MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education
Far Eastern Federal University
(FEFU)
INSTITUTE OF LIFE SCIENCES AND BIOMEDICINE (SCHOOL)

VALUATION FUND

in the discipline (module) "Biostatistics"

Area of study 32.04.01 Public Health

Master's program "Leadership and governance in public health" (program in English for foreign citizens)

Vladivostok 2023

Universal competencies of graduates and indicators of their achievement:

Name of the category (group) of universal competencies	Universal Competency Code and Name (result of mastering)	Code and name of the competency indicator
	UK-6 Able to determine and implement priorities of own activities and ways to improve them on the basis of self-assessment	UK-6.1 Knows the basics of scientific research with an explanation of the technology of their own activities
		UK-6.2 Is able to justify the priorities of its own activities
		UK-6.3 Knows how to formulate goals, objectives of own activity and ways to improve it on the basis of self-assessment

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
UK-6.1 Knows the basics of scientific research with an explanation of the technology of their own activities	Knows the basics of scientific research He is able to explain the technology of his own activity Proficient in the basic methods of scientific research
UK-6.2 Is able to justify the priorities of its own activities	Knows the priority research in his professional field Able to justify the priorities of their own activities
UK-6.3 Knows how to formulate goals, objectives of own activity and ways to improve it on the basis of self-assessment	Knows the main tasks of his professional activity Able to formulate goals, set tasks, determine the way to achieve the goal Possesses knowledge of scientific directions in health care and ways to manage them on the basis of self-assessment

General professional competencies of graduates and indicators of their achievement:

Name of the category (group) of general professional competencies	Code and name of general professional competence (result of mastering)	Code and name of the competency indicator
	OPK-2 Ability to use information technology in professional activities, comply with basic information security requirements	OPK-2.1 Knows and is able to explain the use of information technology
		OPK-2.2 Is able to substantiate the criteria for evaluating IT technologies in practical activities
		OPK-2.3 Possesses the ability to formulate and explain the need to use information technologies in the work of medical organizations in compliance with the basic requirements of information security
	OPK-4 Ability to apply modern methods of collecting and processing information, to conduct statistical analysis and interpretation of results, to study, analyze, assess	OPK-4.1 Knows the basics of computer technologies in the collection, storage, analysis and transmission of information on forecasting the development of events in the state of population health
		OPK-4.2 Is able to use computer technologies in the collection, storage, analysis and transmission of information

| | trends, to predict the development of events in the state of population health | on forecasting the development of events in the state of population health |
| | | OPK-4.3 Possesses the skills of preparing organizational and managerial documentation in a medical organization for forecasting the development of events in the state of population health; possesses methods of multivariate statistics and methods of processing biological information to solve professional problems |

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
OPK-2.1 Knows and is able to explain the use of information technology	Knows modern information technologies and software tools used in professional activities She is able to use modern information technologies and software tools to solve professional problems. Proficient in collecting, processing, assessing the reliability of results and providing the information obtained using modern information technologies and software
OPK-2.2 Is able to substantiate the criteria for evaluating IT technologies in practical activities	Knows the criteria for evaluating IT technologies in their practical activities Able to substantiate the criteria for evaluating IT technologies in practical activities Possesses the skill of substantiating the criteria for evaluating IT technologies in practical activities
OPK-2.3 Possesses the ability to formulate and explain the need to use information technologies in the work of medical organizations in compliance with the basic requirements of information security	Knows the principles of using information technology Is able to apply knowledge on the use of information technologies in practical activities in compliance with the basic requirements of information security Proficient in working with information technologies in healthcare in compliance with the basic requirements of information security
OPK-4.1 Knows the basics of computer technologies in the collection, storage, analysis and transmission of information on forecasting the development of events in the state of population health	Knows the basics of computer technologies in collecting, storing, analyzing, and transmitting information Able to predict the development of events and the state of population health of the population Possesses the skill of collecting, storing, analyzing, transmitting information on all issues of his professional activity
OPK-4.2 Is able to use computer technologies in the collection, storage, analysis and transmission of information on forecasting the development of events in the state of population health	Knows the steps of statistical analysis Is able to use computer technologies in the collection, storage, analysis and transmission of information on forecasting the development of events in the state of population health Proficient in the use of computer technologies in the collection, storage, analysis and transmission of

