# ACE Network Subject Information Guide

## Data 5441 – Networks and High-Dimensional Inference

## Semester 2, 2020

## Administration and contact details

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|---|---|
| **Host Department** | School of Mathematics and Statistics |
| **Host Institution** | **The University of Sydney** |
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| **Name of lecturer** | Eduardo G. Altmann |
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| **Homepage** | Www.maths.usyd.edu.au |
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| **Name of Honours coordinator** | Uri Keich |
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## Subject details

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| **Handbook entry URL** | **https://sydney.edu.au/courses/units-of-study/2020/data/data5441.html** |
| **Subject homepage URL** | **http://www.maths.usyd.edu.au/u/PG/DATA5441/index.html** |
| **Honours student hand-out URL** | |
| | |
| **Start date:** | **25/02/2020** |
| **End date:** | 26/06/2020 |
| **Contact hours per week:** | 4 |
| **Lecture day and time:** | Tuesdays 9-11am; Wednesdays 9-11am |
| | |
| **Description of electronic access arrangements for students (for example, WebCT)** | Zoom. Discussions and codes on: http://www.edstem.org |

## Subject content

### 1. Subject content description

Click here to enter text.

2. **Week-by-week topic overview**

- **1 (24/2) Networks, data science, and high dimensions**
- 2 (2/3) Centrality measures
- 3 (9/3) Random Graph Models
- 4 (16/3) Random Graphs vs. Complex Networks
- 5 (23/3) Mechanistic models: small world and preferential attachment
- 6 (30/3) Exponential Random Graph Models
- 7 (6/4) Community Detection in Networks

(Mid-semester break)

- 8 (20/4) Stochastic Block Models
- 9 (27/4) Inference in high dimensions
- 10 (4/5) Network Resilience
- 11 (11/5) Cascades and spreading in Networks
- 12 (18/5) Dynamical systems in Networks
- 13 (25/5) Project presentation and Exam preparation

3. **Assumed prerequisite knowledge and capabilities**

**Linear algebra (matrices, eigenvalues, etc.); introductory concepts in statistics (statistical models, inference); a programming language.**

4. **Learning outcomes and objectives**

Develop analytical, numerical, and modeling skills that help to connect abstract mathematical ideas to real-world systems represented as networks.

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|---|---|
| LO1 | provide solutions to problems through the application of abstract mathematical theory and computational methods. |
| LO2 | transmit information and skills to others through collaborative computing projects. |
| LO3 | summarize, interpret, and differentiate mathematical and computational models in network science. |
| LO4 | evaluate critically the applicability of mathematical models to a given network data. |
| LO5 | create new computational and mathematical models for networks. |
| LO6 | develop new strategies to communicate research results to specialist and non-specialist audiences. |
| LO7 | synthetise and apply mathematical and computational models to problems and data in new contexts. |

**AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):**

**Learning taxonomy Blooms**

| # | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 |
|---|---|---|---|---|---|---|---|
| T1 | | | | | | | |
| T2 | | | | | | | |
| T3 | Y | Y | | | | | |
| T4 | | | Y | | | | |
| T5 | | | | Y | | | Y |
| T6 | | | | | Y | Y | |

**Learning taxonomy Reference Blooms**

| # | Taxonomy description | Taxonomy component |
|---|---|---|
| T1 | Remembering | Level of Thinking - Cognitive |
| T2 | Comprehending | Level of Thinking - Cognitive |
| T3 | Applying | Level of Thinking - Cognitive |
| T4 | Analysing | Level of Thinking - Cognitive |
| T5 | Evaluating | Level of Thinking - Cognitive |
| T6 | Creating | Level of Thinking - Cognitive |

## 5. Learning resources

All resource are listed in the UoS webpage.

## 6. Assessment

| **Exam/assignment/classwork breakdown** | | | | | |
|---|---|---|---|---|---|
| **Exam** | 40 % | **Assignments** | 30 % | **Class work** | 30 % |
| | | | | | |
| **Assignment due dates** | | **March 3** | March 10 | March 17 | March 24, etc. |
| | | | | | |
| **Approximate exam date** | | | | June 8 | |

# Institution Honours program details

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|---|---|
| **Weight of subject in total honours assessment at host department** | **1 out of 4 UoS** |
| **Thesis/subject split at host department** | |
| **Honours grade ranges at host department:** | |
| **H1** | **80-100 %** |
| **H2a** | 75-79 % |
| **H2b** | 70-74 % |
| **H3** | 65-69 % |