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. [**?**] 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 [**?**] 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.