# Multivariate Data Analysis (3677) 5cr – autumn 2023

## Course description
The course is an introduction to multivariate analysis (i.e. statistical techniques that simultaneously analyse multiple measurements on individuals or objects). The course covers techniques such as MANOVA, Regression Analysis, Factor Analysis, and Cluster Analysis. The statistical program SPSS is used in the course.
This course is included in the study plan for master's studies in Marketing, Logistics and Management, and can be included as a methods course in master's or doctoral studies in any other subjects than statistics.


## Learning goal
You are familiar with the features of multivariate data, can explain the logic behind multivariate analysis and have a working knowledge of the multivariate techniques.

After completing the course, you will be able to
- examine the data and prepare it for multivariate analysis
- apply multivariate methods to well-defined research questions and can carry out multivariate data analysis using SPSS
- interpret and utilize the analysis results, and present the results in written reports
- dissect and evaluate research reports were multivariate analysis are applied.


## Literature
Hair, J.F, Black, W.C, Babin, B.J, Anderson, R.E (2018). *Multivariate data analysis* 8th ed. or earlier. Upper Saddle River (N.J.): Prentice Hall.
8th edition: chapters 1 – 6 or 7th edition: chapters 1 – 4, 8.

The book is available online at Perlego. Create an account following the instructions here: https://libguides.hanken.fi/ebooks/perlego , log in and search for the book.
The book is also available at the library.


## Groups
During the course you will have computer exercises and article reviews (see below). These can be done by cooperating in small groups (3 - 4 persons per group). You can form your own groups anyway you like. If you would like to be part of a group but have difficulties finding one, you can try to post a message in the "Group request" forum on the course Moodle page.

## Course outline, lectures
1. Introduction
2. Data manipulations
3. Hypothesis testing, t-test, ANOVA
4. Multivariate analysis of variance (MANOVA)
5. Multiple regression analysis
6. Multiple regression analysis cont.
7. Exploratory factor analysis
8. Cluster analysis

The lectures will be given online (Teams).

## Computer exercises
Along with the lectures, there will be four sets of computer exercises where you will get to apply the multivariate techniques you've learned to real data using SPSS. The software SPSS is installed on every computer for students at Hanken. Students at Hanken can also get a license for SPSS for their own computer (https://www.hanken.fi/en/it-services/computers/software-licences-your-own-computer). The computer exercises and assignments can be done individually or by cooperating in small groups. However, everyone should submit his or her own solution. A good time to work on the exercises is during the SPSS help desk hours that will be held in room A407 for each exercise set, where you can also get help from one of the teachers.

| Exercise set | Opens in Moodle (11.45) | Help desk (A407, 10.15-11.45) | Deadline (before midnight) |
| --- | --- | --- | --- |
| 1 | Wednesday Sep. 13 | Friday Sep. 15 | Monday Sep. 18 |
| 2 | Wednesday Sep. 20 | Friday Sep. 22 | Monday Sep. 25 |
| 3 | Friday Sep. 29 | Monday Oct. 2 | Wednesday Oct. 4 |
| 4 | Monday Oct. 9 | Wednesday Oct. 11 | Friday Oct. 13 |

Optional: if you would like to learn how to use the multivariate techniques in the statistical program R, "translations" of the SPSS exercises will be made available on the course's Moodle page. This is not a substitute for the SPSS exercises, you will still need to complete the SPSS assignments to get points.

## Article reviews
There is a total of three Article Reviews. Each review will cover one of the three multivariate techniques (MANOVA, regression analysis, and cluster/factor analysis, respectively). Article reviews are done in your group and each group writes a total of three reports (so that each report covers a separate multivariate technique). Answers should be submitted via Moodle no later than one week after each article review session (see schedule below). Detailed instructions on article reviews will be published later in Moodle.

Note that the article review sessions are not lectures but instead provide you with an opportunity to discuss the articles with the teacher and your group. The sessions are not mandatory to attend.

**AI guidelines**
The course follows Hanken's guidelines for the use of artificial intelligence in education. If you use AI-based tools during the writing process or in your work, this must be described in detail in [the work or another report on the use of AI]. You are not allowed to copy answers created by AI. Remember to document your steps in the writing process so that you can demonstrate the progress of your work if incorrect use of AI-based tools is suspected. Read more on Hanken's instruction page:
**https://www.hanken.fi/en/students/learning-lab/artificial-intelligence-studies-and-learning**

Failure to comply with these guidelines constitutes cheating and will be handled according to Hanken's action plan for Academic Dishonesty.

**Final exam**
This is a written exam based on the whole course. The exam is taken individually. The final exam is on October 26th at 9 am with an additional opportunity on November 17th at 3 pm.

**Grading**
The final grade is the sum of the following parts
1) article reviews (max 30 points)
2) exam (max 40 points)
3) computer assignments (max 30 points)

To pass the course, you need to obtain at least 50 points in total.

**Instructors**
Christian Johansson (christian.johansson@hanken.fi)
– lectures, examiner

Markus Belfrage (markus.belfrage@hanken.fi)
– article reviews, computer exercises, SPSS help desk

**Schedule**
Week 37
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|---|---|---|
| Monday (September 11th) | 10.15 – 11.45 | Lecture 1 – Teams |
| Wednesday (September 13th) | 10.15 – 11.45 | Lecture 2 – Teams |
| Friday (September 15th) | 10.15 – 11.45 | SPSS help desk – room A407 |

Week 38
| | | |
|---|---|---|
| Monday (September 18th) | 10.15 – 11.45 | Lecture 3 – Teams |
| Wednesday (September 20th) | 10.15 – 11.45 | Lecture 4 – Teams |
| Friday (September 22nd) | 10.15 – 11.45 | SPSS help desk – room A407 |

Week 39
| | | |
|---|---|---|
| Monday (September 25th) | 10.15 – 11.45 | Article review 1 – room A210 |
| Wednesday (September 27st) | 10.15 – 11.45 | Lecture 5 – Teams |
| Friday (September 29th) | 10.15 – 11.45 | Lecture 6 – Teams |

Week 40
| | | |
|---|---|---|
| Monday (October 2nd) | 10.15 – 11.45 | SPSS help desk – room A407 |
| Wednesday (October 4th) | 10.15 – 11.45 | Article review 2 – room A210 |
| Friday (October 6th) | 10.15 – 11.45 | Lecture 7 – Teams |

Week 41
| | | |
|---|---|---|
| Monday (October 9th) | 10.15 – 11.45 | Lecture 8 – Teams |
| Wednesday (October 11th) | 10.15 – 11.45 | SPSS help desk – room A407 |
| Friday (October 13th) | 10.15 – 11.45 | Article review 3 – room A309 |