**复杂网络与图形信号处理课程教学大纲**

课程代码：85190200

课程中文名称：复杂网络与图形信号处理

课程英文名称：Complex Networks with Graph Signal Processing

学分：2.0 周学时：2.0-0.0

面向对象：

预修要求：

一、课程介绍

（一）中文简介

复杂的网络模型通过网络结构明确地解释了大规模系统中的异构交互。本课程为学生提供了了解网络的工具，以及如何使用它来分析复杂的系统。此外，我们还将讨论图形信号处理(GSP)的相关领域，以及它如何利用网络来捕获数据中的结构交互。本课程将有1个期末考试和1个(30分钟)的展示报告。

（二）英文简介

Complex network models explicit account for heterogeneous interactions in large-scale systems via network structures. This interdisciplinary course provides students with the tools to understand networks and how it can be used to analyze complex systems. In addition, we will cover the related field of graph signal processing (GSP), which uses networks to capture structure interactions in data. The course will have 1 final exam and 1 (30 minutes) presentation based on paper reviews.

Outline:

Chapter 1: Introduction to basic graph theory

Chapter 2: Random graph models and network centralities

Chapter 3: Graph clustering, graph cuts, graph partitioning algorithm I

Chapter 4: Graph partitioning algorithm II

Chapter 5: Graph sampling and visualization

Chapter 6: Time-varying graphs

Chapter 7: Percolation, dynamic process on graphs

Chapter 8: Epidemics model, scaled SIS process

Chapter 9: Graph signal processing

Chapter 10: Graph filter/ Exam/ Presentation

课程安排（假定以2周/32课时安排）:

第1讲:基本图论介绍

第2讲:随机图形模型和网络中心度

第3讲:图形聚类，图形切割和图形分割算法I

第4讲:图形分割算法II

第5讲:图形采样和可视化

第6讲:时变图表

第7讲:渗透，图形的动态过程

第8讲:流行病模型，按比例缩小SIS的过程

第9讲:图形信号处理。

第10讲:图形过滤器/考试/演示

# 1. course requirements

Course requires background in probability and linear algebra. Students are expected by the end of the course to

## A. Understand the open research questions in complex networks and graph signal processing

## B. Be able to use tools from complex network analysis in existing research work

## C. Be able to formulate new research questions in complex network and graph signal processing

2．课程要求

课程要求学生具有概率论和线性代数的背景知识。课程结束时，学生们将预期达到：

A. 了解复杂网络和图形信号处理中的开放性研究问题；

B. 能够在现有的研究工作中使用复杂网络分析工具；

C. 能够在复杂的网络和图形信号处理中提出和准备一些新的研究问题；

# 2. Grading (approximate)

Final: 50%

Paper reviews/presentation: 50%

# 3. REFERENCE BOOKS （参考教材）

1) Networks: An Introduction by MEJ Newman
2) Dynamical Processes on Complex Networks by Alain Barrat and Marc Barthélemy