

# 15-780: Graduate AI

## Homework Assignment #4B

Out: April 19, 2015  
Due: April 22, 2015 5 PM

**Collaboration Policy:** You may discuss the problems with others, but you must write all code and your writeup independently.

**Turning In:** Please email your assignment by the due date to [shayand@cs.cmu.edu](mailto:shayand@cs.cmu.edu) and [vdperera@cs.cmu.edu](mailto:vdperera@cs.cmu.edu). Your solutions should be submitted as a **single** pdf file. If your solutions are handwritten, **scan** them and make sure they are legible and clear. Please submit your code in separate files and provide instructions on how to run it.

## 4 Voting

Give an algorithm for manipulating the Borda algorithm and compute its computational complexity. Here we will define the manipulation problem as follows:

Given a set of candidates  $C$ , a distinguished member  $c \in C$ ; and a set  $V$  of transitive preference orders on  $C$  (e.g.  $V$  voters have already given their preferences).

Can an additional voter, given all the above information, choose a preference order  $P$  that will ensure that  $c$  will be the winner?

The computational complexity should be specified as a function of the above terms (such as  $O(|V|)$  or  $O(|C||V|)$ , etc.) not as simply polynomial or NP, etc. You are free to use research articles on the web, but if so, you must cite your sources.