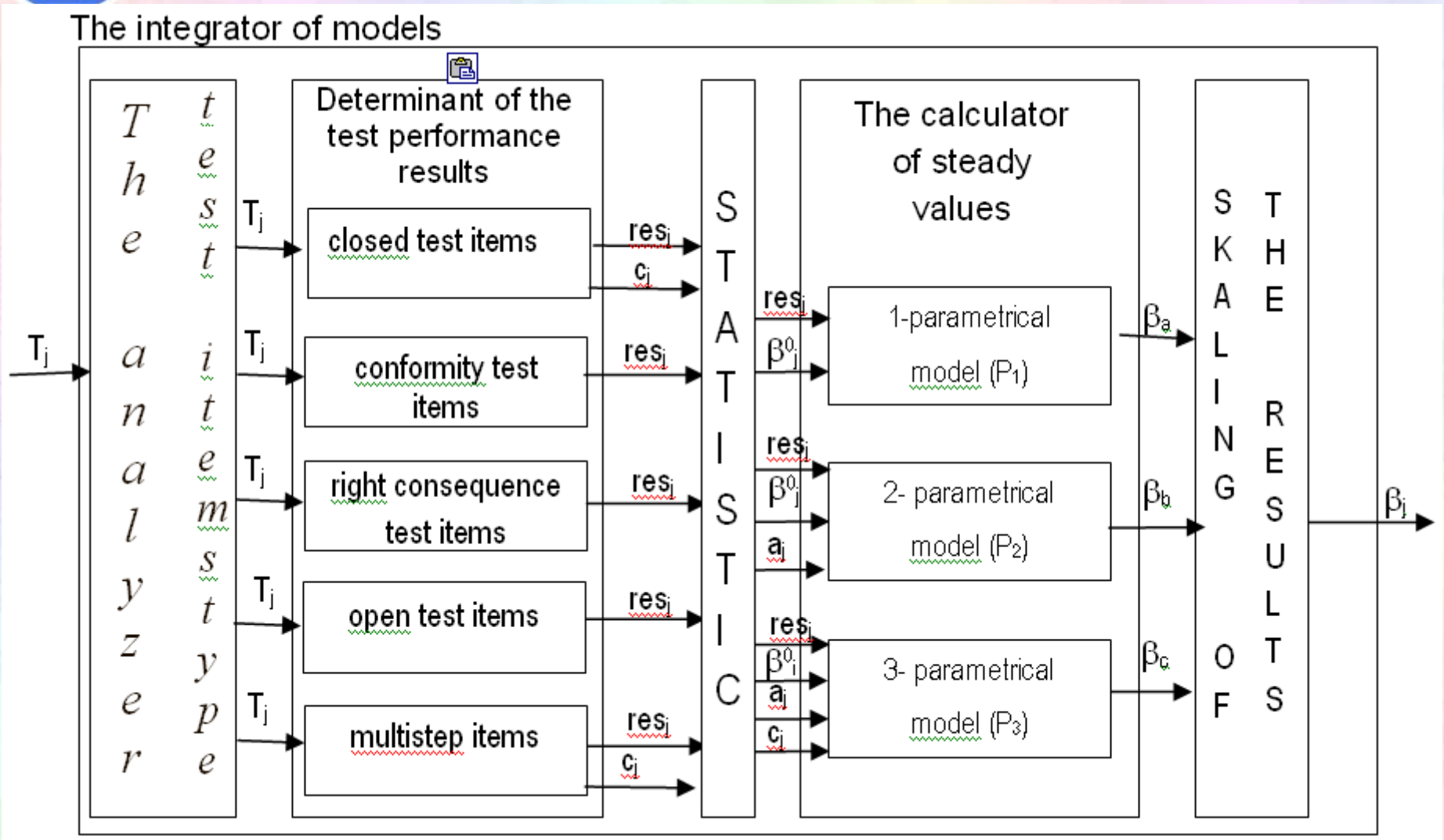
Θ_i – the ability parameter of i-th testee ;

r_{ij} –result of executing of the j-th test item the i-th testee;

a_j – the item discrimination parameter;

c_j – the guessing parameter .

