COMPUTER SCIENCE AND APPLICATIONS

PAPER—III

NOTE: This paper is of two hundred (200) marks containing four (4) sections. Candidates are required to attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION - I

Note : This section contains five (5) questions based on the following paragraph. Each question should be answered in about thirty (30) words and each carries five (5) marks.

(5x5=25 marks)

A private consulting company is dealing in sales and purchase of houses, plots and flats. Persons intending to sell their properties have to fill up property information form, register the property with consulting company, show and deposit necessary documents, description of property, expected price.

The company displays this information with video clips on website.

A person interested in buying such property fills up the order form which contains purchase price.

Site visit is arranged by consultant company.

If bargain price is accepted by seller, he has to pay some advance and the property is marked as "sold".

The necessary formalities are completed by consulting company and they charge necessary commission from the seller.

You are requested to design following :

1. Context and first level DFD.

2. Database Design.

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3. MIS Reports.

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4. Property information form.

5. ER Diagram.

SECTION - II

6.   What is the role of a microsequencer in Microprogramming Control Unit ?

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7. Draw the states of a binary counter for 4 bits.

8. Justify that range queries can benefit from cluster indexing.

9. Define : Referential Integrity and Self-referential Integrity.

10. What are the disadvantages of drawing a circle using polar co-ordinates method ?

11. Compare the scan line polygon fill with the boundary fill algorithm.

12. Write a parse - tree for the following assignment statement : $a = b + c * d + e$;

13. A network on the Internet has a subnet mask of 255.255.240.0, what is the maximum number of hosts it can handle ? Explain how.

14. What do you mean by binary exponential back off ?

15. Write a function in C-language to find maximum of an arbitrary array having n-elements.

16. Try to structure "Furniture", "Chair" and "Table" classes in an inheritance hierarchy.

17. How does the Java runtime handle thread scheduling ?

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18. What are the disadvantages of water-fall model ?

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19. What are the necessary conditions for a deadlock ?

**20.** What are the functions of a distributed operating system ?

SECTION - III

Note : This section contains five (5) Electives. The candidate has to choose one Elective and has to answer all the five questions from that Elective. Each question carries twelve (12) marks and is to be answered in about two hundred (200) words.

(12x5=60 marks)

Elective - I

21. Convert the following non-deterministic finite automata (NFA) to deterministic finite automata (DFA). Write the transition for string 'ab ab abb'
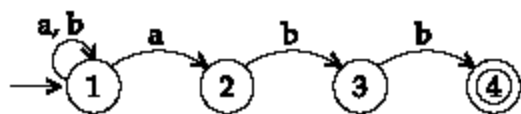
22. Define GNF and CNF. Convert the following grammar to CNF.
    (i)
S	$\rightarrow$	ABa
A	$\rightarrow$	aab
B	$\rightarrow$	Ac
    (ii) Convert the following grammar to GNF
S	$\rightarrow$	AB
A	$\rightarrow$	aA | bB | b
B	$\rightarrow$	b

23. Write a PDA for the language
    $$L = \left\{ a^n b^n \mid n \geq 1 \right\}$$

24. Minimize the mates of the following Deterministic Finite Automata (DFA).
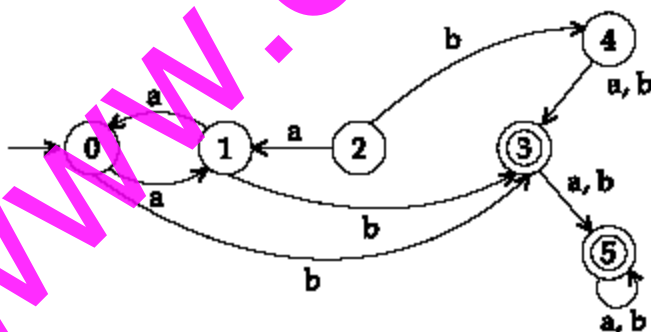
25. Write a Turing machine for the following language.
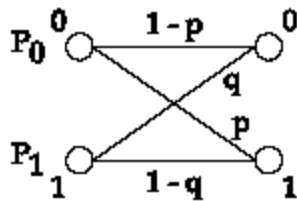 $$L = \left\{ a^n b^n \mid n \geq 1 \right\}$$

OR

Elective - II

21. Consider a Discrete memory with source probabilities - {0.20, 0.20, 0.15, 0.15, 0.10, 0.10, 0.05, 0.05}.

Determine an efficient fixed length code of the source and the Huffman code for the source. Compare these two codes and comment.

