School of Civil and Environmental Engineering

Term 2, 2020

# CVEN9407 TRANSPORT MODELLING

| **COURSE DETAILS** | | |
|---|---|---|
| **Units of Credit** | 6 | |
| **Contact hours** | 4 hours per week | |
| **Class** | Thu 08:00 - 11:00, | online |
| **Workshop** | Thu 11:00 - 12:00 | online |
| | | |
| **Course Coordinator and Lecturer** | Taha Rashidi | |
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## INFORMATION ABOUT THE COURSE

This course is an advanced subject in econometrics with a focus on transportation demand modelling. This course covers a broad range of econometric modelling techniques and their applications in transport systems. Specific emphasis will be placed on estimation process of the models and their reliability in prediction. The topics of the course includes transport data analysis and modelling, linear regression models for continuous and discrete outcomes, interpretation of model estimation results, time series analysis, and survival analysis in transport systems.

## HANDBOOK DESCRIPTION

See link to virtual handbook -

> https://www.handbook.unsw.edu.au/undergraduate/courses/2020/CVEN9407/

## OBJECTIVES

Learning objectives of the course are:

- Deepen the understanding about fundamental concepts in applied statistics.
- Familiarise with econometric methods.
- Explore the state-of-the-art techniques in investigating correlation between dependent and independent

variables.

- Employ mathematical techniques to assess the quality of data and find the suitable specification for different types of datasets.
- Engage in lifelong learning, reflective thinking and self-assessment.
- Communicate effectively in verbal, written and group contexts to a professional standard.

## TEACHING STRATEGIES

The teaching strategies that will be used and their rationale. Give some suggested approaches to learning in the course.

(An example of the approaches to learning are)

| Private Study | <ul><li>Review lecture material and textbook</li><li>Do set problems and assignments</li><li>Join Moodle discussions of problems</li><li>Reflect on class problems and assignments</li><li>Download materials from Moodle</li><li>Keep up with notices and find out marks via Moodle</li></ul> |
|---|---|
| Lectures | <ul><li>Find out what you must learn</li><li>See methods that are not in the textbook</li><li>Follow worked examples</li><li>Hear announcements on course changes</li></ul> |
| Workshops | <ul><li>Be guided by Demonstrators</li><li>Practice solving set problems</li><li>Ask questions</li></ul> |
| Assessments | <ul><li>Demonstrate your knowledge and skills</li><li>Demonstrate higher understanding and problem solving</li></ul> |
| Laboratory Work | <ul><li>Hands-on work, to set studies in context</li></ul> |

## EXPECTED LEARNING OUTCOMES

*This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.*

*Example:*

After successfully completing this course, you should be able to:

| Learning Outcome | | EA Stage 1 Competencies |
|---|---|---|
| 1. | *Learning basic statistics and econometrics in transport modelling;* | *PE1.1, PE1.2, PE1.3* |
| 2. | *Identifying the properties of variables in large scale data* | *PE1.1, PE1.2, PE2.2* |
| 3. | *Complete a comprehensive statistical analysis on large data using statistical packages* | *PE1.2, PE2.2, PE2.3* |
| 4. | *By the conclusion of this course the student will be able to develop knowledge and skills in inferring statistical conclusions from large data* | *PE2.2, PE3.2, PE3.3, PE3.4* |

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

A table of lectures and workshops or practical class topics for each week, indicating the name of lecturer involved (where multiple lecturers teaching in course), online activities, such as discussion forums, and relevant readings from textbook and other reference material identified for the course.

**Term 2 2020**

| Date | Topic | Lecture Content | Demonstration Content |
|---|---|---|---|
| 04/06/2020 (Week 1) | Introduction to transport modelling Statistical inference | Basics of econometrics Review of statistics and probabilities Statistical hypothesis testing | Introduction to R |
| 11/06/2020 (Week 2) | Statistical inference Regression analysis | Two-variable regression assumptions Dummy variables | Running regression in R |
| 18/06/2020 (Week 3) | Regression analysis | Multiple regression analysis Multicollinearity Count data | Running multiple regression in R |
| 25/06/2020 (Week 4) | Regression model troubleshooting | Heteroscedasticity Autocorrelation | Heteroscedasticity and autocorrelation |
| 02/07/2020 (Week 5) | Regression Model Time Series | Time series formulations and Count Data | Running time series in R |
| 09/07/2020 (Week 6) | | *Flexibility week for all courses (non-teaching)* | |
| 16/07/2020 (Week 7) | Discrete choice | Basic definitions Choice set Logit models | Running logit with biogeme |
| 23/07/2020 (Week 8) | Discrete choice | Nested logit | Running nested logit with biogeme |
| 30/07/2020 (Week 9) | Discrete choice | Ordered logit | Running survival analysis in biogeme |
| 06/08/2020 (Week 10) | Survival analysis | Base line hazard, definition and interpretations | Estimating Cox Proportional Hazard in R |

**ASSESSMENT**

This subject has three assessment components: final exam, quizzes and assignments. The final exam is a 1.5-hour exam which includes all the covered topics in the course. The final exam is worth 40% of the overall grade.

As the second assessment component, there are five short Moodle quizzes each worth 3% of the overall

grade (15% in total). Each quiz takes 15 minutes and it is done at the beginning of classes. Three assignments on regression modelling, count data and time series, and discrete choice modelling will be provided on the due courses.

Details of the assignments are given in separate briefs.

