

## Approximating Optimum Online for Online Capacitated Allocation

*Thursday, September 26, 2024 4:15 PM (45 minutes)*

We study online capacitated resource allocation, a natural generalization of online stochastic max-weight bipartite matching. This problem is motivated by ride-sharing and Internet advertising applications, where online arrivals may have the capacity to serve multiple offline users. Our main result is a polynomial-time online algorithm which is  $(0.5+c)$ -approximate to the optimal online algorithm for  $c=0.0115$ . This can be contrasted to the (tight) 0.5-competitive algorithms to the optimum offline benchmark from the prophet inequality literature. Optimum online is a recently popular benchmark for online Bayesian problems which can use unbounded computation, but not “prophetic” knowledge of future inputs. A key technical challenge in deriving our guarantee is bounding the positive correlation among users introduced when rounding a LP relaxation online. Unlike in the case of unit capacities, this positive correlation is unavoidable for guarantees beyond 0.5. Conceptually, our results show that the study of optimum online as a benchmark can reveal problem-specific insights that are irrelevant to competitive analysis.

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**Session Classification:** Afternoon Session