

<i>Course title</i> <b>DIFFERENTIAL STATISTICS</b>	
<b>Lecturers</b> Assoc. Prof. Dr. Sc. Sonya Karabeliova and Chief Asst. Prof. Ph.D. Milen Milanov	
<b>Type of course</b> Core	<b>Level of course</b> Master's
<b>Year of study</b> First	<b>Semester</b> 1st
<b>ECTS</b> 6	<b>Workload</b> 30+30+15
<b>Type of education</b> Full-time	<b>Language of instruction</b> English
<b>Assessment</b> theoretical, practical, and written assignments	

### **Prerequisites**

No.

### **Course aims**

This is a core course designed to assist students in conducting psychological research. It includes research planning, implementation procedures, analyses of research data, and interpretation of relevant results. The main aim of the course is to teach theoretical knowledge and skills for processing and analyzing research data, as well as for interpreting the results from the qualitative and quantitative statistical methods used in psychology research. Students use the SPSS statistical analysis software. The course concludes with a written theoretical exam, a practical exam, and a written assignment that includes description, analysis, and interpretation of the results of one empirical study. Students wishing to improve their grade prepare a course paper.

### **Lectures**

#### **1. STATISTICAL METHODS FOR HYPOTHESIS TESTING**

Basic concepts, terminology. The sequence of hypothesis testing steps. The Null hypothesis.

#### **2. TYPE I AND TYPE II ERRORS**

Statistical reliability of the results. Incorrect decisions about statistical reliability. Significance in research designs. Incorrect interpretations of significance.

#### **3. PARAMETRIC AND NON-PARAMETRIC METHODS FOR HYPOTHESIS TESTING**

Choosing an appropriate statistical criterion. Bivariate frequency distribution.

#### **4. CORRELATION ANALYSIS**

Significance, definition, types. Direction and strength of the relationship. Pearson's coefficient — definition, calculation. Factors that affect the correlation. Interpreting the results.

#### **5. ALTERNATIVE CORRELATION TECHNIQUES**

Point-biserial and phi coefficients; biserial and tetrachoric correlation coefficients; contingency coefficient and Kendall's coefficient.

#### **6. LINEAR REGRESSION**

Definition, regression coefficient, interpretation of results. Assessing the adequacy of the regression model.

#### **7. PARAMETRIC STATISTICAL METHODS FOR HYPOTHESIS TESTING**

One sample t-test. Comparing the mean and standard deviation of the sample and the population. Analysis and interpretation of the results.

#### **8. INDEPENDENT VS. DEPENDENT SAMPLES**

Post-Hoc comparisons. Scheffe's test. Dunnett's test. Comparing alternative procedures. Analysis and interpretation of the results.

#### **9. ANALYSIS OF VARIANCE**

Essence, etymology. Fisher's f-criterion. One-Way Analysis of Variance (One-Way ANOVA). Post Hoc comparisons. Sample sizes. Significance of the experimental effect. Analysis and interpretation of the results.

#### **10. TWO-WAY ANALYSIS OF VARIANCE (TWO-WAY ANOVA)**

Multiple comparisons. Expected mean squares. Significance of the experimental effect. Analyzing the sample sizes. Analysis and interpretation of the results.

**11. ANALYSES OF VARIANCE AND COVARIANCE AS GENERAL LINEAR MODELS.** The General linear models. Factorial designs. Analysis and interpretation of the results. Alternative experimental designs. Analysis and interpretation of the results.

#### **12. NON-PARAMETRIC STATISTICAL METHODS FOR HYPOTHESIS TESTING**

Mann-Whitney test. Wilcoxon test. Comparing the two tests. Student's U-criterion. McNemar's Chi-squared test. Freedman's Chi-squared test.

#### **13. VALIDITY**

Definition, types. Methods for testing construct validity. Factor and factor analysis — definitions, factor analysis methods. Rotations and simplifications of the structure. Analysis and interpretation of the results.

#### **14. RELIABILITY**

Systematic and random errors. Factors increasing or decreasing reliability. Significance of reliability. Item analysis — definition, application. Analysis and interpretation of the results.

#### ***Seminars and Practical Exercises***

1. Correlation analysis — application, types of correlation coefficients.
2. Correlation analysis — identifying and interpreting results.
3. Linear Regression analysis — application, types.
4. Identifying the results of regression analysis. Interpretation.
5. Methods for comparing means. One sample t-test. Analysis and interpretation of the results.
6. Independent samples t-test. Analysis and interpretation of the results.
7. Paired samples t-test. Analysis and interpretation of the results.
8. One-Way Analysis of Variance (One-Way ANOVA). Analysis and interpretation of the results.
9. Two-Way Analysis of Variance (Two-Way ANOVA). Analysis and interpretation of the results.
10. General linear models.
11. Identifying, analyzing and interpreting the results from general linear models.
12. Non-parametric statistical methods. Mann-Whitney test. Wilcoxon test. Analysis and interpretation of the results.

13. Non-parametric statistical methods. Student's U-criterion, McNemara's Chi-squared test, Freedman's Chi-squared test. Analysis and interpretation of the results.
14. Classical factor analysis — application, methods. Classical factor analysis using the principle components analysis. Identification, analysis and interpretation of the results.
15. Item analysis — application, coefficients. Item analysis. Identification, analysis and interpretation of the results.

### **References**

- Breakwell, G., M., Hammond, S., Fife-Schaw, C. (2002). *Research Methods in Psychology*. London: Sage Publication.
- Glasnapp, D., R., Roggio, J., P. (1985). *Essentials of Statistical Analysis for the Behavioral Sciences*. Ohio, Columbus: Bell & Howell Company.
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- Freedman, D., A. (2009). *Statistical Models: Theory and Practice*. Cambridge: Cambridge University Press.
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- Kerlinger, F., N. (1990). *Foundations of Behavioral Research*. New York: Harcourt Brace College Publishers.
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- Salant, P., Dillman, D., A. (1994). *How to Conduct Your Own Survey*. New York: John Wiley & Sons, Inc.
- Wilcox, R., R. (2009). *Basic Statistics. Understanding Conventional Methods and Modern Insights*. Oxford: Oxford University Press.
- Witte, R., S. (1989). *Statistics*. Florida, Orlando: Holt, Rinehart and Winston, Inc.

### **Standards of Academic Integrity**

Generally, academic fraud and dishonesty include, but are not limited to the following categories: cheating, fabrication, plagiarism, multiple submissions, etc.

- **Cheating:** Using unauthorized notes, aids or information on an examination; altering a graded work prior to its return to a faculty member, allowing another person to do one's own work and submitting it for grading.
- **Fabrication:** Inventing or falsifying information, data or citation; presenting data gathered outside of acceptable professorial guidelines; failing to provide an accurate account of how information, data or citations were gathered; altering documents affecting academic records; forging signatures or authorizing false information on an official academic document, grade, letter, form or any other university document.
- **Plagiarism:** Submitting material that in part or whole is not one's own work; submitting one's own work without properly attributing the correct sources of its content.
- **Multiple Submissions:** Submitting identical papers or course work for credit in more than one course without prior permission of the instructor.

A breach of ethics or act of dishonesty can result in:

- failure of an entire course (blatant plagiarism, cheating on a test or quiz)
- academic suspension or expulsion from the university.