22. Consider the binary channel for the figure shown below

Let the a priori probabilities of sending the binary symbol be P_0 and P_1, where $P_0 + P_1 = 1$. Find the a posteriori probabilities $P(X = 0 \mid Y = 0)$ and $P(X = 1 \mid Y = 1)$.

23. State and prove channel capacity theorem.

24. Compute weight and distance between each pair of the following words : 10010101, 01101011, 11001010.

25. Explain image compression organizing feature of map.

OR

Elective - III

21. Consider the following LPP :

min $3x_1 + 4x_2 - 54x_3$

S.t $4x_1 - 11x_2 \geq 7$
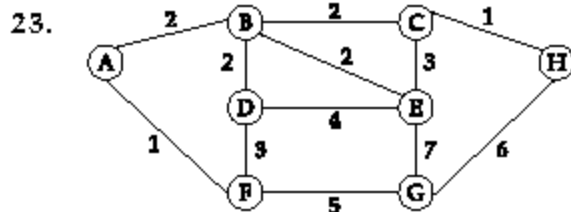
$3x_1 - 8x_3 \leq -11$

$4x_2 - 6x_4 = 8$

$x_1 \geq 0, x_2 \leq 0, x_3 \geq 0$

Convert the above numerical

Problem to :

    (i)   LPP in the standard form.

    (ii)   LPP in the Canonical form.

22. Give Malhotra - Pramod Kumar - Maheshwari Polynomial algorithm for solving Network flow problem

23.

Apply the Bellman-Ford's and Dijikstra's algorithms to find the shortest path from A to F in the network shown in the above figure.

24. (i) Define :

(a) Convex programming problem

(b) Concave programming problem.

(ii) In which (if any) programming problem (of above) does the local external point coincide with the global external point ? Give the mathematical Proof/Justification of your answer.

25. Consider the following region :

$$R = \{(x_1, x_2, \ldots\ldots x_n)^T \epsilon \mid R^n \mid f(x_1, x_2 \ldots\ldots x_n) \geq 0\}$$

Where f is a convex function of n variables. Is R convex ? Is it concave ? Prove your answer using the convex function and region, concave function and region.

OR

Elective - IV

21. Discuss Networks Back Propagation (BP) Training algorithm.

22. Prove that the following properties are satisfied by all fuzzy intersection in Yager class —

    (a) $I_w (a,0) = 0$

    (b) $I_w (a,1) = a$

    (c) $I_w (a,a) \leq a$

    (d) $\lim\limits_{w \to 0} I_w (a,b) = I_{min} (a,b)$

23. Discuss how you would design multilayer perceptron net.

24. Explain with examples - Lambda-cuts of fuzzy sets.

25. What is perceptron ? Give a model for perceptron using the model perceptron, show that two input XOR problem cannot be solved in one layered Neural Network.

OR

Elective - V

21. What is the syntax of "create" system call ? Write an algorithm for creating a file.

22. How do exec system calls works ? Explain in detail logical format of an executable file.

23. Write a program to show that the parent and child get separate data segment.

24. What do you mean by object library, import libraries and dynamic link libraries in Windows environment ?

25. Describe briefly six window functions usually called while creating a window.

SECTION - IV

Note : This section consists of one essay type question of forty (40) marks to be answered in about one thousand (1000) words on any of the following topics. This question carries 40 marks.

(40x1=40 marks)

26. (a) State all rules required to convert the given WFF to the clavsual form and the rules for skolemnization while converting.

    (b) Explain architecture and components of an expert system.

OR

(a) Use the dynamic programming approach to write an algorithm to find the maximum sum in any contiguous sublist of a given list of n real values. Analyze your algorithm, and show the results using order notation.

OR

(a) Write a recursive descent parser for the following grammar.

$$E \rightarrow E + T \,|\, T$$

$$T \rightarrow T * F \,|\, F$$

$$F \rightarrow (E) \,|\, a \,|\, b \,|\, c$$

(b) Trace the recursive calls for the input

$$a * b + c$$