The integrated functional model of a complexity level definition of test items



Testing results

Statistic

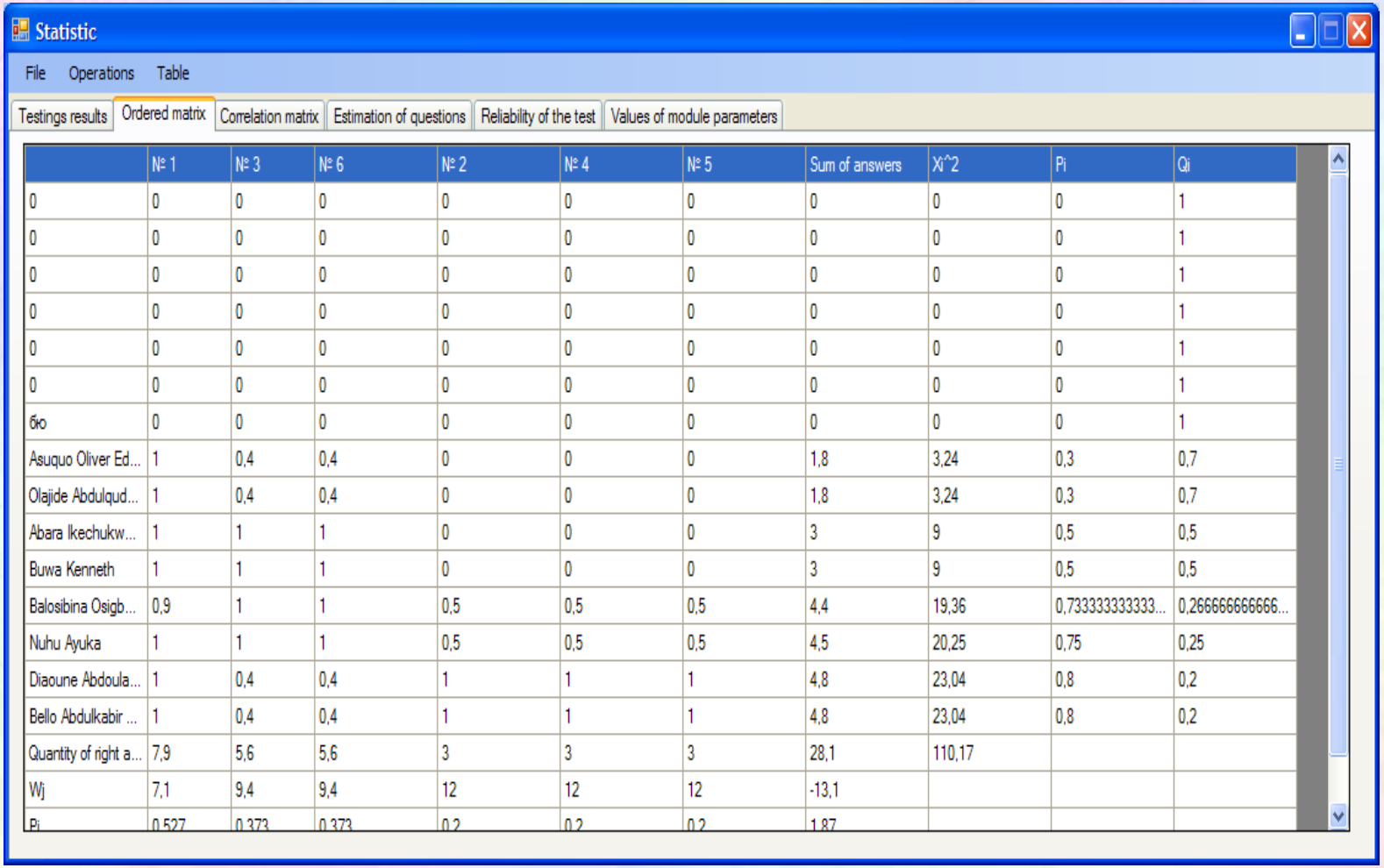
File Operations Table

Testings results | Ordered matrix | Correlation matrix | Estimation of questions | Reliability of the test | Values of module parameters

	№ 1	№ 2	№ 3	№ 4	№ 5	№ 6	Sum score
Diaoune Abdoulaye	1	1	0,4	1	1	0,4	4,8
Abara Ikechukwu Charles JNR	1	0	1	0	0	1	3
Asuquo Oliver Edwin	1	0	0,4	0	0	0,4	1,8
Balosibina Osigbodi Bamanosi	0,9	0,5	1	0,5	0,5	1	4,4
Bello Abdulkabir Temidayo	1	1	0,4	1	1	0,4	4,8
Buwa Kenneth	1	0	1	0	0	1	3
Olajide Abdulqudus Yinka	1	0	0,4	0	0	0,4	1,8
Nuhu Ayuka	1	0,5	1	0,5	0,5	1	4,5
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
бю	0	0	0	0	0	0	0
Quantity of right answers	7,9	3	5,6	3	3	5,6	28,1

