

Q2

I'm going to use the baseball elimination problem discussed in class as an approach to this question.

We'll create a bipartite graph from the races and athletes. For each race create a node and connect the source to each race node with a capacity of 1. Create a node for each athlete and connect each of the athletes (i) to the sink with an edge of capacity of p_i . Then connect each race node to the 5 athletes that participate in the race with edges of capacity 1. If we run a max flow algorithm on this graph and the max flow is m , so we saturate all the outgoing edges from the source, then we know that it is possible for the races to finish in such a way that the i -th athlete wins at most p_i races. This is because if we get a max flow of m it means that we have saturated all the outgoing edges from the source, so we are able to distribute the wins in such a way that no athlete gets to win more than their p_i . If we can't saturate all the outgoing edges from the source, it means that we at least have an athlete i that needs to win more than p_i races, and their edge to the sink has flow = capacity.