

Computer Science

Paper -II

Time allowed : Three hours

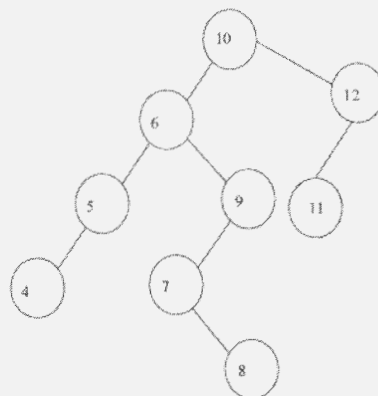
Maximum Marks: 300

The figures in the margins indicate full marks for the questions.

Candidates should answer Question No. 1 and 5 which are compulsory and **three** of the remaining questions, selecting at least **one** from each section.

SECTION-A

1. a. i. Write the advantage of postfix expression over infix expression. 6
ii. Write 3 advantages and 3 disadvantages of index sequential access mechanism of files 6.
iii. Discuss the count to infinity problem of distance vector routing. Explain any one method to overcome the same. 8
iv. Write two ways in which the OSI reference model and the TCP/IP Model are the same. Also write two ways in which they differ. 8
- b. i. Explain the OOPS paradigm in brief. Explain how object orientation contributes to- (A) Programming (B) GUI (C) Data Base (D) Operating System 16
ii. What are the draw backs of E-R model? How could they be overcome using EER model? Explain with example. 8
iii. In the context of concurrency control in DBMS, what are the problems of the basic locking protocol and how 2PL is useful to overcome such problem? 8
2. a. i. Write an algorithm to delete a node from the binary search tree. Consider the following binary search tree, delete node 6 from tree and reconstruct it. 8



- ii. Discuss any four factors that influence the choice of file organization and methods. 8
 - iii. Explain the specific roles of LLC and MAC sub layers of data link layer. 10
 - iv. Define Amplitude, Period, and Phase for a periodic digital signal. 6
 - b. i. In structured programming paradigm differentiate the global and local variables by giving an example. 8
 - ii. Write 10 rules of CODD and explain any three of them with example. 12
 - iii. What are the potential threat points in a database system? Explain any three of them. 8
3. a. i. Evaluate following postfix expression and Illustrate how this expression is represented in stack. 8

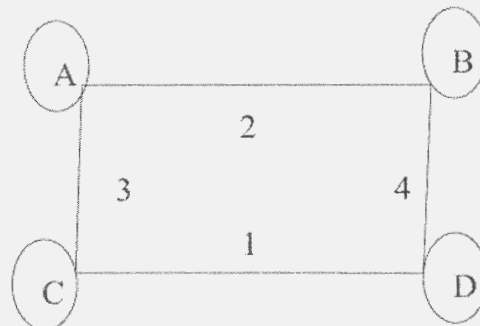
100 8 3 * 50 2 - + -

- ii. Write the advantage of threading a tree. Explain right threaded and left threaded binary tree with example of each. 8
- iii. State any two problems with SLIP protocol. State how they are overcome by PPP protocol. ~~8~~6
- b. i. Explain the necessity of subnet mask with IP address. 8
- ii. For a programming language differentiate between semantics and syntax with example. 10
- iii. Explain the components of domains definition. Illustrate the domain constraints by taking a suitable example. 10
- iv. Explain the concept of cursor in Database, (ii) Explain any four cursor operations. 10

4. a. i. Convert following postfix expression to infix expression: 6

A B _ C D / * E + 6

- ii. Explain the general mechanism of sorting a linked list in ascending order using pointers. 8
- iii. Define minimum spanning tree. Find all the spanning tree and minimum spanning tree of following graph 6



- iv Why do we need framing at data link layer? Explain any two methods to mark the start and end of each frame. 8
- b. i. Why do we need fragmentation and defragmentation at network layer? Explain. 6
- ii. Differentiate between multiple inheritance and multilevel inheritance with example. 8
- iii. Explain terms cardinality and connectivity in context of E-R diagram. 6
- iv (i) Explain Tables, View and Index in DBMS, (ii) Write 3 advantages of views. 12

SECTION-B

- 5. a. i. Write an algorithm to convert a postfix expression to infix expression. 6
- ii. Explain the mechanism of selection sort method. Show the process of sorting following sequence of numbers in ascending order using selection sort method. Show all the intermediate steps after each cycle by highlighting the two numbers exchanging their locations. 10