Program system for quality analysis of test items

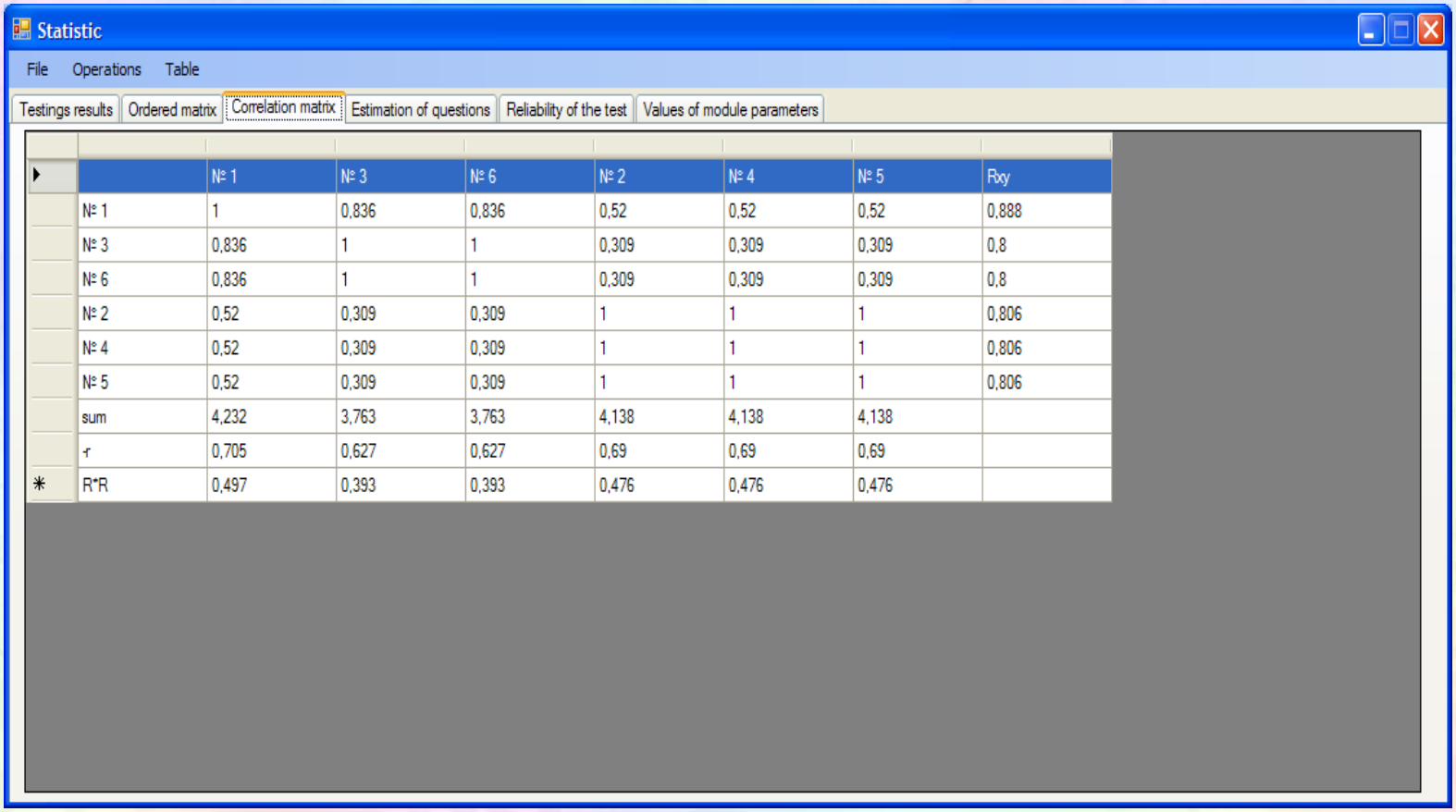
Ordered matrix



	№ 1	№ 3	№ 6	№ 2	№ 4	№ 5	Sum of answers	Xi^2	Pi	Qi
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1
бю	0	0	0	0	0	0	0	0	0	1
Asuquo Oliver Ed...	1	0,4	0,4	0	0	0	1,8	3,24	0,3	0,7
Olajide Abdulqud...	1	0,4	0,4	0	0	0	1,8	3,24	0,3	0,7
Abara Ikechukw...	1	1	1	0	0	0	3	9	0,5	0,5
Buwa Kenneth	1	1	1	0	0	0	3	9	0,5	0,5
Balosibina Osigb...	0,9	1	1	0,5	0,5	0,5	4,4	19,36	0,733333333333...	0,266666666666...
Nuhu Ayuka	1	1	1	0,5	0,5	0,5	4,5	20,25	0,75	0,25
Diaoune Abdoula...	1	0,4	0,4	1	1	1	4,8	23,04	0,8	0,2
Bello Abdulkabir ...	1	0,4	0,4	1	1	1	4,8	23,04	0,8	0,2
Quantity of right a...	7,9	5,6	5,6	3	3	3	28,1	110,17		
Wj	7,1	9,4	9,4	12	12	12	-13,1			
Pi	0,527	0,373	0,373	0,2	0,2	0,2	1,87			

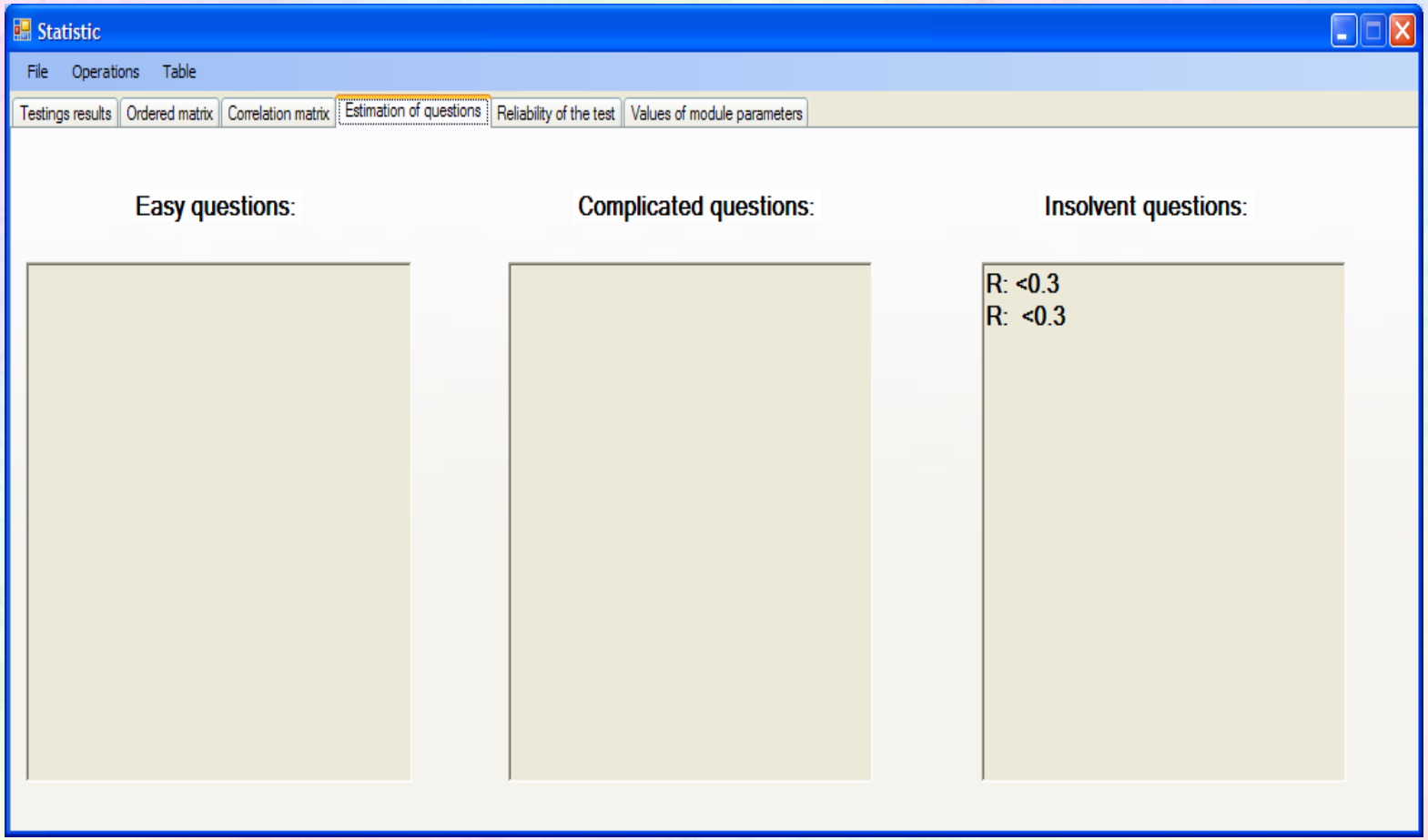
Program system for quality analysis of test items

