Class Exam 1: Date 3Feb2022

Attempt all questions. You answers for each question should typically be just one page.

You need to submit ONE PDF as the answer script. PLEAE WRITE with BLACK INK.

Please write legibly.

Q1. Total Marks: 6

Prove or disprove the following:

a.) $N^{1/2} = O(\log N)$
b.) $\log_a b = O(\log_b a)$ where a,b >1

c.)

$1+2+\ldots+n \text{ is } \Theta(n^2)$

(do not use the fact that 1+2+3+…n = n(n-1)/2).

Q2. Total Marks: 6

Show that for a sequential search (e.g. for integer in an array of integers), the time complexity T(n)

a. T(n) is Omega(1)
b. T(n) is Omega(n)
c. T(n) is Theta(n)

Here these are all Big Omega and Big Theta.

Q3. Total Marks: 8

Show that for the recurrence relations

T(n) = 2 T(n/2)+n,

a.) T(n) = O(n^3)
b.) T(n) = O(n^2)
Assume T(1) is a constant.

Make sure all your proofs are rigorous.