		information on forecasting the development of events in the state of population health
OPK-4.3 Possesses the skills of preparing organizational and managerial documentation in a medical organization for forecasting the development of events in the state of population health; possesses methods of multivariate statistics and methods of processing biological information to solve professional problems		Knows organizational and management documentation in a medical organization Able to prepare medical documentation, predict the development of events in the state of population health Proficient in methods of multivariate statistics of biological information processing to solve professional problems, conducting statistical analysis and interpretation of results; methods of studying, analyzing, assessing trends, forecasting the development of events in the state of population health of the population

MONITORING THE ACHIEVEMENT OF THE COURSE OBJECTIVES

The following evaluation tools can be used for monitoring:

UO-1 – individual interview, mainly at the exam;

UO-4 – Seminar-Dispute;

PR-1 - test;

PR-2 - test

Item No.	Controlled Modules /sections/ Topics of the discipline	Codes and Stages of Competency Formation		Valuation Tools - Name	
				Current control	Intermediate certification
1.	Topic 1. Basic Methods of Descriptive Statistics. Basic Concepts and Terms of Medical and Biological Statistics	UK-6.1; UK-6.2; UK-6.3;	Knows the basic methods of scientific research in health care Is able to use knowledge about scientific research in medicine based on the priorities of their own activities Possesses knowledge of scientific directions in health care and ways to manage them on the basis of self-assessment	UO-1, UO-4, PR-1	UO-1
2.	Topic 2. Features of Sanitary and Statistical Research	UK-6.1; UK-6.2; UK-6.3;	Knows the basic methods of scientific research in health care	UO-1, UO-4, PR-2	UO-1

			Is able to use knowledge about scientific research in medicine based on the priorities of their own activities Possesses knowledge of scientific directions in health care and ways to manage them on the basis of self-assessment		
3.	Topic 3. Biological statistics. Methods for Calculating Generalized Coefficients Characterizing Various Aspects of the Studied Traits	OPK-2.1; OPK-2.2; OPK-2.3;	Knows the principles of using information technology Is able to apply knowledge on the use of information technologies in practical activities in compliance with the basic requirements of information security Proficient in working with information technologies in healthcare in compliance with the basic requirements of information security	UO-1, UO-4, PR-2	UO-1
	Topic 4. Assessment of the reliability of the study results. Application of parametric methods. Nonparametric Methods for Assessing the Reliability of Results, Their Significance and Practical Application	OPK-2.1; OPK-2.2; OPK-2.3;	Knows the principles of using information technology Is able to apply knowledge on the use of information technologies in practical activities in compliance with the basic requirements of information security Proficient in working with information technologies in healthcare in compliance with the basic requirements of information security	UO-1, UO-4, PR-2	UO-1
	Topic 5. Fundamentals of Multivariate Statistical Analysis	OPK-2.1; OPK-2.2; OPK-2.3;	Knows the principles of using information technology	UO-1, UO-4, PR-2	UO-1

			Is able to apply knowledge on the use of information technologies in practical activities in compliance with the basic requirements of information security		
			Proficient in working with information technologies in healthcare in compliance with the basic requirements of information security		
	Topic 6. Methods for assessing the interaction of factors. Correlation analysis. Regression, Computational Techniques and Uses in Biology	OPK-4.1; OPK-4.2; OPK-4.3	Knows the steps of statistical analysis	UO-1, UO-4, PR-2	UO-1
			Is able to use computer technologies in the collection, storage, analysis and transmission of biological information about the state of population health		
			Proficient in methods of multivariate statistics of biological information processing to solve professional problems, conducting statistical analysis and interpretation of results; methods of studying, analyzing, assessing trends, forecasting the development of events in the state of population health of the population		
	Topic 7. Direct Standardization Method	OPK-4.1; OPK-4.2; OPK-4.3	Knows the steps of statistical analysis	UO-1, UO-4, PR-2	UO-1
			Is able to use computer technologies in the collection, storage, analysis and transmission of biological information about the state of population health		

