



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 "Methods of Statistical Analysis in Pharmacy"

Vladivostok
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List of Forms of Assessment Used at Various Stages of Competence Formation in the Course of Mastering the Discipline "Methods of Statistical Analysis in Pharmacy"

Item No.	Supervised sections/topics of the discipline	Code and name of the indicator of achievement	Learning Outcomes	Evaluation Tools	
				Current control	Intermediate Certification
1	Fundamentals of Statistical Data Analysis in Pharmacy	PC-1.4 Prepares the results of research, conducts statistical processing of the results	<p>Knows</p> <ul style="list-style-type: none"> - stages of statistical analysis; - types of variation series, formulas for calculating variation indicators, methods of depicting variation series; determination of the general and sample population, various methods of estimating the parameters of the general population based on the sample data; - the principle of practical certainty, the definition of a statistical hypothesis, the general scheme for its testing, various criteria for agreement <p>Can</p> <ul style="list-style-type: none"> - apply knowledge on the use of information technologies in practice in compliance with the basic requirements of information security; - Use the acquired knowledge in solving applied problems related to the construction and graphic representation <p>variation series, calculation of variation indices;</p> <ul style="list-style-type: none"> - use the acquired knowledge in solving applied problems, <p>Make a reasonable conclusion about the advantages of a particular technological process;</p> <ul style="list-style-type: none"> - Use computer technologies in the collection, storage, analysis and transmission of information <p>Proficiency</p>	Oral Interview (UO-1)	Exam Questions

			<ul style="list-style-type: none"> - terminological apparatus; - methods of multivariate statistics of biological information processing for solving professional problems; - methods of studying, analyzing, assessing trends, forecasting the development of events; - statistical analysis and interpretation of results; - skills of working with information technologies in compliance with the basic requirements of information security 		
2	Basic Concepts and Methods of Mathematical Statistics	PC-1.4 Prepares the results of research, conducts statistical processing of the results	<p>Knows</p> <ul style="list-style-type: none"> - methods of effective search and extraction of scientific data in computer networks <p>Can</p> <ul style="list-style-type: none"> - analyze, systematize and interpret biochemical, genetic and biomedical research data contained in scientific and popular science sources; - analyze, systematize and interpret biochemical, genetic and biomedical research data contained in scientific and popular science sources <p>Skills</p> <ul style="list-style-type: none"> - Proficiency in the analysis and processing of scientific data and their presentation in a popular science form, such as popular science articles 	Test (PR-1)	Exam Questions

Forms of Evaluation Tools:

1. Interview (EO-1),
2. Tests (PR-1).

Scale for assessing the level of achievement of learning outcomes for current and intermediate certification *in the discipline*
"Methods of Statistical Analysis in Pharmacy"

<i>Points (rating score)</i>	<i>Levels of achievement Training</i>		<i>Requirements for the formed competencies</i>
	<i>Current & Intermediate certification</i>	<i>Intermediate Attestation</i>	
<i>100 – 86</i>	<i>Increased</i>	<i>"Passed" / "Excellent"</i>	Freely and confidently finds reliable sources of information, operates with the information provided, has excellent skills in analyzing and synthesizing information, knows all the basic methods of solving problems provided for in the curriculum, knows typical mistakes and possible difficulties in solving a particular problem and is able to choose and effectively apply an adequate method for solving a particular problem. trouble
<i>85 – 76</i>	<i>Base</i>	<i>"Passed" / "Good"</i>	In most cases, he is able to identify reliable sources of information, process, analyze and synthesize the proposed information, choose a method for solving a problem and solve it. Makes single serious mistakes in problem solving, experiences difficulties in rare or difficult cases of problem solving, does not know typical mistakes and possible difficulties in solving this or that trouble
<i>75 – 61</i>	<i>Threshold</i>	<i>"Passed" / "Satisfied"</i>	Makes mistakes in determining the reliability of sources of information, is able to correctly decide only Typical most often Occur trouble in (process information, choose a method to solve a problem, and solve it)
<i>60 – 0</i>	<i>Level Not Reached</i>	<i>"Failed" / "Unsatisfactorily"</i>	Does not know a significant part of the program material, makes significant mistakes, performs practical work unconfidently, with great difficulty.

Current attestation in the discipline **"Methods of Statistical Analysis in Pharmacy"**

Current certification of students in the discipline *"Methods of Statistical Analysis in Pharmacy"* is carried out in accordance with the local regulations of FEFU and is mandatory.

Current certification in the discipline is carried out in the form of control measures (oral survey and testing) to assess the actual results of students' learning and is carried out by the leading teacher.

