

Syllabus for
cmpe556 Complex Networks

3 (3+0+0) ECTS 6

2019 Spring

Catalog Definition

Random, Regular, Scale-Free, Small-World networks. Empirical studies, metrics, models and applications of Complex Networks. Clusters, Community Detection, Same Complex Networks: Social, Biological Networks, Internet, WWW.

Web Site

<http://www.cmpe.boun.edu.tr/courses/cmpe556>.

General Information

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|------------------|---------------------------------|
| Instructor: | Haluk O. Bingol |
| TA: | none |
| Student TA: | none |
| Course Schedule: | WWW 345 @BM A5 |
| PS Schedule: | none |

Grading

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|-------------------------------|------|
| Midterm: | 35 % |
| Final (Project): | 50 % |
| Attendance and Contributions: | 15 % |

Text Book

- none

Reference Books

- Networks - An introduction, Newman, *Oxford*, 2010, [T57.85 .N523 2010].
- The Structure and Dynamics of Networks, Newman, Barabasi and Watts, *Princeton*, 2006, [TK5105.5 .N485 2006].

Course Outline

Course is based on paper reading, presentations and discussions. A term project is designed, implemented, presented and reported as a paper.

Teaching Syllabus

Basic definitions and metrics: walks, paths, cycles, connectedness, trees. Social networks and centrality measures: degree and eigenvector centrality, closeness, betweenness. The collaboration network of movie actors. Erdős-Renyi random graph models: degree distribution, giant connected component, characteristic path length. Small-world networks. Six degrees of separation and the nervous system of *C.elegans*. The clustering coefficient. The World Wide Web. Scale-free networks. Random graphs with a given degree sequence. The Molloy and Reed criterion. Citation networks and the linear preferential attachment. The Barabasi-Albert model and other models of growing graphs. Degree correlations. The Internet and other assortative and disassortative networks. Motif analysis and network superfamilies. Community structures: spectral bisection and hierarchical clustering methods. The modularity and Girvan-Newman algorithm.