

**School of Information Technology
IIT Kharagpur**

Course Id: IT60101 Foundations of Computing Systems

Date: August 29, 2005

Total Time: 60 minutes

Max. Marks: 45

Instructions: Answer all questions. You may answer the questions in any order. However, all parts of the same question must be answered together. Clearly state any reasonable assumption you make.

1.

- (a) Write the recurrence relation for merge sort.
- (b) Solve it using (i) Substitution Method and (ii) Master Method

[2+4+4=10]

2. Use master method to give tight asymptotic bounds for the following recurrence:

$$T(n) = 4T(n/2) + n^2 \qquad \qquad \qquad \mathbf{[5]}$$

3.

- (a) Write an algorithm for performing Merge sort.
- (b) Clearly state the Loop Invariant for the merging routine.
- (c) Show that the Loop Invariant holds for initialization, maintenance and termination.

[5+5+5=15]

4.

- (a) Clearly state what you mean by the following
 - (i) $g(n) = O(f(n))$ and (ii) $g(n) = \omega(h(n))$
- (b) Prove that $o(g(n)) \cap \omega(g(n)) = \emptyset$

[5+5+5=15]