

NATIONAL UNIVERSITY OF SINGAPORE

School of Computing

C S S E M I N A R

Title: **Constraint Programming on Infinite Data Streams**

Speaker: Professor Jimmy Lee
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Chaired by: Dr Yap Hock Chuan, Roland, Associate Professor, School of Computing
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Abstract:

Classical constraint satisfaction problems (CSPs) are commonly defined on finite domains and find applications in timetabling, resource allocation and combinatorial search problems. In many real-life problems, however, quantities can evolve over time while adhering to rules and laws. Such quantities can actually take infinite sequences of values over discrete time points. In this talk, we propose constraint programming on infinite data streams, which provides a natural way to model constrained time-varying problems. In our framework, variable domains are specified by ω -regular languages. We introduce special stream operators as a basis to form stream expressions and constraints. Stream CSPs have infinite search space. We propose a search procedure that can recognize and avoid infinite search over duplicate search space. The solution set of a stream CSP can be represented by a Buchi automaton allowing stream values to be non-periodic. Consistency notions are defined to reduce the search space early. A prototype solver allows us to solve such interesting problems as eventually still life problem, traffic light control, jazzy elevator music generation, declarative specification and solving of the 15-puzzle, improvised juggling patterns, and video game engine synthesis. As diverse as these applications are, they share similar characteristics as controller specification and synthesis. Last but not least, we demonstrate how the solution automaton of a stream CSP can be used to control robotic hardware in real-time and as game engines of "Game and Watch" games.

Biodata:

Jimmy Lee obtained both his BMath (Hons) and MMath degrees at the University of Waterloo, and completed his doctoral studies at the University of Victoria. Upon graduation, he joined The Chinese University of Hong Kong, where he is now Professor in the Department of Computer Science and Engineering. His

research focuses on the theory and practice of constraint satisfaction and optimization with applications in scheduling, resource allocation, and combinatorial problems.