BIOSTATISTICS

General Medicine

Division of Biomathematics

Subject: BIOSTATISTICS
Year, Semester: 1st year/1st semester
Number of teaching hours:
Seminar: 28

1st week:
Lecture: 1. Introduction. Math introduction, functions.

2nd week:
Lecture: 2. Set theory. Conditional probability and its clinical implications. Marginalization, Bayes' theorem. Independent events.
3. Descriptive statistics (measures of central tendency and spread; percentiles, quartiles). Histograms, box and whisker plot.
Seminar: Conditional probability, marginalization, Bayes' theorem. Independent events.

3rd week:
Lecture: 4. Discrete random variables. Characterization and graphical representation of discrete distributions (probability distribution and cumulative distribution function). Binomial and Poisson distributions.
Seminar: Descriptive statistics.

4th week:
Lecture: 5. Continuous random variables. Probability density function. Normal and standard normal distributions.
Seminar: Characterization and graphical representation of discrete distributions. Binomial and Poisson distributions.

5th week:
Lecture: 6. Sampling, biased and unbiased estimation. Central limit theorem. Standard error of the mean. Basics of hypothesis testing.
Seminar: Normal and standard normal distributions.

6th week:
Lecture: 7. Introduction to hypothesis testing: null and alternative hypothesis, level of significance, type I and type II errors, one and two-tailed tests. p value. z-test, one sample t-test.
Seminar: Sampling. Central limit theorem. Standard error of the mean.

7th week:
Lecture: 8. Statistical tests: paired and unpaired t-test, F test.
Seminar: Hypothesis testing. z-test, one sample t-test.

8th week:
Lecture: 9. Diagnostic methods with a statistical approach (specificity, sensitivity, positive- and negative predictive value). ROC curve. Analysis of discrete random variables. Chi-squared test. Epidemiologic investigations: relative risk and odds ratio; Kaplan-Meier curve.
Seminar: Statistical tests: paired and unpaired t-test, F test.

9th week:
Lecture: 10. Summary. Outlook (confidence interval, non-parametric statistical tests, normality tests, analysis of variance (ANOVA)).
Seminar: Diagnostic methods with a statistical approach (specificity, sensitivity, positive- and negative predictive value). ROC curve. Chi-squared test. Epidemiologic investigations: relative risk and odds ratio; Kaplan-Meier curve.

10th week:
Seminar: Summary

Requirements

1. Aim of the course:

The aim of the subject is to give an introduction to biostatistical methods, which can be used in different branches of medicine to solve biostatistical problems and to evaluate experimental results. In addition, providing a solid theoretical foundation the course will also introduce the students to the art and science of performing the simplest calculations.

2. Short description of the course:

Mathematical introduction to the biophysics and biostatistics course (functions, plotting measurements data, fitting, determination of slope, area under the curve, integration). Set theory. Probability, conditional probability, marginalization, Bayes' theorem. Descriptive statistics (determination of mean, median, mode, standard deviation from data set; construction of histograms, box and whisker plot). Discrete and continuous random variables; cumulative distribution function, density function. Binomial, Poisson, normal, and standard normal distribution. Sampling techniques and characterization of samples; biased and unbiased estimate, the central limit theorem. Hypothesis testing (z, t, F and chi2 tests). Clinical implications of conditional probability; diagnostic methods with a statistical approach, epidemiologic investigations (relative risk, odds ratio, Kaplan-Meier curve).

3. Type of the exam:

Colloquium (written). The final exam can be taken during the exam period of the second semester within the exam course, but only for those students who have a valid signature for completing the course requirements.

4. Requirements for the Biostatistics course:

4.1. Lectures, seminars:

Attendance to lectures is not mandatory but strongly recommended. Seminars will be held for each group separately. During seminars, the lecture topics will be discussed in more detail and sample problems, calculations will be solved. Attendance to seminars is mandatory with the student's own assigned group. During the semester on two predetermined seminars (on week 4 and week 10) students write an electronic test of up to 15 minutes for earning points (maximum 10 points) that are added to the result of the grade-offering tests (see section 4.3.1) and contribute to the result of the final exam as bonus points (see section 4.3.2). The bonus points earned are only added to the test result of part B of the final exam (see section 4.3).

Students who complete the colloquium at the end of the second semester as part of the examination course will not be entitled to the bonus points, even if they have already completed the course and have a valid signature (see section 4.3).

4.2. Conditions for signing the lecture book:

Signature for the course is denied if there are more than two absences from the seminars. Arriving late to the seminars may be considered as an absence. No certificates, including a medical certificate, are accepted for the absences. Making up for missed classes is not possible.

4.3. Grade-offering course test and final exam:

Students will write two grade-offering tests between weeks 6-8 and 12-13 in coordination with mid-term tests of other subjects. The duration of these tests will be 45 minutes. The first, electronic test will cover the topics of the lectures of weeks 1-4, and the second, paper-based written test will contain the remaining topics (i.e., lecture topics of weeks 5-9). The grade-offering tests do not count as an A chance exam, writing them is not mandatory. Writing the grade-offering tests is only possible at the appointed time and there will not be any alternative appointments for writing it.

