

Greedy Algorithm for Multiway Matching with Bounded Regret

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We consider a finite horizon online resource allocation/matching problem where the goal of the decision maker is to combine resources (from a finite set of resource types) into feasible configurations. Each configuration is specified by the number of resources consumed of each type and a reward. The resources are further subdivided into three types - offline, online-queueable (which arrive online and can be stored in a buffer), and online-nonqueueable (which arrive online and must be matched on arrival or lost). We prove the efficacy of a simple greedy algorithm when the corresponding static planning linear program (SPP) exhibits a non-degeneracy condition called the general position gap (GPG). In particular we prove that, (i) our greedy algorithm gets bounded any-time regret when no configuration contains both an online-queueable and an online-nonqueueable resource, and (ii) $O(\log t)$ expected any-time regret otherwise (we also prove a matching lower bound). By considering the three types of resources, our matching framework encompasses several well-studied problems such as dynamic multi-sided matching, network revenue management, online stochastic packing, and multiclass queueing systems.

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