STAT 300: Intermediate Statistics for Applications

The following is a guide to the course STAT 300, Intermediate Statistics for Applications, as offered in the second winter term of the academic year 2025-26.

Aims and Objectives: The course aims to be a second course in statistical science, reinforcing and extending ideas encountered in a typical first course in the discipline. The course will expose learners to a wide range of applied statistical methodology, complementing concepts appearing in their first course. Detailed learning objectives for the course will be found in a document located on the course web page.

Pre-requisites: One of STAT 200, STAT 203, STAT 251, BIOL 300, BUSI 291, COMM 191, COMM 291, ECON 325, ECON 327, FRST 231, KIN 206, LFS 252, POLI 380, PSYC 218, PSYC 278.

Co-requisites: None.

Lecturer: Prof. Bruce Dunham (ESB room 3118, email: `B.Dunham@stat.ubc.ca`)

Lectures times: Mondays, Wednesdays, and Fridays, 3pm (in HR MacMillan Building (MCML) 360). There will also be office hours each week and labs on ten weeks of the term, with labs commencing in the third week of term.

Assessment: By the completion of the labs (10%), a fifty–minute midterm test (20%), responses to clickers questions (5%), on-line WeBWorK homeworks (10%), pre-class quizzes (5%), a $2\frac{1}{2}$–hour unseen examination (40%), and two assignments (10%, each worth 5%). It is necessary to pass the final examination to pass the course overall. We will use iClicker Cloud (see `lthub.ubc.ca/guides/iclicker-cloud-student-guide/` for information). Please ensure your student ID identifies you (either your name as it appears in Canvas or, should you have concerns about privacy, the first five digits of your student number).

The usual university rules for extenuating circumstances and plagiarism apply. Dates for the setting and completion of the written assignments are as below:

	Set	Hand-in
Assignment 1	22nd Jan.	5th Feb.
Assignment 2	19th Mar.	2nd Apr.

For the on–line WeBWorK homeworks, the dates when each homework opens

and closes are as follows:

	Opens	Closes
HW1	16th Jan.	25th Jan.
HW2	23rd Jan.	1st Feb.
HW3	30th Jan.	8th Feb.
HW4	6th Feb.	22nd Feb.
HW5	27th Feb.	8th Mar.
HW6	6th Mar.	15th Mar.
HW7	13th Mar.	22nd Mar.
HW8	20th Mar.	29th Mar.
HW9	27th Mar.	5th Apr.
HW10	3rd Apr.	12th Apr.

The homework sets can be accessed via the Canvas page under "WeBWorK". All questions set are of multiple choice or "fill in the blanks" format. All deadlines fall on Sunday evenings. Specific details regarding assessment regulations for the course can be found on the course web page.

Teaching methods: Classes of approximately fifty minutes duration will occur three a week, with online pencasts describing related materials being available from the course web page in advance. Pre-class activities are set before each class and an accompanying quiz due by 3pm on class days. In all sessions an in–class activity will be the main part of the session. A calculator or (preferably) R will be necessary for many of the in–class activities. Guided reading or other activities will be set at the end of one lecture to be completed prior to the next.

There will be required lab sessions most weeks. On the following weeks a lab

activity will count toward the final grade:

	Commencing
1. Week 3	19th Jan.
2. Week 4	26th Jan.
3. Week 5	2nd Feb.
4. Week 6	9th Feb.
5. Week 7	23rd Feb.
6. Week 8	2nd Mar.
7. Week 9	9th Mar.
8. Week 10	16th Mar.
9. Week 11	23rd Mar.
10. Week 12	30th Mar.

There will also be office hours each week, commencing in week 2. Students can register for the Piazza forum via the link on the Canvas page.

Extreme environmental conditions: In the event that environmental conditions mean that in–person classes are impossible, it is expected that lectures and, if practical, labs will be offered synchronously via Zoom. Please see the Canvas page for announcements.

Programme of work: The study time should total around eight hours per week. So in addition to the contact hours, it is essential that learners spend approximately four hours per week on self–study for the course. A proposed workload for a typical week is as follows:

Classes (including pre-class activity, pencasts, quiz, class): 4 hours
WeBWorK: 2 hours
Lab: 1 hour
Reading/reviewing/exercises/assignments: 1 hour

Feedback: After all assignments have been submitted and marked, individual feedback will be provided in the form of brief notes on marked work. Detailed written comments will also be provided on the course web–page where appropriate.

Recommended texts: There is no core text, but there are numerous books that cover at least some of the material in this course, and it is suggested you try the UBC library stock to find those that suit you. There are few books that aspire to support a second course in statistics. A good one though is

Ramsey, F.L. and Schafer, D.W. (2012): *The Statistical Sleuth: A Course in Methods of Data Analysis* (3rd edition). Cengage Learning.

It is likely that the textbook used for a pre-requisite course will cover some of the material in this course. In particular, later chapters of
De Veaux, R.D., Velleman, P.F., Bock, D.E., Vukov, G. and Weir, A. (2019): *Stats: Data and Models*, (Third Canadian edition). Pearson,
include content relevant to this course. Similarly other introductory texts are useful in containing parts of the content of the course, such as
Walpole, R.E, Myers, R.M., Myers, S.L. and Ye, K. (2007): *Probability and Statistics for Engineers and Scientists.* Pearson/Prentice Hall.
Whitlock, M. and Schluter, D. (2020): *The Analysis of Biological Data,* (3rd edit.) MacMillan.
There are useful books available electronically via the library. These include the following which provide details for implementing methods used using the statistical software package R:
Ekstrom, C. T. (2012): *The R Primer.* Chapman and Hall/CRC
Hay-Jahans, C. (2012): *An R Companion to Linear Statistical Models.* Chapman and Hall/CRC
Hothorn, T. and Everitt, B.S. (2010): *A Handbook of Statistical Analyses Using R.* (2nd edition) Chapman and Hall/CRC.

There follows a provisional guide to the lecture slots available. It is possible the material covered in the classes will differ slightly from the description below.

1. Introduction. Pre-test.
2. Motivation. Review of fundamental ideas.
3. Review activities.
4. Nonparametric methods: The sign test.
5. The rank sum test.
6. The Kruskal–Wallis test.
7. Permutation tests.
8. The power of hypothesis tests.
9. The Chi-squared test of goodness–of–fit.
10. Goodness–of–fit for contingency tables.

11. Investigating the fit of a model.
12. Fisher's exact test.
13. Probability plots for model fitting: Normal scores plots
14. Experimental design review: response variables, factors, blocking.
15. ANOVA: Review of concepts.
16. Analysing variance by breakdown of sums of squares.
17. Multiple comparisons
18. Review session
19. Midterm test (23rd February)
20. Interaction in two–way ANOVA
21. Inference in two–way ANOVA
22. Contrasts
23. Factorial and fractional designs
24. Introduction to the bootstrap
25. Bootstrap testing and interval estimation
26. Review of regression concepts
27. Sums of squares in regression
28. Properties of estimators in regression
29. Multiple linear regression
30. Curve fitting via regression
31. Residuals in regression
32. Dummy variables in regression: multiple regression and ANOVA
33. Odds ratios for 2×2 tables

34. Introduction to logistic regression

35. Introduction to time series: descriptive methods

36. Smoothing time series

37. Overview and revision.

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