Usually, exams will be held once a week during the exam period. The exam is written.

4.3.1. Structure of the grade-offering tests and the final exam:
Grade-offering tests: minimum requirement questions, test questions, and calculations.
Final exam:
•part A: minimum requirement questions and short calculations (descriptive statistics, binomial and Poisson distribution, normal distribution, etc.). Maximum score of part A is 40 points.
•part B: test questions (true or false questions, simple- and multiple-choice questions, fill-in questions etc.), calculations, graphs. Maximum score of part B is 100 points (without bonus points).

4.3.2. Evaluation of the grade-offering test and the final exam:
Evaluation of the grade-offering tests:
A maximum of 2x45 points can be earned with the two grade-offering tests. Points earned during the seminar tests (maximum 10) are added to the result of these two tests. Based on this final score (FS), the grades are offered as listed below.
Bonus points: Bonus points are calculated as 10% of the sum of the points earned in the two grade-offering tests (2x45) and the two seminar tests (10) rounded to the nearest integer. For example: 3 + 4 + 35 + 39 = 81→ 8 bonus points.
Evaluation of the final exam:
•If the score of part A is less than 75% (30 out of 40 points), the student fails the final exam. Bonus points earned by tests written in the lectures and seminars are not added to the result of part A.
•If a student passes part A (i.e., the score is greater than or equal to 75% or 30 points) on an exam, the result is valid for his/her subsequent exam chances, i.e., part A does not have to be retaken. But the exemption from retaking part A of the exam is not valid for repeated courses or exam courses, that is the exemption from retaking part A is valid only in the 1st semester.
•If the result of part A is less than 75%, part B is not evaluated.
•If the student passes part A, bonus points are added to the score of part B (max 100 points). Based on this final score (FS), that does not include the points earned in Part A, the following grades are offered:

- FS<60 fail (1)
- 60≤FS<70 pass (2)
- 70≤FS<80 satisfactory (3)
- 80≤FS<90 good (4)
- 90≤FS excellent (5)

The bonus points earned and the exemption from retaking part A of the exam are only valid for the course in which they have been achieved, i.e., they are not valid for repeated courses or exam courses. The grade based on the grade-offering tests or the final exam can be corrected only once, but in this case the final grade is determined by the result of the re-written test i.e., independently from the result of the former test. That is, the new result overrides the previous one.

4.4. Rules for C chance exams:
Evaluation of C-chance exams is performed according to the following table:

	Result of part B is a fail	Result of part B is above the passing level
Result of the minimum requirement questions (part A) is a pass (≥75% = 30p)	final exam grade: FAIL	exam grade is according to the result of the 'B' test (see 4.3)
Result of the minimum requirement questions (part A)	final exam grade: FAIL	oral exam

is a fail, but at least 65% (≥26 p)		
Result of the minimum requirement questions (part A) is less than 65% (<26 p)	'B' test not scored, final exam grade: FAIL	

5. Reading materials:

- Educational material published on the eLearning platform of the course can be downloaded as pdf format (elearning.med.unideb.hu – Department of Biophysics and Cell Biology/English Courses/1st semester/Biostatistics – AOBIST02T1)
- Wayne W. Daniel: Biostatistics, A foundation for Analysis in the Health Sciences, John Wiley&Sons

6. Recommended reading material:

- Practice problems in biostatistics (editors: Zoltán Varga and Tibor G. Szántó). University of Debrecen, Department of Biophysics and Cell Biology, Division of Biomathematics, 2022, ISBN 978-963-490-459-5. It can be downloaded as pdf format (elearning.med.unideb.hu – Department of Biophysics and Cell Biology/English Courses/1st semester/Biostatistics – AOBIST02T1)

7. Exemptions:

Requests for exemptions from the biostatistics course must be turned in to the Credit Transfer Committee. Such requests cannot be directly turned in to the Biomathematics Division or the Department of Biophysics and Cell Biology.

8. Information for repeaters:

For repeaters the attendance on seminars is not compulsory. Students repeating the course are subject to the same rules and requirements as those taking the course for the first time.

9. Rules for calculators:

Rules for calculator usage during course tests and the final examination. To ensure a fair evaluation, to avoid disturbances in the testing room, and to protect the security of the test material the following types of calculators are NOT permitted:

- calculators with built-in computer algebra systems (capable of simplifying algebraic expressions)
- pocket organizers, handheld or laptop computers
- any device capable of storing text. Calculators with a typewriter keypad (so-called QWERTY devices), electronic writing pads and pen-input devices are not allowed either. Calculators with letters on the keys (e.g., for entering hexadecimal numbers or variable names) are permitted if the keys are not arranged in QWERTY format.
- calculators or other devices capable of communicating with other devices
- calculators built into wireless phones
- calculators with paper tape or models that make noise

In general, students may use any four-function, scientific or graphing calculator except as specified above. Sharing calculators during tests is not allowed, and the test proctor will not provide a calculator.