Assignment 1 and quiz 1 – Linear regression

Assignment 2 and quiz 2 – Count and time series regression

Assignment 3 and quiz 3 – Discrete choice models

Format of the assignments:
- Have a cover letter.
- Each question starts from the top of the page
- Reference your work appropriately, if not, you may be penalized for plagiarism.
- Only PDF files are acceptable.
- You have to type your answers. Scanned sheets are NOT acceptable.
- Assignments MUST be submitted to Moodle.

Late submission of assignments results in losing 10% of the total mark of the assignment per day. So there is no point to submit if there has been 10 days after the submission date.

The pass mark in this course is 50% overall, however, students must score at least 40% in the final examination in order to qualify for a Pass in this course (double hurdle).

Supplementary Examinations for Term 2 2020 will be held on Monday 7th September – Friday 11th September (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

| PENALTIES |
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*Late submission of assignments will be penalised at the rate of 10% per day after the due time and date have expired.*

**ASSESSMENT OVERVIEW**

| Item | Available date | Weighting | Learning outcomes assessed | Assessment Criteria *(this needs to explicitly describe what students are expected to demonstrate in the task)* | Due date | Deadline for absolute fail | Marks returned |
|------|------|------|------|------|------|------|------|
| 1.Quizzes | | | | | | | |
| Quiz 1 | 18/06/2020 10:00 | 3 | Comprehensive understanding of basic statistics and probabilities | Students will be assessed based on the accuracy and validity of their submitted solutions to the questions. | 18/06/2020 10:15 | 18/06/2020 10:15 | 18/06/2020 10:15 |
| Quiz 2 | 25/06/2020 10:00 | 3 | Understanding about the basic assumptions behind linear regression models. | Students will be assessed based on the accuracy and validity of their submitted solutions to the questions. | 25/06/2020 10:15 | 25/06/2020 10:15 | 25/06/2020 10:15 |
| Quiz 3 | 02/07/2020 10:00 | 3 | Potential troubles resulting from violating the assumptions and common remedies for them. | Students will be assessed based on the accuracy and validity of their submitted solutions to the questions. | 02/07/2020 10:15 | 02/07/2020 10:15 | 02/07/2020 10:15 |
| Quiz 4 | 16/07/2020 10:00 | 3 | Time series regression and count data | Students will be assessed based on the accuracy and validity of their submitted solutions to the questions. | 16/07/2020 10:15 | 16/07/2020 10:15 | 16/07/2020 10:15 |
| Quiz 5 | 06/08/2020 10:00 | 3 | Discrete choice modelling | Students will be assessed based on the accuracy and validity of their submitted solutions to the questions. | 06/08/2020 10:15 | 06/08/2020 10:15 | 06/08/2020 10:15 |

| 2. Assessments | | | | | | | |
|---|---|---|---|---|---|---|---|
| Assignment 1 | 11/06/2020 | 15 | Linear regression | Hands on project with real world data | 02/07/2020 08:00 | Refer to penalties | 16/07/2020 |
| Assignment 1 | 25/06/2020 | 15 | Time series regression and count data | Hands on project with real world data | 16/07/2020 08:00 | Refer to penalties | 30/07/2020 |
| Assignment 1 | 16/07/2020 | 15 | Discrete choice modelling | Hands on project with synthesised data | 06/08/2020 08:00 | Refer to penalties | 20/082020 |
| 3. Final Exam | | 40 | | | | | |

**RELEVANT RESOURCES**

Material essential for this course is provided in lecture notes available through Moodle.
Suggested references are listed below:
- Gujarati, D.N. (2004) Basic Econometrics, 4th Edition, McGraw Hill
- Casella, G., and R.L. Berger (2001) Statistical Inference, 2nd Edition, Duxbury Press
- Train, K. (2009) Discrete Choice Methods with Simulation, 2nd Edition, Cambridge University Press
- Washington, S. P., M. G. Karlaftis and F. L. Mannering (2011) Statistical and Econometric Methods for Transportation Data Analysis, CRC Press Taylor and Francis Group
- Alain Zuur, Elena N. Ieno, Erik Meesters (2009) A Beginner's Guide to R, Springer
- Randall Schumacker, Sara Tomek (2013) Understanding Statistics Using R, Springer

**DATES TO NOTE**

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

**PLAGIARISM**

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

**ACADEMIC ADVICE**

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: The Nucleus: Student Hub
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

**Appendix A: Engineers Australia (EA) Competencies**

*Stage 1 Competencies for Professional Engineers*

| | **Program Intended Learning Outcomes** |
|---|---|
| **PE1: Knowledge and Skill Base** | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals |
| | PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing |
| | PE1.3 In-depth understanding of specialist bodies of knowledge |
| | PE1.4 Discernment of knowledge development and research directions |
| | PE1.5 Knowledge of engineering design practice |
| | PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice |
| **PE2: Engineering Application Ability** | PE2.1 Application of established engineering methods to complex problem solving |
| | PE2.2 Fluent application of engineering techniques, tools and resources |
| | PE2.3 Application of systematic engineering synthesis and design processes |
| | PE2.4 Application of systematic approaches to the conduct and management of engineering projects |
| **PE3: Professional and Personal Attributes** | PE3.1 Ethical conduct and professional accountability |
| | PE3.2 Effective oral and written communication (professional and lay domains) |
| | PE3.3 Creative, innovative and pro-active demeanour |
| | PE3.4 Professional use and management of information |
| | PE3.5 Orderly management of self, and professional conduct |
| | PE3.6 Effective team membership and team leadership |