Discrete Mathematics Seminar

Illinois State University

2:00–2:50 pm, December 5@STV 401

Speaker: Jo Ellis-Monaghan, Saint Michael's College

Graphs and Knots and DNA Self-assembly

Applications of immediate concern, such as graph drawing and computer chip layout problems, random graph theory and modeling the internet, graph connectivity measures and ecological systems, etc. have driven some of the most interesting questions in the field of graph theory. Currently, scientists are engineering self-assembling DNA molecules to serve emergent applications in biomolecular computing, nanoelectronics, biosensors, drug delivery systems, and organic synthesis. Often, the self-assembled objects, e.g. lattices or polyhedral skeletons, may be modeled as graphs. Thus, these new technologies in self-assembly are now generating fascinating and challenging new design problems for which graph and knot theory are natural tools. We will present some new applications in DNA self-assembly and describe some of the graph- and knot-theoretical design strategy problems arising from them. We will see how finding optimal design strategies leads to developing new algorithms for graphs, addressing new computational complexity questions, and finding new graph invariants corresponding to the minimum number of components necessary to build a target structure under various laboratory settings. We will also see how the problem of knotting can confound assembly. This is a rich area for open problems, interdisciplinary collaborations, and involvement for all levels of investigators, especially students.