CONSTRAINED CONTINUOUS-TIME MARKOV DECISION PROCESSES IN POLISH SPACES

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Abstract: This talk concerns with continuous-time constrained Markov decision processes (MDPs) in the class of *history-dependent* randomized policies. The transition rates may be *unbounded*, the reward and costs are admitted to be *unbounded from above and from below*, and the state and action spaces are Polish spaces. The optimality criterion to be maximized is expected discounted rewards, and the constraints can be imposed on expected discounted costs. First, we give conditions for the non-explosion of underlying processes and the finiteness of the discounted criteria. Second, by using a technique of occupation measures, we prove that the constrained optimality of the continuous-time MDPs can be transformed to an *equivalent* optimality problem over a class of probability measures. Based on the equivalent optimality problem and a so-called $\bar{w}$-*weak convergence* of probability measures developed here, we show the existence of a constrained-optimal policy. Third, by providing a linear programming (LP) formulation of the equivalent optimality problem and its dual problem we show the solvability of constrained-optimal policies, prove that the strong duality condition holds, and further construct a sequence of functions which approximates the constrained optimal reward value. Finally, we use an example to illustrate the main results.