“Characterizing and Detecting Cohesive Subgroups with Applications to Social and Brain Networks”

by **Zeynep Ertem**, Texas A&M

Abstract:

Many complex systems involve entities that interact with each other through various relationships (e.g., people in social systems, neurons in brains). These entities and interactions are commonly represented using graphs due to several advantages. This research is about developing theory and algorithms for novel methods in graph theory and optimization, and their applications to social and brain networks. Specifically, this talk focuses on finding the cohesive subgroups in these networks.

Clique relaxations based on several network metrics are used in classical models of cohesive subgroups in network analysis. In this talk, first, I will introduce a new clique relaxation model based on clustering coefficient using mixed integer programming. I will also describe a novel-clustering algorithm based on this clique relaxation model and show its application to several social networks.

Second I will briefly talk about a special case to this clique relaxation model and its connections to canonical optimization problems like maximum clique problem, maximum independent set, and set covering problem. I will also talk about theoretical properties and practical algorithms to solve this problem optimally and approximately which involves branch and bound and heuristic based approaches.

Finally, I will talk about our study in collaboration with Texas Institute of Preclinical Studies (TIPS), that uses clique relaxation models to explore a new experimental data to understand the effect of concussion on animal brains. I will show cohesive and robust clustering analysis of animal brain networks utilizing this unique and novel experimental data.

Bio:

Zeynep Ertem is a graduating PhD student at Texas A&M University in the Department of Industrial and Systems Engineering. Before joining Texas A&M University, she obtained her B.S. degree from Industrial Engineering Department of Middle East Technical University/Ankara with a minor in Mathematics Department. Her research interests include network optimization, graph theory, approximation algorithms, and health systems optimization.