1 Further results

1. We looked at online matching for bipartite graphs where the vertices arrive. We found the following:

(a) Deterministic algorithms always have competitive ratio \( \leq \frac{1}{2} \),
(b) There is a randomized algorithms with competitive ratio \( \frac{e-1}{e} \).
(c) For randomized algorithms, \( \frac{e-1}{e} \) is the best one can do.

What about general graphs? What if edges arrive? Gamlash et al. \cite{?} showed the following.

(a) For vertex arrivals in general graphs there is a randomized algorithm with competitive ratio \( (\frac{1}{2} + \Omega(1)) \)
(b) For edge arrivals randomization does not help.

2. Role-matchmaking is a problem where players of different skills levels arrive and must be assigned to a team as soon as they arrive. The goal is to have the teams be balanced so that no team dominates. This can get very complicated since different skills is not 1-dimensional. For example, in soccer a team may need a good Goalkeeper more than a great midfielder. This problem has immediate applications to many popular online video games where such as League of Legends and Dota 2. Alman & McKay \cite{?} view this as a dynamic data structures problem. The show (a) assuming the 3SUM conjecture, any data structure for this problem requires \( n^{1-o(1)} \) time per insertion or \( n^{2-o(1)} \) time per query, and (2) there is an approximation algorithm that takes \( O(\log n) \) per operation.