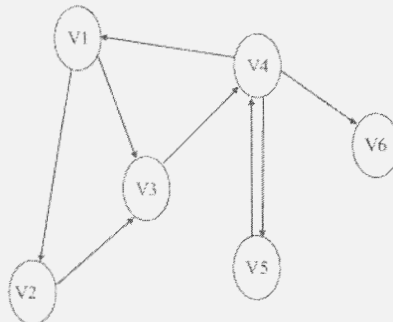
44	33	55	22	11
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- iii. Regarding IP address, give reasons for following statements:
 - (A) All 0s - Never a valid destination
 - (B) All 1s - Never a valid source
 - (C) 127. . . . should not appear on network 9
- iv For establishing TCP connection if there would be two way hand shake instead of three way, what problem may occur? Discuss. 6
- b. i. What is a subprogram? Explain following parameter passing methods to and from subprogram; 8
 - (A) Pass by value (B) Pass by result (C) Pass by reference
- ii. Define 3NF with the help of a suitable example. Explain terms insertion anomalies, deletion anomalies, modification anomalies in the context of 3NF. 10
- iii. What will be the output of following query?


```
SELECT REPLACE(TRANSLATE(LTRIM(RTRIM('!! ATHEN !!','!')),
      '!', 'AN', '**'), '*-', 'TROUBLE') FROM DUAL;
```

 5
- iv. Consider a schema R(A,B,C,D) and functional dependencies A->B and C->D. Then the decomposition R1(A,B) and R2(C,D) is dependency preserving but not lossless join. Comment whether statement is True or False? Justify your answer. 6
- 6. a. i. Write the characteristics of a binary tree and give one example of the same. 6
- ii. Construct binary search tree from the following set of numbers given in the order 20, 35, 12, 3, 28, 3, 14, 31, 16, 13, 30, 35
 - Show the construct of tree in incremental order after each node insertion.
- iii. Comment on the efficiency of sequential file processing. 5
- iv. While using analog signals to transmit digital data, what band width is required for data

- being sent at a rate of 10 bps using analog signal? Assume that each signal element is one bit. 5
- b. i. What is the advantage of multiplexing? Explain FDM and TDM. 9
- ii. What is late binding? Explain the difference between virtual function and pure virtual function. 10
- iii. How are specialization/generalization constraints represented in the EER model? Explain. 9
- iv. What is de-normalization? Why do we perform de-normalization? 8
7. a. i. Write and explain Algorithm to search a node in a linked list. 8
- ii. Define graph and explain its two applications. Show the adjacency list structure of following graph- 10



- iii. Explain following terms in context of network's performance 9
- (A) Throughput
- (B) Packet delivery ratio
- (C) Jitter
- iv. Explain any three properties that are used in quality of service in the network layer. 9
- b. i. Explain the concept of abstract data type with example. 6
- ii. Explain in brief any six causes of Database failure. Explain roll forward and roll back concept of database recovery. 10
- iii. Explain database privilege, system privilege and object privilege in the context of data protection. 8
8. a. i. What is a Circular-queue? What problem of linear queue can be resolved using Circular queue? 4
- ii. Write an algorithm for computing a minimum spanning tree. 8
- iii. Write an algorithm to insert an element in a circular queue. 8
- iv. Explain any two differences between TCP and UDP protocols. 6
- v. Write three functions of data link layer and network layer as applicable to OSI model. 12
- b. i. Discuss any three criteria of programming language evaluation. 6
- ii. What is the importance of Thomas's Write rule in Database concurrency control? How does the Thomas's write rule modifies the checks for a write operation by a Transaction T? 12
- iii. Explain the difference between TRUNCATE and DELETE command of sql. 4

Computer Science

Paper -I

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Candidates should answer Question No. **1** and **5** which are compulsory and **three** of the remaining questions, selecting at least **one** from each section.

