

MA 202
Statistics & Data Management
3 Credits

Instructor: Sandra Kathnelson
Phone: 780 853 8678
Original Developer: Michael Crowe
Current Developer: Sandra Kathnelson
Reviewer: Nicole Nadorozny
Created: 19/01/2010
Revised: 12/10/2016
Approval: 23/11/2016

The Implementation Date for this Outline is 01/09/2015

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2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400
Toll-free in Canada: 1 800 661 6490



MA 202 Version: 2



Statistics & Data Management

Calendar Description

This course provides an introduction to the basic statistical procedures and data management techniques commonly used in the environmental sciences. Emphasis is placed on methods for organizing, storing, retrieving, analyzing, graphing and interpreting environmental data with database and spreadsheet software. Major analytical topics include measures of central tendency and dispersion, probability distributions, parametric and non-parametric hypothesis tests, correlation analysis, simple linear regression, and single-factor analysis of variance.

Rationale

This course is required for first year students within the Environmental Sciences diploma. Most environmental science graduates are regularly collecting, handling, and interpreting environmental data and are often responsible for understanding and implementing techniques described in the scientific literature. This course explains how statistical principles and the scientific method are used to ensure data is collected, managed, analyzed, and interpreted in a scientifically credible manner.

Prerequisites

None

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. explain the purpose of creating and maintaining environmental databases.
2. explain sampling strategies and standard methods used in data collection.
3. use database software to enter, store, retrieve, and manage data.
4. use spreadsheet software to conduct statistical analysis using a variety of parametric and non-parametric tests.
5. interpret the meaning of statistical output.

6. generate statistical graphs and tables that display key summary statistics.
7. identify patterns, trends, and relationships in summarized data.

Essential Employability Skills

Essential employability skills are critical for workplace success and lifelong learning. Lakeland College prepares its graduates for the workplace and lifelong learning by integrating and promoting essential employability skills development in its curricula. Each credit course offered at Lakeland College emphasizes one or more of the following five essential employability skills:

- A. **Communication Skills** that enable individuals to listen, interpret, express, and convey knowledge and ideas so that they are received and understood.
- B. **Teamwork Skills** that enable individuals to respect the thoughts and opinions of others as they work together to plan activities, meet deadlines, complete projects, and contribute to an organization's goals.
- C. **Critical Thinking Skills** that enable individuals to conceptualize and analyze issues from various perspectives while rationally evaluating the strengths and limitations of each perspective and deciding what action to take.
- D. **Adaptability Skills** that enable individuals to respond quickly, willingly, and positively to new conditions and changing times.
- E. **Positive Attitude and Behavioural Skills** that enable individuals to be confident about themselves and to deal with people, problems, and situations with honesty, integrity, and personal ethics.

Please refer to the Knowledge/Skills Matrix of this course outline to review the essential employability skills emphasized in this course.

Resource Materials

Required Text and Materials:

Dretzke, B.J. 2013. *Statistics With Microsoft Excel: Fifth Edition*. Pearson Education, Inc., Saddle River, NJ.

Additional Resources:

Fowler, J., and L. Cohen. 1990. *Practical statistics for Field Biology*. John Wiley & Sons Ltd. Rexdale, ON.

Sokal, R.R., and F.J. Rohlf. 1995. *Biometry*. 3rd ed. W.H. Freeman and Company, New York, NY.

Zar, J.H. 1984. *Biostatistical analysis*. 2nd ed. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Conduct of Course

The lecture component is a formalized lecture situation where the instructor discusses pertinent topics and students normally take notes. Student questions are encouraged to clarify subject areas.

The lab component focuses on lab assignments that pertain directly to material covered in lectures (see below). The instructor provides a brief overview of the requirements for each assignment and students are expected to complete these independently, during the scheduled class time or, if necessary, as homework. Students having difficulty with assignments are encouraged to *seek individualized help from the instructor during the lab period or during office hours*.

Evaluation Procedures

Exams contain questions and problems similar to those covered in lecture and lab. The final grade for the course is weighted according to the following schedule:

Lecture Midterm	20%
Lecture Final	30%
Laboratory Assignments	30%
Laboratory Exam	20%
Total	100%

To obtain credit for this course all lab assignments must be completed and handed in, all scheduled laboratory sessions must be attended, and a minimum grade of 1.0 in the combined lecture/lab and project portions of the course must be achieved.