For each object, a description of the assessment procedures is given in relation to the assessment tools used.

Assessment Tools for Ongoing Monitoring

1. Interview questions.

Topic 1. Variation series.

1. What is called the population and the sample population?
2. Name the types of samples.
3. List the methods of selection.
4. Define the concept of "variation series".
5. Define the term "statistical distribution of the sample".
6. What are the main characteristics of the variation series?
7. Define the term "sample distribution function".
8. How polygons, histograms, and cumulates are built.

Topic 2. Point estimates.

1. Define the concept of statistical estimates of distribution parameters.
2. Name the point statistical estimates and their types.
3. What characterize the general and sample averages?
4. Define the concept of "assessment of the general average by the sample average".
5. Define the concept of "general and sample variance".
6. Define the concept of "standard deviations (s.k.o.)".
7. Define the concept of "general variance estimate".
8. Define the concept of "assessment of the general s.c.o".

Topic 3. Interval evaluations.

1. What are the interval estimates of the distribution parameters?
2. Give examples of calculating interval estimates of distribution parameters.

Topic 4. Assessment of the degree of variability of the trait.

1. How to determine the reliability of interval estimates of distribution parameters?
2. How to Determine the Confidence Interval for the Expected Value of a Normally Distributed Random Variable with a Known Variance?
3. How to Determine the Confidence Interval for the Expected Value of a Normally Distributed Random Variable with an Unknown Variance?

Topic 5. Accuracy of the assessment.

1. How to determine the accuracy of interval estimates of distribution parameters?
2. How to determine the confidence interval for the variance of a normal distributed random variable if the expected value is known?
3. How to determine the confidence interval for the variance of a normal distributed random variable if the expected value is unknown?
4. What is the general approach to trust valuation?
5. What do equidistant and conditional variants allow us to evaluate?
6. How can we reduce the initial variants to equidistant ones?

Topic 6. Method of moments.

1. Define "ordinary moments."
2. Define "starting points."
3. Define the concept of "central moments".
4. Define "conditional empirical moments."
5. What is the relationship between the two?

Topic 7. The method of greatest plausibility.

1. What is the method of greatest likelihood?
2. Give the algorithm of the method of greatest likelihood.

Topic 8. Types of distributions.

1. Characterize the binomial distribution.
2. Describe the normal distribution.
3. Characterize the exponential distribution.

Topic 9. Asymmetry and kurtosis.

1. Define asymmetry.
2. How do you calculate skewness?

3. Define kurtosis.
4. How do I calculate kurtosis?

Topic 10. Sampling method.

1. What is the essence of the sampling method?
2. List the main features of the sampling method when characterizing a data set.

Topic 11. Testing hypotheses about the equality of the mean two populations.

1. Give a sequence for testing hypotheses about the equality of the middle two populations.

Topic 12. Testing hypotheses about the equality of the average two or more populations.

1. Give a sequence for testing hypotheses about the equality of the mean two or more populations.

Topic 13. Testing hypotheses about the equality of trait fractions in two populations.

1. Give the sequence of testing hypotheses about the equality of the shares of the trait in the two populations.

Topic 14. Testing hypotheses about the equality of trait fractions in two or more populations.

1. Give a sequence of testing hypotheses about the equality of trait fractions in more than two populations.

Topic 15. Testing hypotheses about the equality of variances of two populations.

1. Give a sequence of testing hypotheses about the equality of variances of two populations.

Topic 16. Testing hypotheses about the equality of variances of two or more populations.

1. Give a sequence of testing hypotheses about the equality of variances of two or more populations.

Topic 17. Testing hypotheses about numerical parameter values.

1. Give a sequence for testing hypotheses about the numerical values of the parameters.

Topic 18. Testing the hypothesis of a normal distribution of the population. Pearson's criterion for consent.

1. Give a sequence of hypothesis testing about the normal distribution of the population.
2. What does the Pearson test evaluate?

Topic 19. Define the minimum sample size.

1. What is meant by a minimum sample size?
2. How do I determine the minimum sample size?

Topic 20. Testing statistical hypotheses.

1. What is called a "statistical hypothesis"?
2. Give Examples of Statistical Hypotheses
3. In what cases are statistical hypotheses tested?
4. What are the errors made in the statistical testing of statistical hypotheses?
5. Define the term "statistical criterion for hypothesis testing".
6. What does the area of hypothesis acceptance indicate? Bluespot? Critical points?
7. What are the types of bluespots?
8. Describe the sequence of steps to find the bluespot and critical points.
9. Describe the criteria of agreement: Pearson's criterion (chi-square), the Kolmogorov-Smirnov criterion of agreement, the Bartlett test.
10. Define the term "criterion power".

