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;
- 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;

**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%

**Find out more**

For more information about the department, programmes, relevant open days and to browse other modules, visit [ucl.ac.uk](http://ucl.ac.uk).

Disclaimer: All information correct as of June 2019. Please note that aspects of the module may be subject to change. UCL will make best efforts to inform applicants of major changes.
-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.