Applied Probability II

Section 1: Module admin

Professor Caroline Brophy

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Section 1.1: Background information

About me

Professor Caroline Brophy

Associate Professor of Statistics

Research interests: developing and applying statistical models for Ecology, Agronomy and Climate Change studies.

About you!

Students taking this module come from a wide range of programmes:

- Management Science and Information Systems
- Mathematics major and Economics minor
- Mathematics Single Pathway
- Mathematics major and Irish minor
- Mathematics major and Statistics minor
- English Literature and Mathematics
- Mathematics and Philosophy
- Mathematics and Psychology
- Computer Science Single Pathway
- Visiting students

You have all taken Applied Probability I (pre-requisite).

There 180+ students registered to this module.

Section 1.2: Module details

Lectures

There will be two lectures per week.

- These will be held 'live' online at 9am on Mondays and 3pm on Thursdays.
- Lectures will be recorded and available 'on-demand' after each session; however, please attend the live lectures.

Assessment

- Final two-hour exam worth 85%.
- Continuous assessment worth 15%.
  - There will be four continuous assessments sheets during the semester that will each be worth an equal amount.
  - The four continuous assessment sheets will be handed out in weeks: 2, 4, 6 and 8 respectively.
  - There will be one week to complete each sheet, so deadlines in weeks: 3, 5, 7 and 9.

Laboratory sessions

There will be one laboratory session per week, starting in week 2.

- In these sessions, you will be split into smaller groups and will attend at your allocated 1-hour slot each week.
- Some weeks, a laboratory activity sheet will be provided to work through during the laboratory. Laboratory activity sheets do not count towards your continuous assessment grade.
- Some weeks, the material from a continuous assessment sheet that has been already submitted will be covered during the laboratory session.

Learning outcomes

- LO1: Derive confidence intervals and hypothesis tests for means and variances
- LO2: Derive prediction intervals for simple statistical models and explain how they differ from confidence intervals
- LO3: Conduct and explain the outputs of hypothesis testing in regression analysis
- LO4: Define maximum likelihood estimates and how to compute them
- LO5: Implement a bootstrap to construct confidence intervals
- LO6: Construct a q-q plot and use simple transformations of data that can make it more Normally distributed
- LO7: Construct a probability plot for any given distribution where its distribution function is known
- LO8: Calculate the properties of multivariate distributions
- LO9: Derive marginal and conditional probabilities of the bivariate Normal distribution

Topics covered

- Derivation of the confidence interval and tests of hypothesis for normal data; the difference between a confidence interval and a prediction interval
- The Central Limit Theorem and what it says about confidence intervals and tests of hypothesis
- Hypothesis testing for regression analysis
- The bootstrap approach to confidence intervals and tests of hypothesis
- Introduction to maximum likelihood estimation and computation
- The q-q plot and transforming data to make it more Gaussian
- Introduction to multivariate distributions

Let's do an experiment!

We are going to do an experiment in class today. I ask that you will each participate by carrying out a simple task. I will be recording the length of time it takes you to complete the task.

Where will I find this experiment?

- Under 'MODULE MATERIAL' there is a link called 'In-class experiment'. If you click on that page, you will just see an announcement saying that we will do an experiment during our first class.
- During our class, a new link will appear on that page called 'Experiment 2021'.

How will I participate?

- When it is time, I will tell you to refresh your Blackboard page and click into the experiment.
- You will have to answer just one question to complete the experiment.
- You will be asked to put a list of five words in alphabetical order. Put a number 1 beside the first alphabetical word, a 2 beside the second one, and so on.
- Please try to complete the question as quickly as you can BUT please make sure you have the correct order before you submit your answer.

Let's do an experiment!

Important notes:

- 'Experiment 2021' It will appear as a test on Blackboard. BUT IT WILL NOT COUNT TOWARDS YOUR GRADE FOR THIS MODULE!
- 'Experiment 2021' will appear as a test that is overdue. PLEASE IGNORE THIS OVERDUE MESSAGE!
- Doing this experiment is for fun and so that we can work on some data that you have been involved in collecting. When I download the dataset from Blackboard, I will not record your name. The data will be anonymised before we use it in class.
- I will stay in the live lecture. When you have completed your task, please come back and put a message in the chat to say 'finished'.
- The link to 'Experiment 2021' will disappear at the end of the first lecture. If you are watching the recorded version of the lecture, or just reading the lecture notes back, the link will not be available.
- Thank you for participating in this in-class experiment!