Correlation matrix



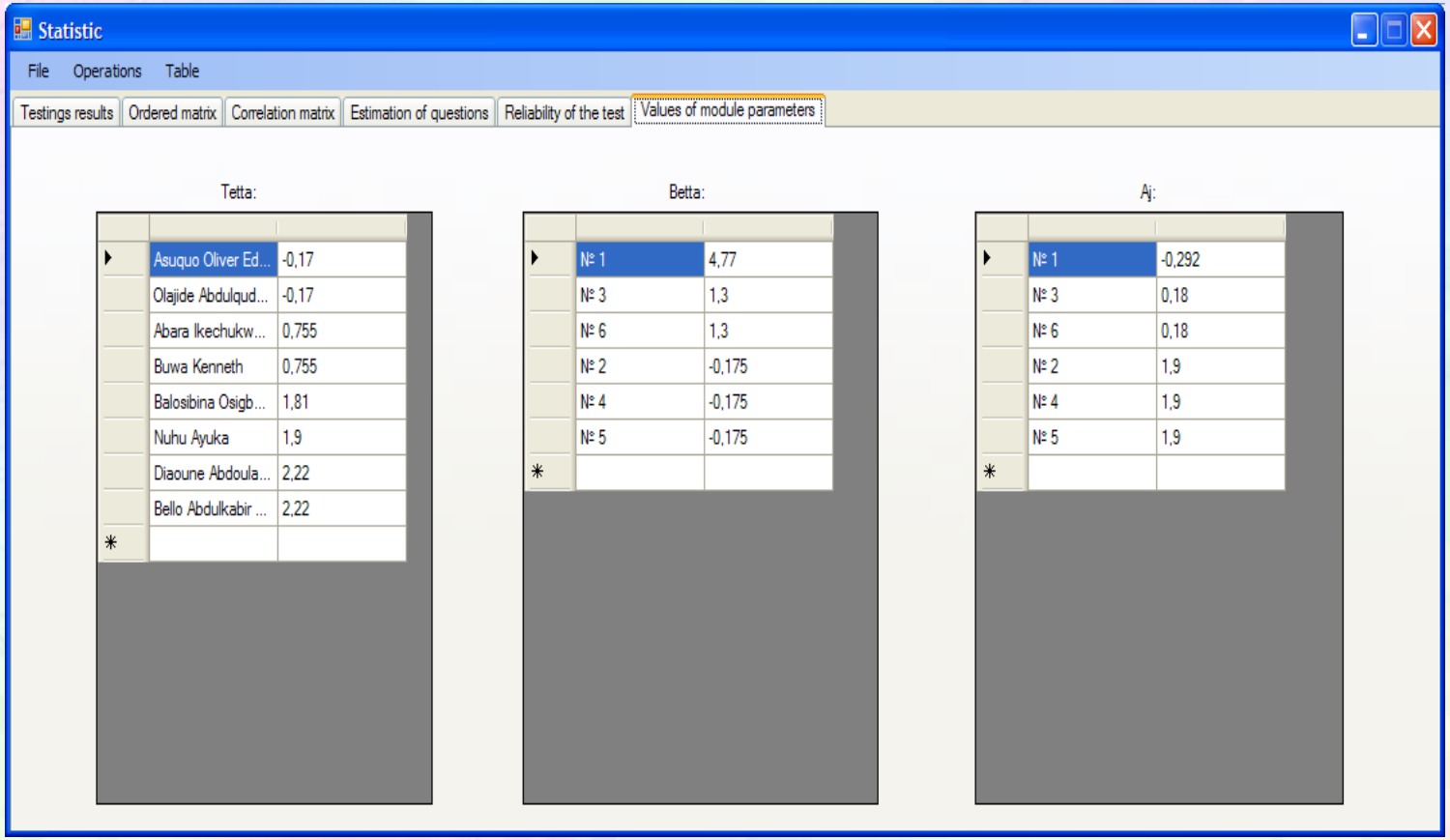
	№ 1	№ 3	№ 6	№ 2	№ 4	№ 5	Rxy
№ 1	1	0,836	0,836	0,52	0,52	0,52	0,888
№ 3	0,836	1	1	0,309	0,309	0,309	0,8
№ 6	0,836	1	1	0,309	0,309	0,309	0,8
№ 2	0,52	0,309	0,309	1	1	1	0,806
№ 4	0,52	0,309	0,309	1	1	1	0,806
№ 5	0,52	0,309	0,309	1	1	1	0,806
sum	4,232	3,763	3,763	4,138	4,138	4,138	
r	0,705	0,627	0,627	0,69	0,69	0,69	
* R*R	0,497	0,393	0,393	0,476	0,476	0,476	