SECTION-A

1. a. Define Turing Machine. Construct a Turing Machine for the proper subtraction i.e. $m - n = \max(m-n, 0)$ where $m - n$ is $m-n$ if $m \geq n$ and 0 if $m < n$ 20
- b. Define Deterministic Automata. Draw DFA for divisibility of 3 over an alphabet set $\Sigma = \{0,1,2, \dots,9\}$ 10
- c. What is addressing mode? Explain the working of direct and indirect addressing mode with example. 15
- d. What is an instruction cycle? Explain the register organization of 8086 microprocessor in detail. 15
2. a. Define Push Down Automata. Give Push Down Automata to accept the following Language
 $L = \{0^n 1^m \mid n \leq m\}$ 20
- b. i. Explain the difference between internal and external fragmentation. 20
- ii. Explain the organization of DMA. 20
3. a. i. Explain the working of cache memory. 20
- ii. What are the different types of ROM and RAM? 20
- b. A computer uses a memory unit with 256K words of 32 bit each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 bit register, and an address part.
- i. How many bits are there in the operation code, the register code part, and the address part?

- ii. Draw the instruction word format and indicate the number of bits in each part. 20
- iii. How many bits are there in the data and address inputs of the memory. 20
4. a. i. State Pumping Lemma for Context Free Language. 5
- ii. Define a Non-Deterministic Finite Automata. Draw a NDFA for the language that have a 1 either two or three position from the end. The alphabet set is {0,1}. 9
- iii. Define Context Free Grammar. What is Ambiguous Grammar? Is the given grammar ambiguous
- $$\begin{aligned}
 S &\rightarrow A1B \\
 A &\rightarrow 0A \mid \epsilon \\
 B &\rightarrow 0B \mid 1B \mid \epsilon
 \end{aligned}$$
- 6
- b. i. What is an indirect measure and why such measures common in software metrics work? 20
- ii. Describe the role of risk analysis in an evolutionary process model like the spiral model
- Elaborate the test strategies for object oriented software 20
 - Why is a highly coupled module difficult to unit test?

SECTION - B

5. a. i. Consider a logical address 0 space of 8 pages of 1024 words mapped onto a physical memory of 32 frames
- How many bits are there in the logical address?
 - How many bits are there in the physical address? 15
- ii. Explain the necessity for mutual exclusion. What is the minimum level of mutual exclusion that is necessary for the implementation of useful mutual exclusion in operating systems? What other forms are useful? 15
- b. i. Describe the difference between "known risk" and "unpredictable risks" in context of software development. 15
- ii. What is the difference between thread based and use - based strategies for integration testing? How does cluster testing fit in? 15

6 a. i. Write short notes on mealy machine. Draw a mealy machine for finding 1's complement of a given binary number. 15

ii. Consider the ϵ NFA

	ϵ	a	b	c
->p	0	{p}	{q}	{r}
q	{p}	{q}	{r}	0
*r	{q}	{r}	0	{P}

• Compute the ϵ -closure of each state.

• Convert the ϵ -NFA to NFA 15

b. i. What is the difference between a direct and indirect address instruction? How many reference to memory are needed for each type of instruction to bring an operand into a process register? 15

ii. What are interrupts? Draw the block diagram of instruction cycle with interrupts. 15

7 a. i. Assume a stack-oriented processor that includes the stack operations PUSH and POP. Arithmetic operations automatically involve the top one or two stack elements. Begin with an empty stack, what stack elements remain after following instructions are executed?

PUSH 4

PUSH 7

PUSH 8

ADD

PUSH 10

SUB

MUL

10

ii. Differentiate between RISC and CISC. 10

iii. What are the four main components of general purpose computers? Show it with a block diagram. 10

b. Transform P and V operations on a semaphore S into equivalent critical regions without busy-waiting. 15

- c. Explain the following with suitable example 15
- Size oriented metrics
 - Function oriented Metrics
8. a. i. Describe the difference between short term, medium term and long term scheduling. 15
- ii. Explain the organization and working of following types of Turning Machine
- Multi-tape Turning Machine 15
 - Turning machine with Semi-Infinite Tape
- b. Which is more valuable to object oriented testing, white box or black box testing? Justify your answer. 15
- c. A computer has a cache, main memory, and a disk used for virtual memory. If a referenced word is in the cache, 20ns are required to access it. If it is in main memory but not in cache, 60ns are needed to load it into the cache, and then the reference is started again. If the word is not in main memory, 12ns are required to fetch the word from disk, followed by 60ns to copy it to the cache, and then the reference started again. The cache hit ratio is 0.9 and the main memory hit ratio is 0.6. What is the average time in ns required to access a referenced word on this system? 15