Computer Science Colloquium

Speaker: Myra Cohen

Date: Monday, March 19, 2018

Time: 4:10 p.m.

Location: 223 Atanasoff Hall

From Theory to Practice and Back: A Tale of Combinatorial Designs, Optimization, and Search in Software Testing

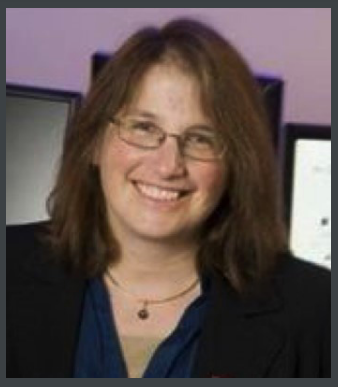
Software is embedded in our daily lives, running business and home infrastructures, driving cars, and continuously, sometimes autonomously, making important decisions that impact a broad set of stakeholders. Yet, software is imperfect and prone to failures, potentially causing billions of dollars in financial losses each year. As such, research in software testing, has focused on developing novel ways to more efficiently and effectively find faults in programs before they escape into the field. The complexity and richness of modern programs, has led to the need for adaptation of techniques borrowed from other disciplines. For instance, there is a large community of researchers using SAT solving, evolutionary search-based optimization techniques, and learning to generate, select and prioritize test cases. While we can simply use these methods as tools, there is also an opportunity to extend and improve them based on what we learn from applying (or failing to apply) them to real systems. Software is an exciting domain for study, because it lacks the structure and symmetry of many synthetic problems.

In this talk I discuss several examples of how we have used combinatorial design theory, optimization and search for software test generation, and show how what we have learned in that process can potentially lead to novel research directions in those fields from which we have borrowed. First, I show how we can use combinatorial designs to improve software testing in practice, while using the same algorithms to improve bounds of theoretical interest to mathematicians. I then illustrate how the need for handling dependencies between software configuration options in real systems led to new constrained combinatorial objects and algorithms, and demonstrate how this led to a tight interleaving of heuristic search and SAT. I then present a hyper-heuristic search for software test generation that automatically learns and adapts over time, while producing potentially rich information about the underlying problem search space. Finally, I present some emerging software testing domains that we arestudying, including some that are safety critical, where we are applying designs, optimization and search, to continue this interplay between practice and theory.

IOWA STATE UNIVERSITY

Department of Computer Science

www.cs.iastate.edu



Myra Cohen is a Susan J. Rosowski Professor in Computer Science and Engineering at the University of Nebraska-Lincoln where she is a member of Laboratory for Empirically-based Software Quality Research and Development, ESQuaReD. Her research expertise lies in testing of complex software such as highly-configurable software, software product lines or those with graphical user interfaces, and in search-based software engineering. She received her Ph.D. from the University of Auckland, New Zealand, and was the recipient of an NSF CAREER award, an AFOSR Young Investigator Award, and has received 2 ACM distinguished paper awards. She is currently an ACM Distinguished Scientist. She serves on the steering committee of the IEEE/ACM International Conference on Automated Software Engineering, ESEC/FSE, and the International Conference on Software Testing. She is currently serving as the program co-chair for ICST 2019 and ESEC/FSE 2020. She has served multiple organizational roles in software engineering conferences, and was the general chair of Automated Software Engineering in 2015.