Department of Mathematics
II Semester 2013-2014
MAL 342 Analysis and Design of Algorithms
Minor I   Weightage 20%
Date 7.2.14   Time 8 -9 A.M

Q1   (a) Describe the recurrence for the time complexity of quick sort. Solve the
recurrence asymptotically.   [2]
(b) Can the Master Theorem be applied to the recurrence $T(n)=4T(n/2)+n^2 \log n$?
Why or why not? Give an asymptotic upper bound for this recurrence.   [2+3]
(c) Let $T_1(n)=7T_1(n/2)+n^2$ and $T_2(n)=aT_2(n/4)+n^2$, describe the worst case running
time of algorithm 1 and algorithm 2, respectively , to solve a problem. What is
the largest integer value for "a" such that algorithm 2 runs asymptotically faster
than algorithm 1? Give reason.   [4]

Q2.   Let A be an array of n distinct integers. An order pair (i, j), $1 \le i < j \le n$, is an
inversion of A if $A[i] > A[j]$. Design an $O(n \log n)$ time algorithm to count the
number of inversions of an array A of n distinct integers.   [6]

Q3.   Design an $O(n)$ time algorithm to sort n integers $a_1, a_2, \ldots, a_n$ if $0 \le a_i \le n^2-1$
for each i, $1 \le i \le n$.   [3]