Topic 21. Types of links. Correlation coefficient.

1. What types of connections does mathematics make?
2. What types of connections do statistics establish?
3. What is meant by "correlation coefficient"?

Topic 22. Correlation coefficient for small and large samples.

1. Define "small sample"
2. Define "large sample"
3. How do you calculate the correlation coefficient for a small sample?
4. How do I calculate the correlation coefficient for a large sample?

Topic 23. Correlation ratio.

1. Define the concept of "correlation relationship".
2. Provide a formula to calculate the correlation ratio.

Topic 24. Linear correlation. Regression equations.

1. Define Linear Correlation
2. Finding the parameters of the sample equation of the straight line of mean square regression from ungrouped data.
3. Draw a correlation table.
4. What does the sample correlation coefficient show?
5. How is the hypothesis of the significance of the sample correlation coefficient tested?
6. Give a formula to write the regression equation.

Topic 25. Coefficient of regression.

1. Provide a formula to calculate the regression coefficient.
2. What does the regression coefficient show?

Topic 26. Regression line.

1. What does the regression line show?
2. Draw a regression line.

Topic 27. Least squares method.

1. Give the algorithm of the least squares method.

Topic 28. Processing of experimental data. Application of statistical methods.

1. Give examples of the use of statistical methods for data processing.

Topic 29. Fundamentals of Analysis of Variance.

1. What is the essence of analysis of variance?
2. Give examples of how analysis of variance can be used in data processing.

Topic 30. Fundamentals of Analysis of Variance.

1. What is the essence of analysis of variance?
2. Give examples of how analysis of variance can be used in processing.

Criteria for Evaluating an Oral Answer in a Topic Interview

Evaluation	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
"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 allowing significant inaccuracies in answering the question, correctly applies theoretical provisions in solving practical issues and problems
"Satisfactory"	A "satisfactory" grade is given to a student if he/she has knowledge only of the main material, but has not mastered its details, allows inaccuracies, insufficiently correct formulations, violations of the logical sequence in the presentation of the program material
"Unsatisfactory"	An "unsatisfactory" grade is given to a student who does not know a significant part of the program material, makes significant mistakes

2. Typical tasks for independent work.

Type 1. Answer the theoretical questions:

1. What are the ways to present experimental data? Give examples.
2. What characteristics of experimental data, processes and phenomena are descriptive? Give examples.
3. What is the algorithm for testing statistical hypotheses?
4. What are the measures of the relationship between the traits?
5. What statistical parameters are used to evaluate the sampling parameters?

Type 2. On a model example, using "Data Analysis" technologies

1. Tabulate the data.
2. Build a table of grouped frequencies. Graphically depict the resulting frequency distributions.
3. Formulate the problem of processing experimental data.
4. Calculate the numerical characteristics of the sample.
5. Build an algorithm for testing statistical hypotheses.
6. Test the normality hypothesis of the distribution using sample skewnesses and kurtosis.
7. Calculate the chi agreement criterion – square.
8. Using measures of correlation between traits, calculate and evaluate the resulting correlations.
9. Build a "Dissipation Cloud" of correlation dependencies.
10. Using the method of factor analysis, calculate the contribution of each trait

to the process under study.

11. Use confidence intervals to estimate the sampling parameters.

12. Using the regression analysis method, build a predictive model of the process or phenomenon under study.

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.

Intermediate Assessment Tools (Exam)

When working with tests, you are asked to choose one answer option out of three or four proposed. At the same time, the complexity of the tests is not the same. Among the proposed tests, there are tests that contain several options for correct answers. The student needs to provide all the correct answers.

The tests are designed for both individual and collective solutions. They can be used in the process of both classroom classes and independent work. The selection of tests necessary for the control of knowledge in the process of intermediate certification is made by each teacher individually.

The results of the test tasks are evaluated by the teacher on a five-point scale for attestation or according to the "pass" - "fail" system. An "excellent" grade is given if you answer more than 90% of the tests offered by the teacher. A "good" score is given if you answer correctly on more than 70% of the tests. The grade is "satisfactory" – with a correct answer to 50% of the proposed tests.

Sample test tasks

(insert correct answer number)

1. Knowledge in the field of statistical analysis of medical data is necessary for:

a. at the planning stage;

- b. at the data collection stage;**
- c. at the data analysis stage;**
- d. at the stage of preparing the publication.**

2. Do the groups differ statistically if the confidence interval for the absolute risk difference does not include zero?

- a. Unknown;
- b. do not differ;
- c. vary;
- d. More research is needed.

