

# Assignment 1

csci2200, Algorithms

## Instructions:

- HONOR CODE: WORK ON THIS ASSIGNMENT ALONE, OR WITH ONE PARTNER. BETWEEN DIFFERENT TEAMS, COLLABORATION IS AT LEVEL 1 [VERBAL COLLABORATION ONLY]
  - Check out the Homework guidelines on class website.
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1. **Finding the 1's in a Matrix:** Consider an  $n \times n$  array  $A$  which consists of 0's and 1's. Suppose each row consists of 1's and 0's such that, in any row  $i$  of  $A$ , all the 1's come before any 0's. Assuming  $A$  is already in memory, describe a method running in  $O(n)$  time (*not*  $O(n^2)$  time) for finding the row of  $A$  that contains the most 1's.

*We expect: (1) pseudocode and an English description of your algorithm; (2) a brief justification on why is it correct; (3) analysis of its running time.*

2. **Finding min and max:** Describe a method for finding both the minimum and the maximum of  $n$  numbers with fewer than  $3n/2$  comparisons in total. (Hint: Start by counting how many comparisons it takes to find the min and the max, and go from there).

*What we expect: The idea of the algorithm and pseudocode. A brief justification on why it finds the min and max correctly. Its analysis as function of  $n$  showing that it performs  $3n/2$  comparisons.*

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## **Evaluation**

This assignment (and all subsequent assignments) will be evaluated along four general criteria:

1. **Algorithm:** Is the algorithm clearly described ? Is the general idea included? Is high-level pseudocode included?<sup>1</sup>
2. **Correctness:** Does the algorithm solve the problem?
3. **Analysis:** Is the running time of your algorithm analysed?
4. **Style:** Does it look professional and neat? Is the explanation written carefully in complete sentences, and well-organized logic? Is it easily human-readable? Is it complete yet concise? Is it easy to understand? These kinds of questions do not affect correctness but greatly affect how readable the algorithm is.

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<sup>1</sup>Pseudocode should be clear enough that a student who took 1101 can understand what your algorithm is doing and could implement it in a language of their choice, without thinking too hard. At the same time, pseudocode is **not actual code**, and should not include details that are straightforward and make the ideas hard to follow. For e.g. it is preferred to say “find the max element in the array” (basic straightforward process) rather than spell it out.