



**Independent University**  
**Department of Computer Science & Engineering**  
Midterm Examination, Autumn 2020  
**CSE 211 - Algorithms**

1. True or False [CO1] [5 Marks]

- a. If an algorithm gives correct output for most of the input instances then we can define it as a correct algorithm.
- b. It is possible to sort numbers without even comparing a single number.
- c. Counting sort can only sort negative numbers.
- d. Radix sort has a mechanism of tackling the problem of big range.
- e. We need a stable sorting algorithm as a subroutine for radix sort.

2. Prove or Disprove [CO1] [10 Marks]

- a.  $\log_2 n = O(\sqrt{n})$
- b.  $4^n = \Theta(2^n)$

3. Solve the following Recurrence Relations [CO1] [10 Marks]

- a.  $T(n) = 8T(n - 2) + n^2$ ,  $T(0) = 1$
- b.  $T(n) = 9T(n/4) + n$ ,  $T(1) = 1$

4. Analyze the following pseudocode and write the running time. [CO2] [15 Marks]

for  $i = 0$  to  $n$ ,  $i = i + 1$ :

    for  $j = n$  to  $j < n$ ,  $j = i + 1$ :

        for  $k = 1$  to  $n/2$ ,  $k = k + 1$ :

$\text{max\_heapify}(A)$

    for  $j = 1$  to  $\sqrt{n}$ ,  $j = j + 2$ :

$\text{max\_heapify}(A)$

5. After finishing an internship in the USA, you are invited to be an instructor for CSE211. Suppose you have just graded your students serially. Now you have to sort the IDs of the students according to their marks. Suggest an algorithm that can do efficiently perform this task. [CO2] [5 Marks]
6. Given three sorted arrays. Is it possible to run a binary search on these numbers? If it is possible then how would you do it and what will be its running time? [CO3] [10 Marks]
7. Suppose, you are requested to build a voting system where there will be only two candidates. Your algorithm should keep track of two objects named respectively "c1" and "c2". If any candidate gets a vote your program has to increase the amount of vote by one of that candidate. When the election ends your program needs to provide the result. Which algorithm will you use as the primary subroutine to design your program and how will it help? [CO3] [15 Marks]

Number of candidates: 2

Number of voters:  $n$