3. The confidence interval is:

- a. **The interval in which the true value of the parameter is located.**
- b. mean + standard error of the mean;
- c. mean + standard deviation;
- d. The interval from the minimum to the maximum value of the characteristic.

4. The statistical population is:

- a. a set of relatively homogeneous units of the phenomenon under study;
- b. A set of heterogeneous objects to be studied.
- c. A group of recorded random events.

5. The Law of Large Numbers states that:

- a. The more units are covered by statistical observation, the worse the overall pattern appears;
- b. the fewer units are covered by statistical observation, the better the overall pattern appears;
- c. The more units are covered by statistical observation, the better the overall pattern appears.

6. Observations covering all members of the population under study without exception are called:

- d. Solid;
- e. Partial;
- f. Sample.

7. What is the population?

- a. part of the whole;

- b. All objects of the studied category;
- c. The size of the feature.

8. What is sampling?

- a. the value of the feature of the object;
- b. Trait score
- c. part of the population.

9. Representativeness bias refers to:

- a. full surveillance;
- b. continuous surveillance;
- c. selective observation.

10. What indicators of variability do you know?

- a. fashion;
- b. median;
- c. limits, standard deviation, coefficient of variation.

11. What defines a variant (date) in statistics?

- a. Numeric value of the feature size of the unit.
- b. Distance between objects
- c. the rate of evolution in biology.

12. Random selection of a variant from the population shall be called:

- a. randomization;
- b. homogenization;
- c. Standardization.

13. Re-selection differs from non-repeat selection in that:

- a. Once selected, the unit of observation is returned to the population;
- b. Selection is repeated if the sampling process fails.
- c. The calculation of the average error is repeated several times.

14. 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.

15. 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.

16. What is the degree of correlation between the traits?

- a. positive, negative;
- b. straight, reverse;
- c. Strong, medium, weak.

17. Which variation series constants are considered to be basic?

- a. heritability and recurrence rates;
- b. Average. arithmetic standard deviation, stat. Errors;
- c. correlation and regression coefficients.

18. 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

19. How do I determine the validity of the results of a statistical error?

- a. if the parameter > its error is 3 times or more, then it is reliable;
- b. the number of errors in the recombination of genetic material;
- c. by heteroploidy.

20. The geometric mean is:

- a. the root of the product of individual indicators;
- b. the product of roots from individual indicators;
- c. The root is the sum of individual indicators.

21. How will the arithmetic mean change if all variants of the population are reduced by a factor of A?

- a. will decrease by a factor of A;
- b. will increase by a factor of A;
- c. will not change.

Give a short answer:

1. The aggregate from which a certain part of its members is selected for joint study is called (...).

2. A part of the population selected in one way or another is called (...).
3. The numerical indicators that characterize the general population are called (...).
4. The numerical indicators that characterize the sample are called (...).
5. The magnitude of the deviation of a sample characteristic from its general parameter is called (...).
6. A single member of a statistical population is called (...).
7. A double series of numbers, showing how the numerical values of a feature are related to their frequencies in a given statistical population, is called (...).

List of Exam Questions

1. The subject of statistics.
2. The Concept of the Statistical Method.
3. The concept of statistical observation.
4. Stages, forms, types and methods of statistical observation.
5. Classification and grouping as a method of processing and analysis of primary statistical information.
6. Basic techniques for building and executing grouping.
7. Types of groupings. Statistical table.
8. The concept of an absolute indicator. Types of absolute indicators.
9. Relative indicators. Their role and typology.
10. The concept of average. Scope of application of averages in statistical research.
11. Types of averages and methods of their calculation.
12. Structural characteristics of the sample population. Fashion and median.
13. Mean power characteristics of the sample population.
14. The concept of variation. Sampling range.
15. The concept of variation. Mean linear deviation.
16. The concept of variation. Dispersion.
17. Variance and standard deviation.
18. Coefficient of variation.
19. The essence of the correlation.
20. Principal Component Essence.
21. Pearson's linear correlation coefficient.
22. Spearman's rank correlation coefficient.
23. The concept of selective observation. Types of sampling. Methods of sampling.
24. Understanding data in the population. Methods for extending sample observation to the general population.

25. Statistical graphs and charts.

26. Basic concepts of regression analysis. Pairwise linear regression.

Requirements for the presentation and evaluation of materials (results):

An "excellent" grade is given to a student if he/she has deeply and firmly mastered the program material and answered more than 86% of the questions correctly, "good" - more than 71%, satisfactory - more than 60% of the questions, "unsatisfactory" - less than 60% of the questions.