The midterm exam contains a 'closed-book' and 'open-book' component. The lecture final is closed-book and cumulative. The lab final exam is all open-book. Each assignment and exam is converted to a percentage and a total course percentage is calculated using the above weighting values. Finally, the total course percentage is converted to a grade using the Lakeland College grade strip (see below).

Late lab assignments are not graded and a zero mark is assigned.

Knowledge/Skills Matrix

Students apply and demonstrate their knowledge and skills to use

A. Communication Skills

A1. by listening, reading, interpreting information, and communicating effectively

Evaluation(s)/Goal(s): Midterm/Goals 1-7; Final/ Goals 1-7; Lab Exercises/ Goals 1-7

A2. by using written, spoken, and/or visual formats and media to communicate and meet needs of each particular audience
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Evaluation(s)/Goal(s): Assignments/ Goals 1-7
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A3. by using libraries, Internet, technical publications, journals and other sources to find pertinent information

Evaluation(s)/Goal(s): Assignments/ Goals 5-7
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B. Teamwork Skills

B1. by using interpersonal skills to create an atmosphere that maximizes the strengths of group members to accomplish tasks
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Evaluation(s)/Goal(s): NA

B2. by using interpersonal skills to resolve conflict, relate to others, and assist others

Evaluation(s)/Goal(s): NA

B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines
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Evaluation(s)/Goal(s): NA

B4. by treating other members of the group open-mindedly and fairly
--

Evaluation(s)/Goal(s): NA

B5. by developing tactics/strategies to accomplish tasks

Evaluation(s)/Goal(s): Assignments / Goals 1-7

C. Critical Thinking Skills

C1. by seeing critical thinking as a lifelong process of self-assessment

Evaluation(s)/Goal(s): N/A

C2. by examining problems closely
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Evaluation(s)/Goal(s): N/A

C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts
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Evaluation(s)/Goal(s): N/A

C4. by seeking out the truth

Evaluation(s)/Goal(s): N/A

C5. by finding solutions; make decisions

Evaluation(s)/Goal(s): Lab Exercises / Goals 1-7

C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic

Evaluation(s)/Goal(s): N/A

C7. by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences
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Evaluation(s)/Goal(s): Lab Exercises / Goals 1-7

D. Adaptability Skills

D1. by working independently or as part of team
--

Evaluation(s)/Goal(s): Lab Exercises / Goals 1-7

D2. by carrying out multiple tasks or projects

Evaluation(s)/Goal(s): Assignments / Goal 1-7
--

D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done
Evaluation(s)/Goal(s): NA
D4. by being open and respond constructively to change and uncertainty
Evaluation(s)/Goal(s): Assignments

E. Positive Attitude and Behavioural Skills

E1. by dealing with people, problems, and situations with honesty, integrity, and personal ethics
Evaluation(s)/Goal(s): Midterm / Goals1-7; Final / Goals 1-7; Lab Exercises / Goals 1-7
E2. by showing interest, initiative, and effort
Evaluation(s)/Goal(s): Midterm / Goals1-7; Final / Goals 1-7; Lab Exercises / Goals 1-7
E3. by affirming the need for positive solutions and encourage positive interaction and feedback
Evaluation(s)/Goal(s): NA
E4. by balancing personal and family activities with job-related activities
Evaluation(s)/Goal(s): NA

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports, therefore absenteeism is recorded.

- a. Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours can be required to withdraw and would then automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade).
- b. An excused absence is one that is verified with your instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another instructor regarding a field trip or other activity, or authorization by

your instructor following an in-person meeting. Be sure to contact your instructor and ask what they will require from you as verification of each absence. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

Course Units/Topics

Lecture and Laboratory Content:

1. Environmental Data
2. Database Design and Management
3. Introduction to Statistics
4. Descriptive Statistics (measures of center and variability)
5. Presenting Data (figures, tables, and captions)
6. Parameter Estimation (confidence levels)
7. One-Sample Hypothesis Testing
8. Two-Sample Hypothesis Testing (paired and unpaired t-tests, Mann-Whitney test, Wilcoxon test)
9. Single Factor ANOVA and Kruskal-Wallis tests
10. Analyzing Frequencies (G-test)
11. Correlation Analysis (Spearman Rank and Pearson's Product Moment Correlation Coefficients)
12. Simple Linear Regression
13. Data Collection and Sampling Concepts



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