Estimation of questions

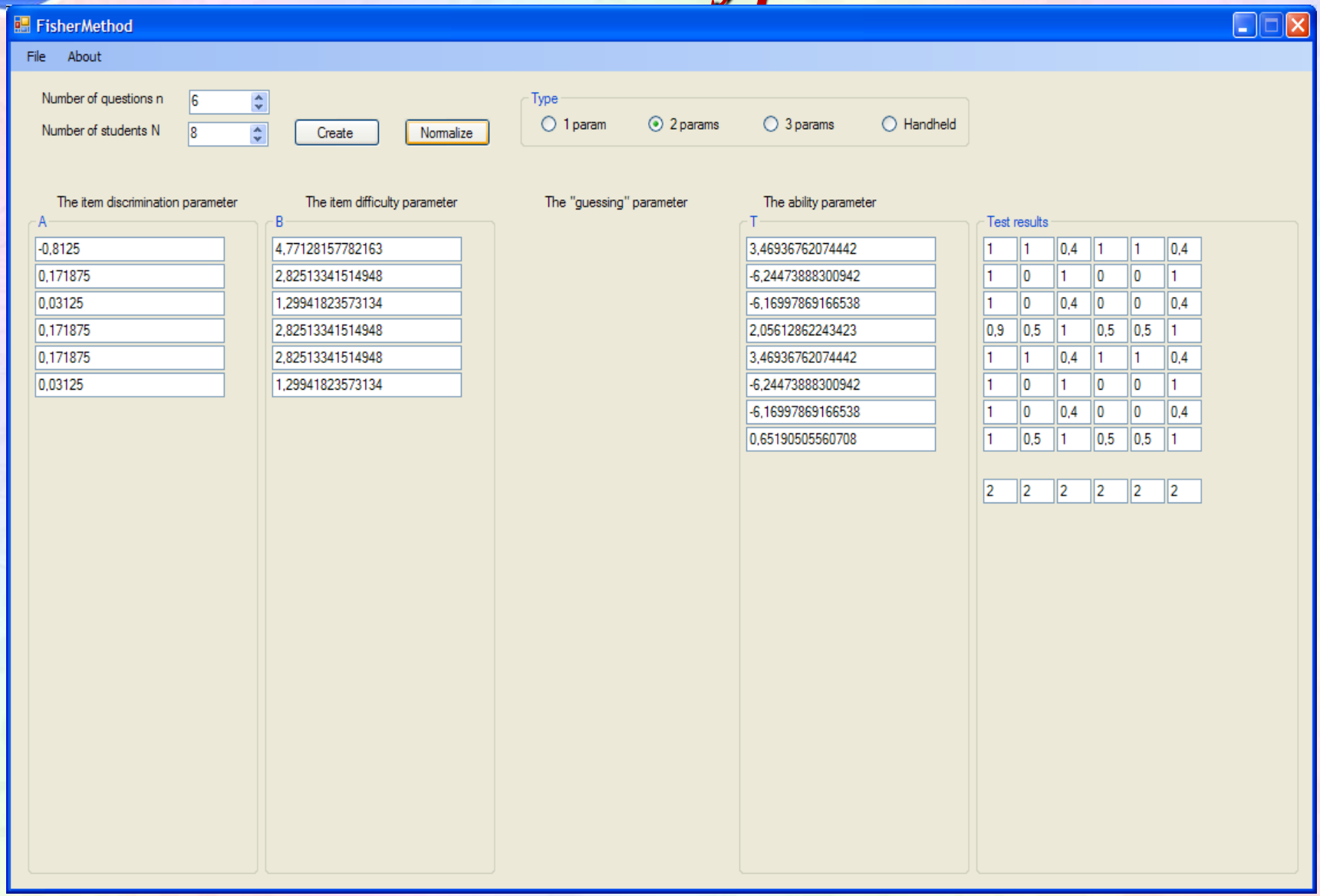


Program system for quality analysis of test items

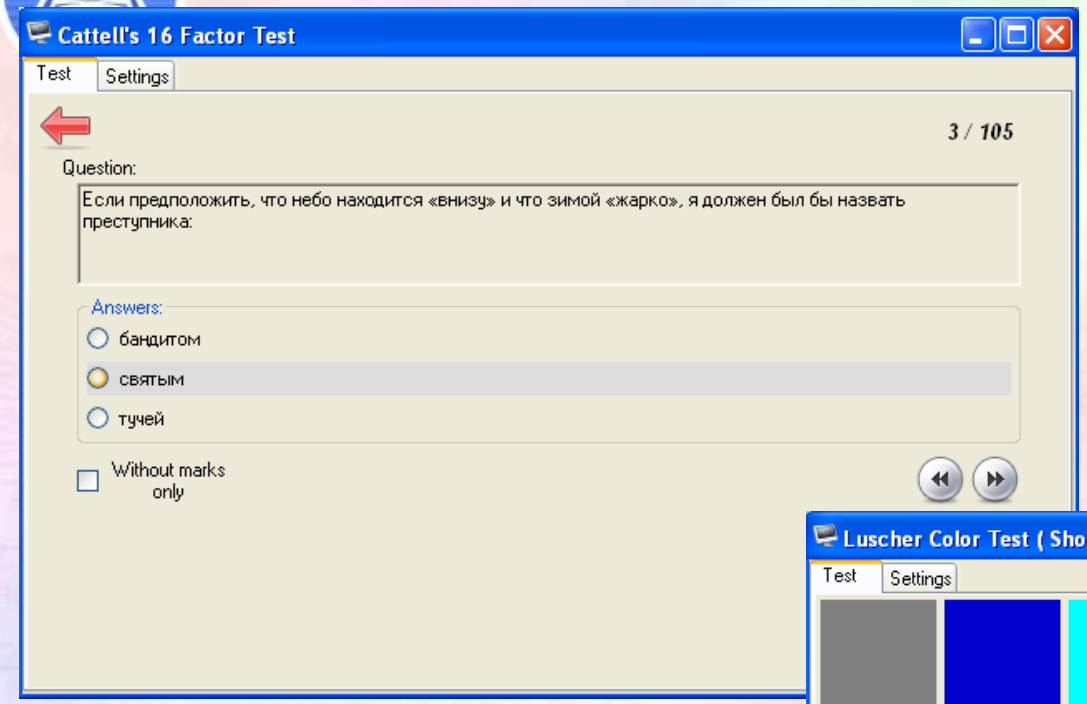
Finding of steady parameters: the ability parameter - (teta), item difficulty parameter (beta) and item discrimination parameter of items (A)