			Proficient in methods of multivariate statistics of biological information processing to solve professional problems, conducting statistical analysis and interpretation of results; methods of studying, analyzing, assessing trends, forecasting the development of events in the state of population health of the population		
	Topic 8. Methods of analysis of the dynamics of the phenomenon. Graphical representation in statistics, types of graphic images, their use for the analysis of phenomena	OPK-4.1; OPK-4.2; OPK-4.3	Knows the steps of statistical analysis Is able to use computer technologies in the collection, storage, analysis and transmission of biological information about the state of population health Proficient in methods of multivariate statistics of biological information processing to solve professional problems, conducting statistical analysis and interpretation of results; methods of studying, analyzing, assessing trends, forecasting the development of events in the state of population health of the population	UO-1, UO-4, PR-2	UO-1
	Topic 9. Automated A Priori Analysis of a Statistical Population in MS Excel	OPK-4.1; OPK-4.2; OPK-4.3	Knows the steps of statistical analysis Is able to use computer technologies in the collection, storage, analysis and transmission of biological information about the state of population health Proficient in methods of multivariate statistics of	UO-1, UO-4, PR-2	UO-1

				biological information processing to solve professional problems, conducting statistical analysis and interpretation of results; methods of studying, analyzing, assessing trends, forecasting the development of events in the state of population health of the population		

Oral questioning is the most common method of testing students' knowledge. In the course of oral questioning, direct contact is established between the teacher and students, in the course of which the teacher receives ample opportunities to assess the quantity and quality of students' assimilation of educational material. It is the most common and adequate form of control of students' knowledge, includes an interview (mainly at an exam and test), a colloquium, and a report.

Criteria for evaluating the oral response:

"5 points" is given to a student if he gives correct answers to the questions under discussion, which is distinguished by the depth and completeness of the disclosure of the topic, is able to draw conclusions and generalizations, give reasoned answers that are logical and consistent.

"4 points" is given to a student if he gives correct answers to the questions under discussion, which are distinguished by the depth and completeness of the disclosure of the topic, is able to draw conclusions and generalizations, but one or two mistakes are made in the answers.

"3 points" is given to a student if he/she gives answers to the discussed questions that do not fully reveal him/her, there is no logical construction of the answer, and makes several mistakes.

"2 points" is given to a student if he gives answers to the questions under discussion, which show that he does not know the material of the topic, cannot give reasoned answers, serious mistakes are made in the content of the answer.

A seminar-dispute involves a collective discussion of a problem in order to establish ways to solve it in a reliable way. The seminar-dispute is held in the form of dialogical communication between the participants. It presupposes high mental activity of the participants, instills the ability to conduct polemics, discuss material, defend views and beliefs, and concisely and clearly express their thoughts. Often, the seminar-dispute is based on reports, reports on the topics of essays, prepared by

students in advance, in as part of each practical lesson. The teacher announces a question and invites one of the students to make a presentation for 5-7 minutes, either at their request or at their choice. After the presentation, the teacher and students ask questions and make additions and comments.

A dispute can be triggered by the teacher during the lesson or planned in advance by the teacher and is formed as a process of dialogical communication, during which practical experience of discussing theoretical and practical problems is formed. In the course of polemics, students form their resourcefulness and quick thinking. At such a seminar, students learn to accurately express their thoughts and argue their point of view, as well as to refute opponents in a sustained manner.

For all questions, it is necessary to work through the relevant material from the textbook, lecture notes, additional literature and relevant laboratory work.

Answers to questions, speeches, and student activity in class are assessed by the current grade.

Written works

Tests are a means of testing the ability to apply the acquired knowledge to solve problems of a certain type on a topic or section. A test is an intermediate stage of monitoring trainees in order to identify the level of residual knowledge. For students, the test is a good opportunity to test and consolidate their knowledge with practice.

The test contains a list of questions and different answer options. Each question is worth a certain number of points. The result of the test depends on the number of questions to which the correct answer was given.

As the final stage of intermediate (semester) certification, a test is provided.

