

**Tribhuvan University**  
**Institute of Science and Technology**  
**2070**

Bachelor Level/ Third Year/ Fifth Semester/ Science  
Computer Science and Information Technology (CSc. 303)  
**(Design and Analysis of Algorithm)**

Full Marks: 80  
Pass Marks: 32  
Time: 3 hours

*Candidates are required to give their answers in their own words as far as practicable.  
The figures in the margin indicate full marks.*

**Attempt all the questions.**

1. Explain the term Big-oh, Big-omega and Big-theta notation. Show that a function  $f = 3n^2 + 4n + 7$  is big theta of  $n^2$ . (8)
2. What do you mean by a recurrence relation? Solve the following recurrence relation using iterative expansion method.
  - a.  $T(n) = 2 \left( \frac{n}{2} \right) + 1, 1$   
 $T(1) = 1$   
 $T(n) = 2n - 1$   
 $n$
  - b.  $T(n) = 2 \left( \frac{n}{2} \right) + 1$   
 $T(1) = 1$   
 $T(n) = 2n - 1$   
 $n$   
(2+6)
3. Write an algorithm for quick-sort and trace out the algorithm for the following array  $A[] = \{16, 7, 15, 14, 18, 25, 55, 32\}$ . (4+4).
4. How can you solve the selection problem in linear time? Write the algorithm and analyze for its time complexity. (8)
5. What is prefix code? You have given a message text having seven distinct characters {p, q, r, s, t, u, v} with frequency {40, 20, 15, 12, 8, 3, 2}. Trace the Huffman algorithm to build the tree and obtain the optimum prefix codes for each characters. (2+6)
6. Explain Prim's algorithm for computing the MST of a given graph and analyze it. Also verify the correctness of this algorithm. (5+3)
7. Distinguish the main idea for divide and conquer approach with dynamic programming approach. Find the longest common subsequence between two sequences  $\langle A, B, C, B, D, A, B \rangle$  and  $\langle B, D, C, A, B, A \rangle$ . (2+6)
8. Define convex hull in 2D. Explain the Graham's scan algorithm for computing convex hull and analyze it.  
(2+6)
9. Explain about the complexity classes P, NP and NP complete with suitable examples. (8)
10. Explain Dijkstra's algorithm for computing the single source shortest path in a graph with suitable example. (8)