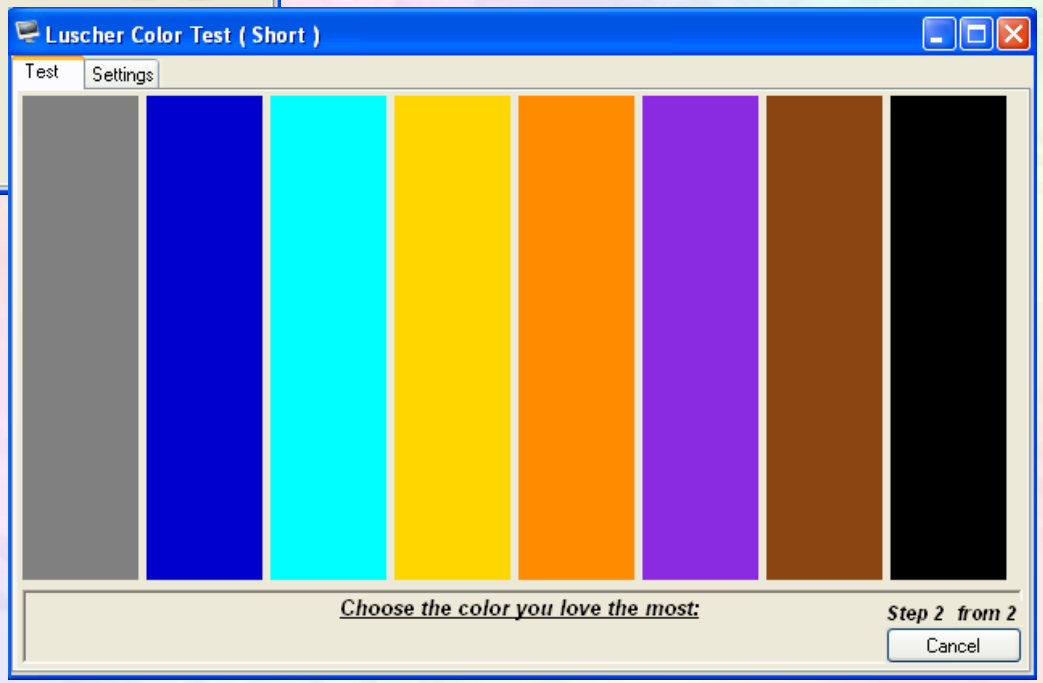


Program system for definition of the item discrimination and ability parameters



Application of psychological testing





Conclusions

The developed technology of marking of the tests depending on type and a difficulty level of test items:

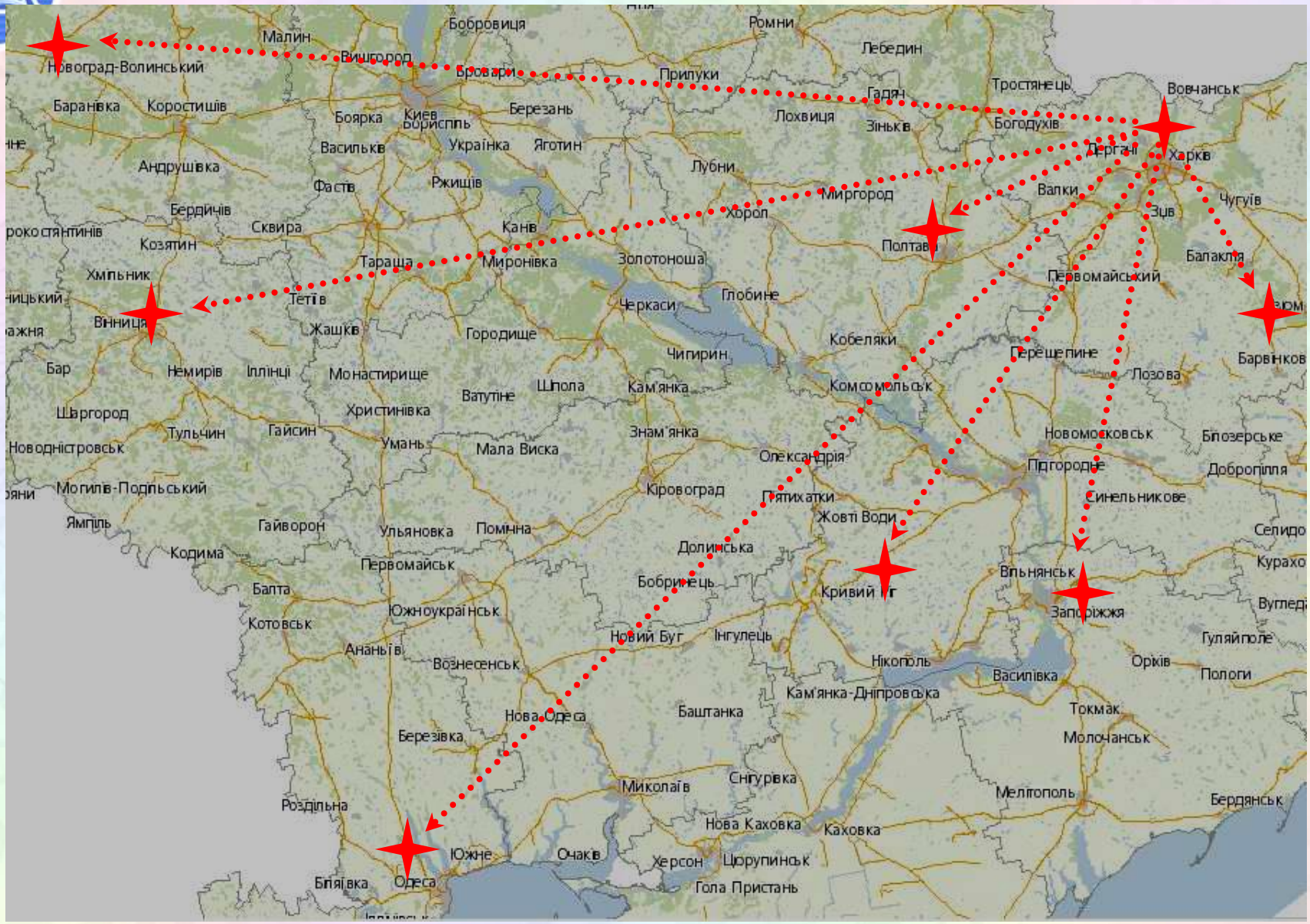
- ✓It is simple in use;
- ✓Make easy process of the knowledge control of testee;
- ✓ Takes into account performance of all test items forms on a continuous scale ;
- ✓Allows to estimate a difficulty level of test items;
- ✓Allows to carry out the qualitative analysis of test items
- ✓allows to use of different scales .

