

University of Alberta
Department of Mathematical & Statistical Sciences

Design and Analysis of Experiments
STAT 568, Winter 2021

Instructor: Adam B Kashlak
Office: My Basement via Zoom
E-mail: kashlak@ualberta.ca

Office Hours: Thurs 1530-1650
or by appointment

Lecture Room & Time: Zoom, Tues 1530-1650
Tentative Exam Time: 15-Apr-2021 at 9am

Course Web Pages: eClass
<https://sites.ualberta.ca/~kashlak>

Course Description:

The general linear model. Fully randomized designs, one-way layout, multiple comparisons. Block designs, Latin squares. Factorial designs confounding, fractions. Nested designs, randomization restrictions. Response surface methodology. Analysis of covariance.

Course Prerequisites:

Prerequisite: STAT 368 and a 400-level STAT course. Knowledge on linear algebra and regression analysis is highly recommended.

It is important to prepare yourself for this course through a review of the prerequisite material. Students who do not have the required prerequisites at the time of taking this course should not expect supplementary professorial tutoring from the instructor.

Course Objectives and Expected Learning Outcomes:

- Understanding of similarities and differences among various experimental designs.
- Being able to suggest designs given an hypothesis and data.
- Ability to run such tests in R.

Lecture Schedule:

My plan is to do live lectures / discussions on Tuesdays from 1530-1650 Mountain time, and

to produce 80 minutes (4 x 20 min) of prerecorded video lectures to cover the Thursday lecture hours.

The following is a rough outline of the course material to be discussed.

Weeks	Topic
1	One-Way ANOVA
2	Tukey Test, Cochran's Theorem
3	Blocking, Latin Squares
4	BIBD, Split Plot, ANCOVA
5	Multiple Testing
6	FDR
7	Reading Week
8	Factorial Designs
9	Fractional Factorial Designs
10	Three Level Designs
11	Response Surface Design
12	Prime & Mixed Level Designs
13	Project Discussions & Review

Recommended Resources:

Lecture notes are available on the course website (<https://sites.ualberta.ca/~kashlak/data/stat568.pdf>). This will be the main source of course material.

Supplementary Textbook: Available at Cameron Library reserve desk (QA 279 W82), for purchase at the University bookstore, and possibly online¹.

Experiments: Planning, Analysis, and Optimization, Second Edition. C.F. Wu and M.S. Hamada

Other Resources:

Design and Analysis of Experiments with R. J. Lawson. 2014, Chapman and Hall/CRC. Available at Cameron Library reserve desk (QA 276.6 L39)

Software:

The only software we are going to use is R. This software is free and you can download it from: <http://www.r-project.org/>.

Grade Evaluation:

The course mark will be calculated based on the following breakdown:

¹ <https://www.library.ualberta.ca/catalog/7918236>

Course Component	Weight of Total Mark	Date
Participation	15%	Weekly discussions on Tuesdays
Written Report	35%	R 1 Apr
Midterm	15%	R 11 Feb
Final Exam	35%	R 15 Apr

Note: The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this document. Students must verify this date on BearTracks when the Final Exam Schedule is posted.

The final letter grade will be determined from the course mark as follows: An overall course mark of 65% or more guarantees a passing grade of at least C+. An overall course mark of 90% or more guarantees a grade of at least A.

Grades are unofficial until approved by the Department and/or Faculty offering the course.

Assignments:

There will be four assignments due every two weeks on Wednesdays beginning on 17 Jan and skipping reading week. Due dates are 17 Jan, 31 Jan, 14 Feb, 6 Mar, 20 Mar, 3 Apr. Assignments should be submitted at the beginning of class at 1pm (or earlier either physically or electronically). It is always recommended to make a photocopy of your work. Each assignment is worth 3.3% of your final grade.

Past (or Representative) Evaluative Material:

Past exams, if available, will be posted to eClass for the purpose of pre-exam review. However, such exams have been written by other professors than the current one.

Exam Format:

The final exam will consist of a few long questions covering most of the course material. Some will be focused on mathematical derivations. Others will be essay based requiring you to design an experiment for some proposed data.

Exam Aids:

Students are required to have a writing implement. No calculators, notes, books, or other resources are required or allowed. (This may be revised once the exam is written)

Excused Absence Where the Cause is Religious Belief:

For an excused absence where the cause is religious belief, a student must contact the instructor(s) within two weeks of the start of Fall or Winter classes to request accommodation for the term (including the final exam, where relevant). Instructors may request adequate documentation to substantiate the student request.

