Random graphs and ranking
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Network science is an exciting multidisciplinary research area that studies the network phenomenon and its applications ranging from web search and transportation networks to understanding the structure of social connections, and processes on networks such as infection and information spreading.

The networks are often chaotic and highly dynamic. Mathematics helps us to understand their structure and predict their development. We start this course with Introduction, in which we cover most essential surprising properties shared by complex networks on entirely different nature. This includes the famous small-world phenomenon, scale-free phenomenon and friendship paradox. Next, we will cover Configuration Model (CM) – one of most natural and essential random graph models for networks. We will discuss under which conditions CM results in a simple graph, which is important because all real world graphs are simple. Finally, we will discuss the PageRank algorithm, which was one of most important factors in success of Google, and have a quick look at recent mathematical results and challenges in its analysis.

The course consists of 6 lectures, each 45 minutes. The overview of the course is as follows.

Lectures 1-2: Complex networks and their properties
Exercises: 1-8 (Exercises 1 and 2 are easy and can be skipped)

Lectures 3-5: Complex networks and their properties
Exercises: 9-11

Lecture 6: PageRank
Exercises: 12

Study material. In the lectures 1-5 we use the book book 'Random Graphs and Complex Networks' by Remco van der Hofstad, chapter 1 and 7.

`http://www.win.tue.nl/~rhofstad/NotesRGCN.pdf`