

Time : 3 hours

Full Marks : 200

**Instructions :**

- (1) Answer all questions following the directions.
- (2) The figures in the margin indicate full marks for the questions.

1. Answer the following questions (any two) : 10×2=20

(a) Simplify the following Karnaugh's map

$$f(A, B, C, D) = \sum(0, 1, 2, 4, 6, 8, 11, 12)$$

Draw the logic diagram for the resultant Boolean expression using AND, OR and NOT gates.

(b) Differentiate between struct and union. When is union preferred over struct? Give one example for each.

(c) Explain function overloading in C++ with an example.

2. Answer the following questions (any two) : 10×2=20

(a) Compare array and list. State where they stand in the context of speed, space, reliability, insertion, deletion and access operation.

(b) Describe an algorithm to evaluate postfix expression using stack.

(c) Consider the following list :

31, 28, 17, 62, 3, 42, 86, 25, 45, 52

Sort the above list using heap sort algorithm. Show all the intermediate steps.

3. Answer the following questions (any two) :

10×2=20

- (a) What are the parameters based on which a scheduling algorithm is analysed? Compare FCFS (First Come First Serve) and SRTN (Shortest Remaining Time Next) scheduling techniques for the following data set :

Sl. No.	Process ID	Arrival Time (hh : mm : ss)	Requested CPU Time (in second)
1	P1	09 : 00 : 00	3
2	P2	09 : 00 : 02	2
3	P3	09 : 00 : 03	1
4	P4	09 : 00 : 05	4
5	P5	09 : 00 : 06	3

- (b) Find hit ratio for the following sequence of page request using First-in First-out (FIFO), Optimal (OPT) and Least Recently Used (LRU) algorithms. Assume there are four frames and initially all the frames are empty :

1, 2, 3, 2, 5, 6, 3, 4, 6, 3, 7, 3, 1, 5, 3, 6, 3, 4, 2, 4, 3, 4, 5, 1.

- (c) What are the different tasks to be performed by file management system? Draw the hierarchical model of a file system and explain different modules.

4. Answer the following questions (any two) :

10×2=20

- (a) Construct a minimized DFA from the regular expression  $(x+y)x(x+y)^*$ . Trace for a string  $w = xxyx$ .

- (b) Find a grammar  $G'$  in CNF equivalent to  $G$ ,

$S \rightarrow aAD, A \rightarrow aB|bAB, B \rightarrow b, D \rightarrow d$

- (c) Describe with suitable example the data structures used in an assembler.

5. Answer the following questions (any two) :

10×2=20

- (a) Describe the following terms with reference to virtual memory :

TLB, Page Map Table, Least Recently Used,  
Page Table Base Register, Virtual Address

- (b) What is the difference between a loosely coupled and a tightly coupled MIMD computer? What are the relative advantages of these two types of MIMD computers? Explain your answer with a suitable block diagram.
- (c) Explain how pipelining is implemented in superscalar processor.

6. Answer the following questions (any two) :

10×2=20

- (a) What is the difference between requirement analysis and requirement specification? Using suitable example, explain different types of requirement problems that should be identified and resolved during the requirement analysis activity.
- (b) Explain unit testing and integration testing processes with suitable example.
- (c) What is software quality? Describe the SEI-CMM software quality model.

7. Answer the following questions (any two) :

10×2=20

- (a) What is the closure set of Functional Dependency? Given a relation  $R(A, B, C, D)$  with FD's  $F = \{A \rightarrow B, A \rightarrow C, C \rightarrow D\}$ . Consider the decomposition of  $R$  into  $R_1(A, B, C)$  with FD's  $F_1 = \{A \rightarrow B, A \rightarrow C\}$  and  $R_2(C, D)$  with FD  $F_2 = \{C \rightarrow D\}$ . Is the decomposition lossless and dependency preserving? Explain.
- (b) Consider the employee database, where the primary keys are underlined :
- employee (employee-name, street, city)  
works (employee-name, company-name, salary)  
company (company-name, city)  
manager (employee-name, manager-name)

Give an expression in SQL for each of the following queries :

- (i) Find the names of all employees who work for 'State Bank of India'.
- (ii) Find the names and cities of residence of all employees who work for 'Vijaya Bank'.