

## SURV6350: Analysis of Observations

Callaghan

Semester 1 - 2024



THE UNIVERSITY OF  
NEWCASTLE  
AUSTRALIA

## OVERVIEW

<b>Course Description</b>	This course extends students' understanding of probability and statistical inference. This is applied to the least squares adjustment of survey and levelling networks as well as to the estimation of the precision of the computed coordinates or heights. In addition, the course covers the application of least squares modelling to various areas of relevance to surveyors.
<b>Academic Progress Requirements</b>	Nil
<b>Requisites</b>	This course has similarities to SURV3350. If you have completed SURV3350 you cannot enrol in this course.
<b>Assumed Knowledge</b>	MATH1110, MATH1120.
<b>Contact Hours</b>	<b>Callaghan Computer Lab</b> Face to Face On Campus 1 hour(s) per week(s) for 11 week(s) The above distribution of contact hours may alter on a weekly basis and will be confirmed in the course outline handed to students in Week 1. <b>Field Study</b> Face to Face On Campus 4 hour(s) per week(s) for 1 week(s)  <b>Lecture</b> Face to Face On Campus 3 hour(s) per week(s) for 13 week(s) starting Week 1 The above distribution of contact hours may alter on a weekly basis and will be confirmed in the course outline handed to students in Week 1. <b>Tutorial</b> Face to Face On Campus 1 hour(s) per week(s) for 13 week(s) starting Week 1
<b>Unit Weighting Workload</b>	10 Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

# COURSE OUTLINE

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# CONTACTS

**Course Coordinator**     **Callaghan**  
Dr Mehdi Khaki  
Mehdi.Khaki@newcastle.edu.au  
(02) 4921 6626  
Consultation: EA128

**Teaching Staff**             Other teaching staff will be advised on the course Canvas site.

**School Office**                **School of Engineering**  
EAG02  
EA Building  
Callaghan  
Seng-admin@newcastle.edu.au  
9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

# SYLLABUS

**Course Content**

- Statistics applied to surveying.
- Sampling distributions, confidence intervals, statistical tests
- Least squares adjustment by the condition and parametric methods.
- Applications of least squares to basic surveying problems.
- Propagation of variance.
- Absolute and relative error ellipses.
- Pre-analysis of surveys, industrial applications of least squares, computer packages.

**Course Learning Outcomes**

**On successful completion of this course, students will be able to:**

1. Document the adjustment of field data in an analytical form
2. Identify appropriate solution techniques for adjustment problems
3. Solve surveying and levelling network adjustment problems
4. Analyse and interpret network adjustment results
5. Assess the precision of network adjustment outcomes
6. Apply the concepts of statistics to surveying adjustment problems
7. Conduct research and apply findings to practical problems

**Course Materials**

**Lecture Materials:**

- Vol. 1: Least squares estimation, propagation of variance, error ellipses
- Vol. 2: Probability and statistical inference
- Additional notes that replace parts of Chapters in lecture notes

**Note**

- All notes are available on Canvas.
- The Vol.1 and Vol.2 are available for purchase on Callaghan Campus.
- Students should be aware that the lecture notes Vol.1 and Vol.2 will be used as reference readings. The content that will be delivered is indicated in this course outline and is, in particular, listed in the timetable below.

**Other Resources:**

- Software Excel, Matlab and StarNet.

**Recommended Text:**

- Wolf, P.R. and C. Ghilani (1997), Adjustment computations: Statistics and least squares in surveying and GIS. John Wiley and Sons. Inc.: New York, NY.
- Harvey, B.R. (2006) Practical Least Squares and Statistics for Surveyors, School of Surveying and Spatial Information Systems, The University of New South Wales, UNSW Sydney, NSW 2052, Australia.

# ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Assignment 1 - Probability and the least squares adjustment	As notified on the course Canvas site.	Individual	10%	1, 2, 3, 4
2	Assignment 2 - Statistics and the least squares adjustment	As notified on the course Canvas site.	Individual	25%	1, 2, 3, 4, 5, 6
3	Assignment 3 - Statistics and error analysis	As notified on the course Canvas site.	Individual	15%	1, 2, 3, 4, 5, 6, 7
4	Formal Exam		Individual	35%	1, 2, 3, 4, 5, 6
5	Report - Research investigation	As notified on the course Canvas site	Individual	15%	1, 2, 3, 4, 5, 6, 7

**Late Submissions**

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

## Assessment 1 - Assignment 1 - Probability and the least squares adjustment

**Assessment Type Description**

Written Assignment

**Weighting**

10%

**Due Date**

As notified on the course Canvas site.

**Submission Method**

Online

**Assessment Criteria**

Understand the concepts and achieve correct solutions. Perform computations using correct data.

**Return Method**

**Feedback Provided**

Online - .

## Assessment 2 - Assignment 2 - Statistics and the least squares adjustment

**Assessment Type Description**

Written Assignment

Students will perform a field survey by teamwork, from which the measurements will be submitted and also used in assignment 2. Questions are related to the least squares adjustment of the measurements using Excel and check the results using software StarNet. Field survey and assignment questions takes 5% and 20% of marks, respectively. Field survey involves group work, but assignment should be individually completed.

**Weighting**

25%

**Due Date**

As notified on the course Canvas site.

**Submission Method**

Online

**Assessment Criteria**

Understand the concepts and achieve correct solutions. Perform computations using correct data.

**Return Method**

Feedback Provided Online - .

### Assessment 3 - Assignment 3 - Statistics and error analysis

**Assessment Type** Written Assignment  
**Description** Assignment 3 will continue Excel computations of assignment 2, but mainly focuses on the quality of least squares estimates, error analysis and statistical tests. Some output results from assignment 2 can be directly used in assignment 3. The results should be checked against those from StarNet.  
**Weighting** 15%  
**Due Date** As notified on the course Canvas site.  
**Submission Method** Online  
**Assessment Criteria** Understand the concepts and achieve correct solutions.  
**Return Method**  
**Feedback Provided** Online - .

### Assessment 4 - Formal Exam

**Assessment Type** Formal Examination  
**Description**  
**Weighting** 35%  
**Due Date**  
**Submission Method** Formal Exam  
**Assessment Criteria**  
**Return Method**  
**Feedback Provided**

### Assessment 5 - Report - Research investigation

**Assessment Type** Report  
**Purpose** Develop advanced research, analytical, writing and presentation skills.  
**Description** Students will research a specific topic related to the course. The lecturer will provide a topic for the research task, but in consultation with the lecturer, the student can propose an alternative topic. Any alternative topic must be agreed and approved by the lecturer prior the end of Week 3 of semester. The student will then investigate the topic, which may include conducting literature reviews, analysing data, examination of case studies, etc. Through this process, the student will gain specific knowledge about the topic, and develop an understanding of future trends in this area.  
  
The student will also present a 15 minute presentation to the class and/or the surveying academic staff.  
**Weighting** 15%  
**Due Date** As notified on the course Canvas site  
**Submission Method** Online  
Specific Location  
**Assessment Criteria**  
**Return Method**  
**Feedback Provided** Online - .

## ADDITIONAL INFORMATION

### Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of

		a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

\*Skills are those identified for the purposes of assessment task(s).

**Communication Methods**

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.

**Course Evaluation**

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

**Oral Interviews (Vivas)**

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the [Oral Examination \(viva\) Procedure](#). In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the [Student Conduct Rule](#).

**Academic Misconduct**

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to <https://policies.newcastle.edu.au/document/view-current.php?id=35>.

**Adverse Circumstances**

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:

<https://policies.newcastle.edu.au/document/view-current.php?id=236>

**Important Policy Information**

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at <https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures> that support a safe and respectful environment at the University.

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*This course outline was approved by the Head of School on the 29/01/2024. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.*

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