

# Methodology in Agricultural and Food Sciences ANSC 7500 Winter 2020

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## **Academic Integrity**

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty. Students should acquaint themselves with the University's policy on academic integrity (<http://umanitoba.ca/academicintegrity/>).

## Course outline

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Topic	# lectures
1. Principles of scientific experimentation and checklist for design and analysis of experiments.	1
2. Populations, sampling, distributions, probability, notation, ttests, power of tests	6
3. Linear regression, analysis of variance, assumptions of ANOVA	3
4. Multiple regression, Type I and II SS	2
5. Experimental designs overview	1
6. The completely randomized design (CRD)	7
7. Factorial experiments	2
8. The nested design	2
9. Randomized complete block designs	3
10. Latin square designs	2
11. Split-plot designs	2
12. Repeated measures designs	3
Other: 2 midterms, one virtual computer-lab class	3

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# Software

Students will gain expertise in the use of statistical analysis computer software (primarily SAS).

Computer session: 09:00-11:00 Friday, Jan. 22

## **SAS University Edition**

- ❖ Free for students and staff
- ❖ Can run on PCs, Macs or Linux workstations
- ❖ Contains a subset of all the functionality in SAS Foundation. Nonetheless, it includes most of the SAS products that you will need
- ❖ You do not have to be connected to the internet in order to run it
- ❖ Available for download:

[http://www.sas.com/en\\_us/software/university-edition.html](http://www.sas.com/en_us/software/university-edition.html)

## **SAS 9.4 for Windows**

- ❖ Licenses available from IST at \$100/machine

## Textbooks and reference material

The following manual will be used to learn the SAS system for analysis of data:

Crow, G.H. 2012. Using SAS in Agricultural and Food Sciences Research. University of Manitoba. U. of M. bookstore (includes lecture notes). Price is ~\$15.

Apart from the manual, there is **no required textbook** for this course. However, you will benefit from owning **a good text to use as a general reference** not only for this course but for your research work.

Two good ones are

- Quinn and Keough (2002). Experimental design and data analysis for biologists. Cambridge University Press.
- **Steel et al. (1997)**. Principles and procedures of statistics -- a biometric approach. Third edition. McGraw-Hill Publishing Company

## Useful texts

Box, G.E.P, Hunter, W.G. and Hunter, J.S. 2005. Statistics for experimenters: Design, innovation, and discovery. 2<sup>nd</sup> Edition. John Wiley and Sons, Inc. New York.

Clewer, A.G. and D.H. Scarisbrick. 2001. Practical statistics and experimental design for plant and crop science. John Wiley and Sons, New York.

Cochran, W.G. and Cox, G.M. 1992. Experimental designs. 2<sup>nd</sup> Ed. John Wiley and Sons, Inc. New York.

Gill, J.L. 1980. Design and analysis of experiments in the animal and medical sciences. Volumes 1 and 2. The Iowa State University Press. Ames, Iowa.

Kaps, M. and W.R. Lamberson. 2004. Biostatistics for animal science. CAB International, Wallingford, Oxfordshire, UK.

Mead, R., Curnow, R.N. and Hasted, A.M. 2003. Statistical methods in agriculture and experimental biology. 3<sup>rd</sup> Edition. Chapman and Hall.

Ott, R.L. and Longnecker, M. 2010. An Introduction to Statistical Methods and Data Analysis, 6<sup>th</sup> Edition. Brooks/Cole, Cengage Learning. Belmont, CA.

Quinn, G.P and Keough, M.J. 2002. Experimental design and data analysis for biologists. Cambridge University Press. New York.

Roberts, E.A. 1992. Sequential data in biological experiments. An introduction to research workers. Chapman and Hall, New York.

Snedecor, G.W. and Cochran, W.G. 1989. Statistical methods. The Iowa State University Press. Ames, Iowa.

Steel, R.G.D., J.H. Torrie and D.A. Dickey. 1997. Principles and procedures of statistics -- a biometric approach. Third edition. McGraw-Hill Publishing Company. Toronto.

Stroup, W.W. 2013. Generalized linear mixed models: modern concepts, methods and applications. CRC Press.

See also **SAS online reference manuals, including:**

The MIXED Procedure

The GLIMMIX Procedure

SAS version 9.4 reference materials (we use procedures described in Base SAS or in SAS/STAT)

<http://support.sas.com/documentation/94/index.html>

## Assignments

Assignments will be given out at the last class of each week (usually Thursday) and will be **due one week later**.

Students are encouraged to **work together on assignment** problems. The assignment work that is submitted by each student, however, should be **written up independently** and be in each student's own words.

Access assignment material through your UM Learn site for this course.

## Student evaluation

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Midterm exam 1, February 12	15%
Midterm exam 2, March 12	25%
Assignments	25%
Final exam (date TBD)	35%

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**All exams will be open book**



## Assessment of grades

You will get **numeric scores for assignments and exams**.

These scores will be weighted according to the above scheme to come up with a final numerical score.

This final score will be used to assign the letter grade which will appear on your transcript -- See section 4 of the General Academic Regulations of the University online calendar for a description of the letter grade system (2018-2019)

<http://crscalprod1.cc.umanitoba.ca/Catalog/ViewCatalog.aspx>

Final scores will be rounded, e.g., -76.4 becomes 76, thus a B; 76.5 becomes 77, thus a B+.

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Numerical score	Letter grade
91-100	A+
84-90	A
77-83	B+
70-76	B
65-69	C+
60-64	C
50-59	D
Under 50	F

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## Voluntary Withdrawal

The last day for voluntary withdrawal without academic penalty is **Mar. 31**

## Assignments

For assignment work, I encourage you to work together on problems - the purpose of assignments is to understand the material.

You may also use the internet for background material.

The completed assignment work that you hand in must be in **your own words**.

If the internet, or other material is used in your work, this must be **properly referenced**.

Please refer to the University Calendar for statements on academic dishonesty including Plagiarism and Cheating. See section 8 of the General Academic Regulations of the University online calendar (2018-2019)

<http://crscalprod1.cc.umanitoba.ca/Catalog/ViewCatalog.aspx>

## Examples of previous tests

Previous tests will be posted on the UM Learn site for this course.

ANSC 7500  
Methodology in Agricultural  
and Food Sciences

Lecture Notes (Author: G.H. Crow)

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