

# CS 2443: Quiz 1

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- Total marks: 10.
  - Read the question carefully and answer to the question only.
  - Maintain academic honesty.
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1. Consider the  $\mathcal{O}(n)$  time algorithm to find the  $k^{th}$  smallest element taught in the class. Suppose we make blocks of size 9, instead of blocks of size 5 in the algorithm. Then, what will be the recurrence relation of the running time? Also get the best possible asymptotic *upper and lower* bound on the running time by solving the recurrence. (3)
2. Give the best possible asymptotic upper bounds for the following recurrence relations. The base cases are  $T(1) = T(2) = 5$  for all the relations.

(a)  $T(n) = \sqrt{n} \cdot T(\sqrt{n}) + 5$  (3)

(b)  $T(n) = 3T(\frac{n}{4}) + T(\frac{n}{6}) + n$  (2)

3. Consider the following recurrence relation.

$$\begin{aligned} T(n) &= 3T(n-1) + n^2 \\ T(0) &= 1 \end{aligned}$$

Using the method of mathematical induction prove that  $T(n) = \mathcal{O}(3^n)$ . (2)