1. and factor analyses
2. Cluster analysis, purpose of the method
3. Multivariate Scaling, Interpretation Methods

Assessment Tools for Intermediate Attestation
Exam Questions

1. The concept of biological statistics.
2. Features of biological research.
3. Understanding the Population and the Sample Population: Methods of Collecting Variant in Sample.
4. Laws of Distribution of Random Variables.

5. A series of variations and its graphic representation; interval and non-interval variation series.

6. Asymmetry and kurtosis.

7. Means: power and structural means.

8. Measures of variation in the sample population.

9. Statistical estimates of general parameters.

10. Interval estimation of general parameters.

11. Statistical comparisons; Criteria for the significance of differences between samples: (Student's t-test, Fisher's F-test).

12. Correlation, correlation coefficient.

13. Description of the correlation between qualitative traits.

14. Correlation analysis.

15. Regression analysis.

16. Cluster analysis.

17. Discriminant analysis.

18. Formulate a statistical conclusion: what does it mean to accept or reject the null hypothesis (No): a) when comparing empirical and theoretical distributions; b) when comparing two sample populations; c) in correlation analysis; d) analysis of variance;

19. Characteristics of the data analysis process in software products: Statistica, Stadia, MS Excel.

20. Quantitative and qualitative features.

21. Basic concepts of biometrics.

22. The main genetic and mathematical parameters of the population (each separately – arithmetic mean, sigma, coefficient of variation, sample size, etc.).

23. The structure of the diversity of the trait.

24. Analysis of the structure of the diversity of the trait.

25. Normal distribution.

26. Binomial distribution. Poisson distribution.

27. Correlation, regression and their use.

28. Normalized deviation.

29. The concept of the levels of reliability and probability of error-free forecasts.

30. Selective parameter errors. Confidence intervals.

31. Reliability of the difference in sample parameters.

32. Criterion χ^2, its application to solve biological problems.

33. Classification of models of biological systems.

34. Models characterizing population growth. 33. Data Analysis Software on Personal Computers.

35. Study planning, evaluation and selection of accounting methods.

36. Estimation of population density and abundance and density of species.

37. Study of the relationship of individual species to habitat types.

Exam Grading Criteria

Exam Assessment Requirements for the formed competencies

"Excellent" An "excellent" grade is given to a student if he/she has deeply and firmly mastered the program material, comprehensively, consistently, clearly and logically coherently presents it, is able to closely link theory with practice, freely copes with tasks, questions and other types of application of knowledge, and does not find it difficult to answer when changing tasks, uses the material of monographic literature in the answer, correctly justifies the decision made, has versatile skills and methods of implementation practical tasks;

"Good"   A grade of "good" is given to a student if he/she knows the material well, presents it competently and to the point, without making significant inaccuracies in the answer to the question, correctly applies theoretical provisions in solving practical issues and problems, has the necessary skills and techniques for their implementation;

"Satisfactory"   A grade of "satisfactory" is given to a student if he/she has knowledge only of the main material, but has not mastered its details, makes inaccuracies, insufficiently correct formulations, violations of the logical sequence in the presentation of the program material, has difficulties in performing practical work;

"Unsatisfactory"   An "unsatisfactory" grade is given to a student who does not know a significant part of the program material, makes significant mistakes, is uncertain, and performs practical work with great difficulty.

Assessment Tools for Ongoing Attestation

Typical tasks for independent work

Type 1. Answer the theoretical questions:

1. What does biological or variational statistics mean?

2. At the intersection of which sciences is the scientific branch of biometrics located?

3. What is a fundamental biological concept?

4. What is meant by a sample population?

5. What are the individual variable traits called?

6. How many stages does a biomedical examination include?

7. What are the methods of biological research?

8. What determines the size of the population?

9. What are the coefficients that characterize the ratio of the part to the whole?

10. Which generalizing quantity estimates the size of a trait that varies in magnitude in the aggregate?

11. What are quantitative methods of statistical data processing called?

12. What are the names of quantitative methods of statistical data processing, the application of which does not require knowledge of the law of distribution of the studied features in the aggregate and calculation of their main parameters?