Aspects of introduction

- Introduction of this system in higher educational establishments will allow to conduct objective testing of knowledge trained.

- The system can be used both in educational institutions of any level of accreditation, and in organizations and establishments where professional selection with the help of testing is conducted, and also on courses of improvement of qualification where there are computer classes.

Introduction of the system



УКРАЇНА
Міністерство освіти і науки України
Державний департамент інтелектуальної власності

СВІДОЦТВО

про реєстрацію авторського права на твір
№ 14030

Комп'ютерна програма "Програмний комплекс для проведення комп'ютерного та інтерактивного навчання та тестування знань "КОДЭКС УМА" (Контролирующая Обучающая Дидактическая Экспериментальная Система, Учитывающая Мозговую Атаку)"
(вид, назва твору)

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(повне ім'я, псевдонім (за наявності))

Дата реєстрації 02.09.2005

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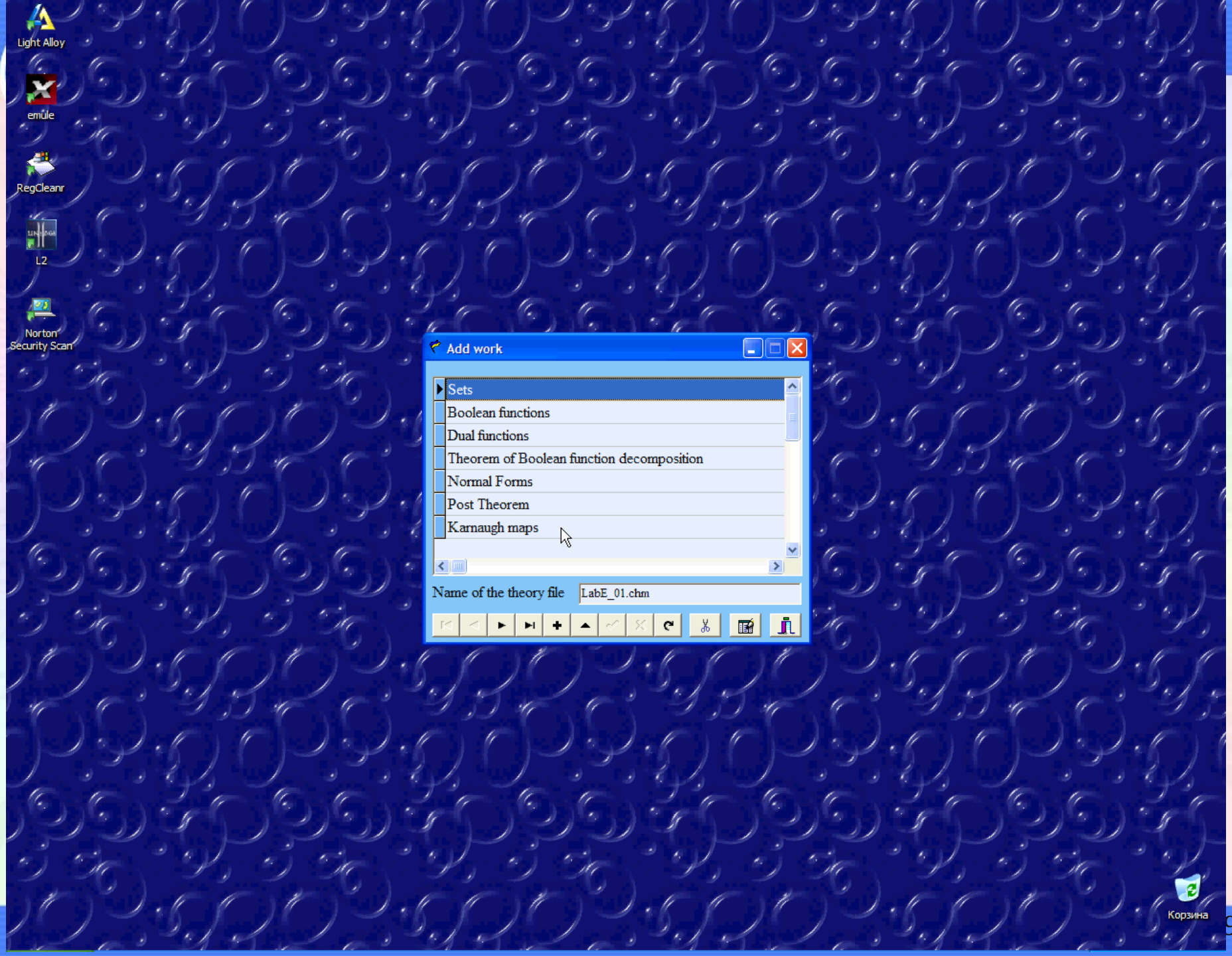
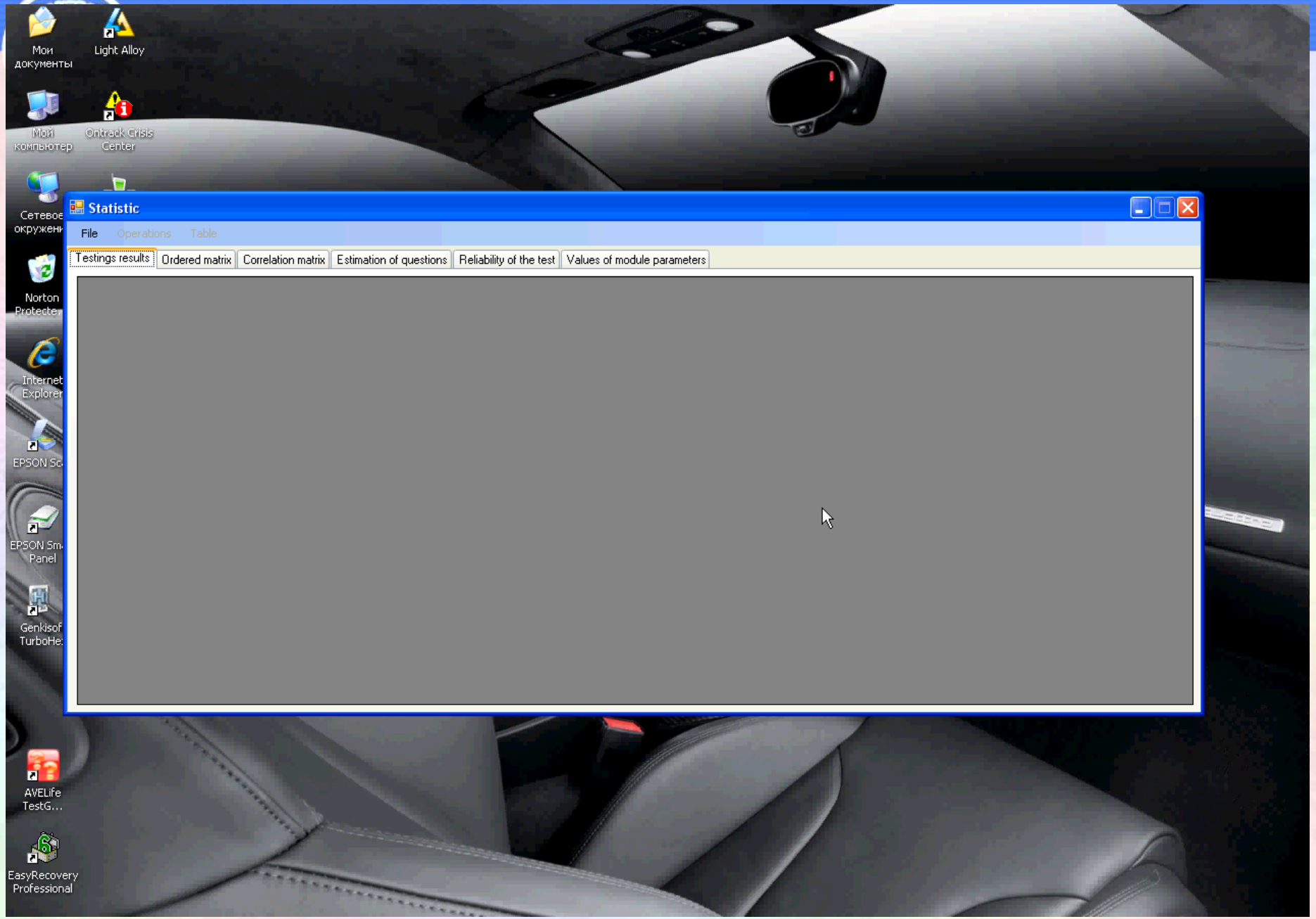
М.П.


Light Alloy
emule
RegCleanr
L2
Norton Security Scan
Add work
Sets
Boolean functions
Dual functions
Theorem of Boolean function decomposition
Normal Forms
Post Theorem
Karnaugh maps
Name of the theory file
LabE_01.chm
Корзина


Мои документы
Light Alloy
Мой компьютер
Ontrack Crisis Center
Сетевое окружени
Norton Protecte
Internet Explorer
EPSON Sc
EPSON Sm Panel
Genkisof TurboHe
AVELife TestG...
EasyRecovery Professional
Statistic
File
Operations
Table
Testings results
Ordered matrix
Correlation matrix
Estimation of questions
Reliability of the test
Values of module parameters