

Black-box Testing Liveness Properties of Partially Observable Stochastic Systems

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Abstract: We study black-box testing for stochastic systems and arbitrary omega-regular specifications, explicitly including liveness properties. We are given a finite-state probabilistic system that we can only execute from the initial state. We have no information on the number of reachable states, or on the probabilities; further, we can only partially observe the states. The only action we can take is to restart the system. We design restart strategies guaranteeing that, if the specification is violated with nonzero probability, then w.p.1 the number of restarts is finite, and the infinite run executed after the last restart violates the specification. This improves on previous work that required full observability. We obtain asymptotically optimal upper bounds on the expected number of steps until the last restart. We conduct experiments on a number of benchmarks, and show that our strategies allow one to find violations in Markov chains much larger than the ones considered in previous work.

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