13. What concept does the relationship between attributes mean?

14. What is the purpose of finding out how one quantity changes quantitatively when another quantity changes by one?

15. What is the technique for calculating standardized indicators?

16. What indicators characterize the intensity of changes in the analysis of the time series?

17. What requirements should be met when building graphic images?

18. What two problems are solved on the basis of a priori analysis of the initial statistical material?

Type 2. Using a model example

- Make a series of variations, calculate: the arithmetic mean of the method of moments, the standard deviation, the coefficient of variation, the mean error of the arithmetic mean.

Type 3. Using a model example

- Calculate the correlation coefficient between the two indicators.

- Calculate the correlation coefficient using the square method, assess the reliability of the relationship.

- Define confidence boundaries with a 99% accuracy probability.

- Calculate the χ^2 criterion and determine whether the difference between the numbers obtained in the course of the statistical study and the "expected values" is significant or insignificant;

- Calculate standardized indicators, compare them with derived values, and draw appropriate conclusions.

Type 4. Using a model example

- Make a model of human biorhythms;

- Construct several graphs in the same axes illustrating the values of several variational series of biological values of indicators;

- build a scatter diagram illustrating the dependence of one value of a biological indicator on another;

- implement the technology of working in the "Data Analysis" mode in MS Excel: "Histogram"; "Selection"; "Descriptive Statistics"; "Rank and Perseverance"; "Random Number Generation"; "Two-Sample G-Test for Mediums"; "Two-sample/-test with the same variances"; "Two-sample/-test with different variances"; "Two-sample F-test for variances"; "Paired Two-Sample Test/-Test for Averages"; "Univariate Analysis of Variance"; "Two-Way Analysis of Variance Without Repetition"; "Two-Factor Analysis of Variance with Repetitions"; "Covariance"; "Correlation"; "Regression"; "Moving Average"; "Exponential smoothing"; Fourier Analysis.

Evaluation Criteria for Self-Paced Reports

Assessment of the defense of independent work is carried out when submitting a report in electronic form, on a two-point scale: "passed", "not passed".

A grade of "pass" is given to a student if he/she submits for defense a report on independent work that meets the requirements for the assigned tasks, for design, demonstrates mastery of methods and techniques of theoretical and/or practical aspects of work.

A "failed" grade is given to a student if he/she does not know the methods and techniques of the theoretical and/or practical aspects of the work, makes significant mistakes in the work, submits a report with significant deviations from the rules for the design of written works.

Typical test tasks
(insert the number of one correct answer)
1. What is the population?
a. part of the whole;
b. All objects of the studied category;
c. The size of the feature.
2. What is sampling?
a. Attribute value of an object
b. Trait Score
c. part of the population.
3. What indicators of variability do you know?
a. fashion;
b. median;
c. limits, standard deviation, coefficient of variation.
4. What defines a variant (date) in statistics?
a. Numeric value of the attribute size of the object
b. Spacing Between Objects
c. Rate of Evolution in Biology

5.What is regression?

a. alteration of hereditary material;

b. partial return of offspring to the average level for the population;

c. variability of the characteristics of the organism group.

6. What is the factor that determines the correlation?

a. independent chromosome divergence in meiosis;

b. the relationship between the traits;

c. Alteration of genetic material.

7. What is the degree of correlation between the attributes?

a. positive, negative;

b. straight, reverse;

c. Strong, medium, weak.

8.What are the basic constants of the variation series?

a. heritability and recurrence rates;

b. Average. arithmetic standard deviation, stat. Errors;

c. correlation and regression coefficients.

1. What indicates the degree to which the sample parameters correspond to the parameters of the population?

a. Statistical errors

b. correlation coefficient

c. coefficient of regression

10. How to determine the reliability of the results of a statistical error?

a. If the parameter > its error by 3 times or more, then it is reliable;

b. the number of errors in the recombination of genetic material;

c. by heteroploidy.

Test Evaluation Criteria

Assessment is carried out in an e-learning session on a hundred-point scale.

The test includes 100 tasks, with a maximum test score of 100.

Within the framework of the current level of knowledge assimilation in the discipline, a test result of at least 61 points is allowed.