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| **Subject name:**  Measurement data processing | | **NEPTUN-code:**  RKXMF1ABNE | **Lessons:** lc+pr+lb  1+2+0 | **Credit:** 4  **Req.**: m |
| **Subject leader and lecturer:**  Dr. Mészárosné Dr. Habil. Bálint Ágnes | | **Position:**  associate professor | **Prerequisite:**  RKXMA2HBLNE | |
| **Description of knowledge:** | | | | |
| When we look at the environmental elements (air, water, soil), we obtain a large amount of measurement data. Large amounts of data are not in themselves meaningful. Our data must be evaluated, i.e. processed, to make sense of it. In simpler cases, we use data processing programs such as Microsoft Excel. The principles of data sorting are described. We may need special statistical software packages to help us establish relationships between our measured data. Describe the basic statistics principles (descriptive statistics, ANOVA, etc.). There are several statistical software packages: paid ones such as SPSS, SAS, etc. and free ones such as JASP and R2. We will also introduce students to an important program for scientific data processing (Origin). Using the free R2 suite of programs, we can write procedures to analyse our data. We can compare algorithms generated using Matlab and Maple with programs explicitly written for statistical analysis. | | | | |
| **A detailed description of the subject, timetable** | | | | |
| **Education Week** | **Topics for Lectures and Exercises** | | | |
| 1. | **Lecture:** Introduction. Experiment. The measurement. Basic statistics. Error propagation.  **Exercise:** Types of averages. Calculation with Excel. | | | |
| 2. | **Exercise:** Calculate additional averages. | | | |
| 3. | **Lecture:** Analysis of correlation. The correlation coefficient. Functions describing the measurement results. Linear regression.  **Exercise:** Exercise correlation analysis with Excel. | | | |
| 4. | **Exercise:** Linear regression with Excel, JASP, and presentation with Origin and SPSS. | | | |
| 5. | **Lecture:** The method of least squares. Nonlinear regression.  **Exercise:** Additional regression calculation exercises. | | | |
| 6. | **Exercise:** Nonlinear regression. One possible help Origin and JASP | | | |
| 7. | **Lecture:** Detailed description of JASP  **Exercise:** Preparation for the 1st test, practice exercises. | | | |
| 8. | **Exercise:** Write test 1, solve theoretical test questions in Moodle, solve problems in Excel, and upload them to Moodle. | | | |
| 9. | **Lecture:** One-factor analysis of variance  **Exercise:** Exercise one-factor analysis of variance with Excel and JASP. | | | |
| 10. | **Exercise:** Further one-factor ANOVA exercise. | | | |
| 11. | **Lecture:** Presentation of analysis of variance with SPSS. Other free programs.  **Exercise:** Examples for ANOVA in SPSS and JASP. | | | |
| 12. | **Exercise:** Exercise non-repeated and repeated two-factor analysis of variance exercises | | | |
| 13. | **Lecture:** Two and three-factor analysis of variance.  **Exercise:** Two and three-factor analysis of variance. Factor analysis through examples, demonstrated with JASP and SPSS. | | | |
| 14. | **Exercise:** Writing test 2 from the second part of the material (test in e-learning from the theoretical part and solution of the problem) | | | |
| **Mid-term requirements** | | | | |
| **Participation in occupations:**  Participation is mandatory. Compulsory completion of two final papers (weeks 8 and 14) | | | | |
| **Final papers, minutes, reports, etc.**  Final examination: weeks 8 and 14. You are solving test problems from theory in Moddle, solving issues in Excel, and uploading to Moodle. | | | | |
| **The method of obtaining a signature / mid-term mark:**   1. Test 1: 50 points (20 points theory test; 30 points problem solving). Minimum: 26 points 2. Test 2: 50 points (20 points theory test; 30 points problem solving). Minimum: 26 points. The two compulsory tests give the mid-year mark.   **Final mark:**  Under 52 points: unsatisfactory; 52-62 points: satisfactory; 63-75 points: intermediate; 76-85 points: good; 86 points and above: Excellent  For those who fail the test, a make-up exam will be given at an agreed-upon date. In case of failure of the end-of-year mark, the test date announced in the first week of the examination period will be less. Both exams can be made up at the end of the year. | | | | |
| **The professional competencies to be acquired** | | | | |
| Ability to process measurement data using different methods and software. You must have basic and specialist statistical skills. You must be able to develop yourself. You must be able to perform calculations accurately. Be able to identify the most appropriate methods for processing your data. He/she must be able to think logically.  You should be able to present your calculations and justify the results. | | | | |
| **References:** | | | | |
| **Mandatory:**  Course material in pdf format uploaded to e-learning:   * Katharine Alexis Kormanik: Statistics Fundamentals Succinctly, Copyright © 2016 by Syncfusion, Inc. 2501 Aerial Center Parkway Suite 200 Morrisville, NC 27560 USA * presentation material in ppt   **Recommended for:**   * Paul Mac Berthouex, Linfield C. Brown: Statistics for environmental engineers, second edition, 2002 by CRC Press LLC, Lewis Publishers is an imprint of CRC Press LLC, No claim to original U.S. Government works, International Standard Book Number 1-56670-592-4 * Petra Petrovics: SPSS tutorial & exercise book for business statistics, Miskolc, 2012 * Professor Mark A. Goss-Sampson: Statistical Analysis in JASP A Guide for Students, JASP 2024, Copyright © 2024 by Mark A Goss-Sampson. Licenced as CC BY 4.0 | | | | |
| Comment: | | | | |