

Computer Science

Paper-II

Time Allowed: Three Hours

Maximum Marks: 300

- Note:* 1. The figures in the margin indicate full marks for the questions.
2. Candidate should answer questions No. 1 and 5 which are compulsory and any **three** of the remaining questions, selecting at least **one** from each section.

SECTION – A

1. (a) The Tower of Hanoi is a mathematical game. The game consists of 3 rods, and n disks of different sizes which can slide onto any rod. The puzzle starts with the disks stack in ascending order of size on rod number 1 (the smallest disk is on the top). The objective of the game is to move the entire stack to rod number 3, obeying the following rules:
- Only one disk can be moved at a time.
 - Each move consists of taking the upper disk from one of the rods and sliding it onto another rod, on top of the other disks that may already be present on that rod.
 - No disk may be placed on top of a smaller disk.

Write an algorithm using the recursive technique to output a series of moves which solve the Tower of Hanoi problem. The input and output are as follows:

Input: one single number which represents the number of disks on the rod

Output: Each line of output consists of a pair (i, j) , which represents a move from rod number i to rod number j . The sequence of moves should move the entire stack from rod number 1 to rod number 3. 25

- (b) Traverse the given tree using in order and Post Order traversal. 15
- (c) Find the minimum cost spanning tree for the following weighted graph and explain. 20

2. (a) How address resolution is performed with table look up? Explain with the help of a suitable example. 20
- (b) Explain the three way hand shake mechanism used by TCP to terminate a session reliably. 20
- (c) (i) What is a socket? How read and write is performed using sockets. 10
- (ii) A router connects to atmost K networks. How many routers R are required to connect to N networks? Derive an equation that gives R in terms of N and K. 10
3. (a) (i) What is the difference between monolithic programming and procedural programming? 10
- (ii) Explain the basic design strategies embedded in OOP. 10
- (b) Describe the differences between the interpretative and compiled implementations of a programming language, emphasising the advantages and disadvantages. 20
- (c) (i) Define the following: 10
- Formal language Grammars.
 - Terminal symbols.
- (ii) Explain briefly on Dead code elimination code optimisation techniques. 10
4. (a) Suppose that the operator “++” (denoting concatenation) is overloaded, with types
- Character \times Character \rightarrow String,
 Character \times String \rightarrow String,
 String \times Character \rightarrow String, and
 String \times String \rightarrow String.
- Is this overloading context-dependent or context-independent? Identify each occurrence of “++” in the following expressions:
- c++s
 (s ++ c) ++ c
 s++(c++c
- where c is a character variable and S is a string variable. 20

- (b) (i) Define the five basic operators of relational algebra with an example each. 10
- (ii) What is ODBC? How does Oracle act as ODBC and give examples of front end uses with ODBC. 10
- (c) Consider the following relation schemes: 20
- Project (Project#, Project_name, chief_architect)
- Employee (Emp#, Empname)
- Assigned_To (Project#, Emp#)

Give expression in Tuple calculus and Domain calculus for each of the queries below:

- (i) Get the employee numbers of employees who work on all projects.
- (ii) Get the employee numbers of employees who do not work on a specific project.

SECTION – B

5. (a) (i) Write a note on multi version time stamp ordering algorithm. 10
- (ii) Explain entity integrity and referential integrity rules in relational model. Show how these are realized in SQL. 10
- (b) Define a view and a trigger: 20
- S (S#, SNAME, STATUS, CITY)
- SP (S#, P#, QTY)
- P (P#, PNAME, COLOR, WEIGHT, CITY)

Construct a view for the above relations which has the information about suppliers and the parts they supply. The view contains the S#, SNAME, P#, PNAME renamed as SNO, NAME, PNO, PNAME.

- (c) Construct a binary tree for the following expression: 20
- (i) $((a*b+c)*d)$
- (ii) $A-B*C/D$
- (iii) $(a*(b+c)*d)$

6. (a) Construct sorting for the following numbers using Quick sort procedure and discuss the time complexity and space complexity of this Algorithm.
42, 12, -8, 98, 67, 83, 08, 104, 07 20
- (b) Consider the following schema: 20
- Suppliers(sid : integer, sname : string, address : string)
- Parts(pid : integer, pname : string, color: string)
- Catalog(sid : integer, pid : integer, cost : real)
- The key fields are underlined, and the domain of each field is listed after the field name. Therefore sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in relational algebra (RA):
- (i) Find pairs of sids such that the supplier with the first sid charges more for some part than the supplier with the second sid.
- (ii) Find the pids of parts supplied by at least two different suppliers.
- (c) (i) What is meant by Data Independence? Explain in brief. 10
- (ii) Differentiate between B trees and B+ trees. 10
7. (a) Explain under what order of input, the insertion sort will have worst-case and best-case situations for sorting the set { 142, 543, 123, 65, 453, 879, 572, 434 } and explain steps in detail. 20
- (b) Construct a weighted graph G and explain in detail an algorithm for identifying all pair of shortest paths and suggest its O(n). 20
- (c) (i) What are communication channels? Discuss various communication channels available for networks. 10
- (ii) What is meant by Protocol? 10
8. (a) What is TCP/IP Model? Explain the functions and protocols and services of each layer. Compare it with OSI Model. 20
- (b) Write short notes on (with appropriate examples): 20
- (i) Sliding Window Protocols
- (ii) CIDR
- (c) Differentiate between the following: 20
- (i) Theta Join. (ii) Equi Join. (iii) Natural Join (iv) Outer Join.