ICE-EM Access Grid Room Project

Subject Information Form

Administration

1. Department and institution

   School of Mathematical and Geospatial Sciences
   RMIT University

2. Subject name and code

   Complex Networks: theory and analysis
   (MATH2181, MATH2180, MATH2182, MATH2208, MATH2207)

3. Handbook entry URL, subject homepage URL, host honours student hand-out URL

   - Handbook entry URL
     http://www.rmit.edu.au/browse;ID=BH010
   - Subject homepage URL
     http://www.rmit.edu.au/browse;ID=BH010
   - Host Honours student hand-out URL
     http://www.rmit.edu.au/browse;ID=BH010

4. **Lecturer** name and contact details

Name:	Dr Stephen Davis
Phone:	03 9925 2278
Email:	stephen.davis@rmit.edu.au
Homepage:	http://www.rmit.edu.au/browse;ID=ke7g19jela4

5. **Honours coordinator** name and contact details

Name:	Dr Stephen Davis
Phone:	03 9925 2278
Email:	stephen.davis@rmit.edu.au

6. Start date, end date, number of teaching weeks

Start date:	29th July
End date:	9th October
Number of teaching weeks:	10

7. Contact hours per week

There will be two 1-hour lectures per week for 10 weeks.

8. Description of electronic access arrangements for students (for example, WebCT)

NA

Academic

1. Overview of subject content

   This course is designed for Honours students of mathematics and statistics and will examine the structure and function of networks. The course will introduce students to the analysis of real networks that arise in areas such as biology and epidemiology but will emphasise the analytical techniques used to classify and characterise networks from all disciplines. The course will begin with a short, focused study of graph theory as the mathematical basis for network science.

   Note: the assessment of this course will often involve applying the techniques introduced in the lectures to real networks and hence students should be comfortable with programming; student will preferably have some experience working with the statistical software R (http://www.r-project.org/).

2. Detailed syllabus

   Week 1: Graph definitions; paths and circuits; connectedness and components; betweenness and closeness; diameter, radius, centrality; adjacency matrix; path matrix; Laplacian matrix.

   Week 2: Clustering coefficient; cyclic coefficient; spectral properties of graphs; types of graphs; types of networks.

   Week 3: Topological structure of networks; degree sequence; degree distribution; entropy and energy; the Gini coefficient.

   Week 4: Regular networks; *k*-regular networks; binary tree network; toroidal networks; hypercube networks.

   Week 5: Small-world networks; the Watts-Strogatz procedure; properties of small-world networks.

   Week 6: Scale-free networks; network growth models; the rich get richer; the good get richer; properties of scale-free networks.

   Week 7: Random networks; Erdos-Renyi (ER) algorithm; Gilbert, ER and anchored random networks; properties of random networks.

   Week 8: Further network models; the configuration model.

   Week 9: Spatial networks; bond percolation; site percolation; long-range percolation; properties of spatial networks.

   Week 10: Community detection; subgraphs and motifs.

3. Detailed breakdown of assumed prerequisite knowledge, including host prerequisite subject URLs

There is no prerequisite knowledge but the assessment of this course will often involve applying the techniques introduced in the lectures to real networks and hence students should be comfortable with programmin; student will preferably have some experience working with the statistical software R (http://www.r-project.org/).

4. Assessment

(i) Exam/assignment/class work breakdown

Exam	60 %
Assignment	40 %
Class work	0 %

(ii) Assignment due dates

- 6th of September, 2013
- 4th of October, 2013

(iii) Approximate exam date

Take-home exam: October 28th - November 1st, 2013

5. Required student resources

- Text/printed notes

  None required.

- Software (local access)

  The statistical software R.

Institutional Honours Details

1. Weight of subject in total honours assessment at host department

   12.5%

2. Thesis/subject split at host department

   25% thesis
   75% course work (6 courses)

3. Honours grade demarcators at host department

   - H1 = 80-100 %
   - H2a = 75-79 %
   - H2b = 70-74 %
   - H3 = 65-69 %