Networks and Systemic Risk (COMP0046)

Description

Aims:
Overall, the module represents an introduction to the topic of systemic risk and stress propagation in networked systems. The first part of the module presents a general introduction to complex networks and dynamical processes; the second part is focused on specific applications to the study of contagion in financial networks.

Learning outcomes:
On successful completion of the module, a student will be able to:
1. compute network metrics and provide a statistical description of networks;
2. analyse dynamical processes on networks;
3. implement simple algorithms for the analysis of financial contagion.

Content:
Introduction to complex networks:
- Basic concepts of networks (graphs, subgraphs, adjacency matrix, undirected, directed and weighted networks), common metrics (degree, centrality, clustering, degree distribution, excess degree distribution, mixing patterns, real world examples);
- Network models (random networks, configuration model, small world, preferential attachment);
- Maximum-entropy networks;

Collective behaviour:
- Emergence of a giant cluster. Robustness to random and targeted attacks;
- Epidemic spreading processes on networks;
- Cascade processes on networks;

Application to interbank networks and systemic risk:
- Interbank networks and their properties;

Key information

Year: 2019/20
Credit value: 15 (150 study hours)
Delivery: PGT L7, Campus-based
Reading List: [View on UCL website]
Tutor: Dr Fabio Caccioli
Term: Term 2
Timetable: [View on UCL website]

Assessment

- Written examination (main exam period): 50%
- Report: 25%
- Written examination (departmentally managed): 25%

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- Furfine default algorithm and cascades of defaults;
- Clearing vector of payments and the Eisenberg-Noe model;
- Distress propagation in absence of default: DebtRank;
- Overlapping portfolios and price mediated contagion;
- Leverage cycles;

**Requisites:**

In order to be eligible to select this module, a student must be registered on a programme for which it is a formally-approved option or elective choice AND must have familiarity with basic probability and calculus.

The Coursework requires basic programming skills.