Special two-day course

``Selected topics in graph-oriented problems''

Dept. of System Design, Tokyo Metropolitan University
organized by Professor Naoyuki Kubota

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Instructor:

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Synopsis:

In this two-day lecture, we discuss the following topics:

(a) Constrained shortest-path problems;
(b) Cyclic scheduling;
(c) Matching in a graph (if the time permits).

For topic (a), we compare two representative approaches: (1) search through policies from the top of the ranking list for finding the best policy that first satisfies the imposed constraint; and (2) augment the state space appropriately for a dynamic programming (DP) algorithm to deal with the newly-added constraint. In deterministic cases, both ranking and state augmenting DP procedures yield the "same" optimal solution to the posed constrained problem because *the policy and the sequence of decisions represent the same optimal solution*. In stochastic cases, however, those two approaches end up with different policies due to stochastic state transitions; typically, the state-augmenting DP obtains an optimal feedback policy, which is better than the best constraint-satisfying policy in the ranking list obtainable from the original unconstrained stochastic process. For approach (1), we introduce the Dreyfus method for ranking top K best paths.

For topic (b), we consider a cyclic staffing problem in relation to the minimum mean cycle problem in a directed graph (digraph). For finding the best mean cycle in a digraph, we first describe a straightforward idea based on the Floyd-Warshall algorithm, and then consider how to improve it.

If the time permits, we discuss various matching problems, starting with *bipartite matching*, a representative basic problem in topic (c).