Missed Term Work

A student who cannot complete an assignment or project due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for an excused absence. To apply for an excused absence, a student must inform the instructor within two working days following

the scheduled date of the term work or term exam missed, or as soon as the student is able, having regard to the circumstances underlying the absence. In all cases, instructors may request adequate documentation to substantiate the reason for the absence at their discretion.

Any missed assignments will result in a loss of 3.3% from the final grade unless excused in which case the weight of the assignment will be added to the final.

An excused absence is a privilege and not a right; there is no guarantee that an absence will be excused. Misrepresentation of Facts to gain an excused absence is a serious breach of the *Code of Student Behaviour*.

Missed Final Examination:

A student who cannot write the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination. Students who failed at the start of term to request exam accommodations for religious beliefs are expected to follow the normal deferred final examination process. Such an application must be made to the student's Faculty office within two working days of the missed examination and must be supported by a Statutory Declaration (in lieu of a medical statement form) or other appropriate documentation (Calendar section 23.5.6). Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. Misrepresentation of Facts to gain a deferred examination is a serious breach of the *Code of Student Behaviour*.

Any deferred final examinations are scheduled as follows: See Important Dates from the Academic Schedule on the MSS Associate Chair (Undergraduate) site.

Re-examination:

A student who writes the final examination and fails the course may apply for a re-examination. Re-examinations are rarely granted in the Faculty of Science. These exams are governed by University (Calendar section 23.5.5) and Faculty of Science Regulations (Calendar section 192.5.3). Misrepresentation of Facts to gain a re-examination is a serious breach of the *Code of Student Behaviour*.

STUDENT RESPONSIBILITIES

Academic Integrity:

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the *Code of Student Behaviour* (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an

offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All forms of dishonesty are unacceptable at the University. Any offense will be reported to the Senior Associate Dean of Science who will determine the disciplinary action to be taken. Cheating, plagiarism and misrepresentation of facts are serious offenses. Anyone who engages in these practices will receive at minimum a grade of zero for the exam or paper in question and no opportunity will be given to replace the grade or redistribute the weights. As well, in the Faculty of Science the sanction for **cheating** on any examination will include **a disciplinary failing grade** (NO EXCEPTIONS) and senior students should expect a period of suspension or expulsion from the University of Alberta.

Collaboration on Assignments:

Collaboration is certainly allowed for assignments especially as your future careers will require collaboration. However, it is important to understand the material. Else, you will perform poorly on the exams. Below are some standard collaboration tips from the university. Importantly, every student must submit his or her own work.

1. Do not write down something that you cannot explain to your TA or instructor.
2. When you are helping other students, avoid showing them your work directly. Instead, explain your solution verbally. Students whose work is copied also receive academic sanctions.
3. If you find yourself reading another student's solution, do not write anything down. Once you understand how to solve the problem, remove the other person's work from your sight and then write up the solution to the question yourself. Looking back and forth between someone else's paper and your own paper is almost certainly copying and will result in academic sanctions for both you and your fellow student.
4. If the instructor or TA writes down part of a solution in order to help explain it to you or the class, you cannot copy it and hand it in for credit. Treat it the same way you would treat another student's work with respect to copying, that is, remove the explanation from your sight and then write up the solution yourself.
5. There is often more than one way to solve a problem. Choose the method that makes the most sense to you rather than the method that other students happen to use. If none of the ideas in your solution are your own, there is a good chance it will be flagged as copying.

Exams:

Your student photo I.D. is required at exams to verify your identity. Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes has elapsed. Electronic equipment cannot be brought into examination rooms.

Cell Phones:

Cell phones are to be turned off during lectures, labs and seminars. Cell phones are not to be brought to exams.

Audio or Video Recording:

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Students Eligible for Accessibility-Related Accommodations (students registered with Student Accessibility Services – SAS):

Eligible students have both rights and responsibilities with regard to accessibility-related accommodations. Consequently, scheduling exam accommodations in accordance with SAS deadlines and procedures is essential. Please note adherence to procedures and deadlines is required for U of A to provide accommodations. Contact SAS (www.ssds.ualberta.ca) for further information.

Student Success Centre:

Students who require additional help in developing strategies for better time management, study skills, or examination skills should contact the Student Success Centre (2-300 Students' Union Building).

Policy about course outlines can be found in section 23.4(2) of the University Calendar.

Disclaimer:

Any typographical errors in this Course Outline are subject to change and will be announced in class.

Copyright:

Dr. Adam B Kashlak, Department of Mathematical & Statistical Sciences, Faculty of Science, University of Alberta (2021).