Signature and Name of Invigilator

1. (Signature) _____

   (Name) _____

2. (Signature) _____

   (Name) _____

Roll No. | | | | | | | |
(In figures as per admission card)

Roll No. _____
(In words)

Test Booklet No.

J–8707

PAPER–III
COMPUTER SCIENCE AND APPLICATIONS

Time : 2½ hours] **[Maximum Marks : 200**

Number of Pages in this Booklet : **40** Number of Questions in this Booklet : **26**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. Answers to short answer/essay type questions are to be given in the space provided below each question or after the questions in the Test Booklet itself.

   No Additional Sheets are to be used.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Test Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the question booklet will be replaced nor any extra time will be given.**
4. Read instructions given inside carefully.
5. One page is attached for Rough Work at the end of the booklet before the Evaluation Sheet.
6. If you write your name or put any mark on any part of the Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
7. You have to return the Test booklet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
8. **Use only Blue/Black Ball point pen.**
9. **Use of any calculator or log table etc. is prohibited.**
10. **There is NO negative marking.**

परीक्षार्थियों के लिए निर्देश

1. पहले पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए।
2. लघु प्रश्न तथा निबंध प्रकार के प्रश्नों के उत्तर, प्रत्येक प्रश्न के नीचे या प्रश्नों के बाद में दिये हुये रिक्त स्थान पर ही लिखिये।

   इसके लिए कोई अतिरिक्त कागज का उपयोग नहीं करना है।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी। पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे जिसकी जाँच आपको अवश्य करनी है :
   (i) प्रश्न-पुस्तिका खोलने के लिए उसके कवर पेज पर लगी सील को फाड़ लें। खुली हुई या बिना स्टीकर-सील की पुस्तिका स्वीकार न करें।
   (ii) **कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चैक कर लें कि ये पूरे हैं। दोषपूर्ण पुस्तिका जिनमें पृष्ठ/प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें। इसके लिए आपको पाँच मिनट दिये जायेंगे। उसके बाद न तो आपकी प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा।**
4. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें।
5. उत्तर-पुस्तिका के अन्त में कच्चा काम (Rough Work) करने के लिए मूल्यांकन शीट से पहले एक पृष्ठ दिया हुआ है।
6. यदि आप उत्तर-पुस्तिका पर अपना नाम या ऐसा कोई भी निशान जिससे आपकी पहचान हो सके, किसी भी भाग पर दर्शाते या अंकित करते हैं तो परीक्षा के लिये अयोग्य घोषित कर दिये जायेंगे।
7. आपको परीक्षा समाप्त होने पर उत्तर-पुस्तिका निरीक्षक महोदय को लौटाना आवश्यक है और इसे परीक्षा समाप्ति के बाद अपने साथ परीक्षा भवन से बाहर न लेकर जायें।
8. **केवल नीले/काले बाल प्वाईंट पैन का ही इस्तेमाल करें।**
9. **किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है।**
10. **गलत उत्तर के लिए अंक नहीं काटे जायेंगे।**

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.

3. MIS Reports.

4. Property information form.

5. ER Diagram.

SECTION - II

Note : This section contains fifteen (15) questions each to be answered in about thirty (30) words. Each question carries five (5) marks.

(5x15=75 marks)

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

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 ?

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

19. What are the necessary conditions for a deadlock ?

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

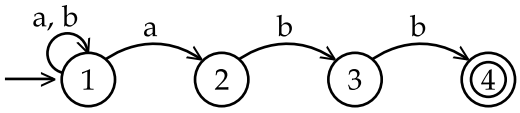
SECTION - III

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.

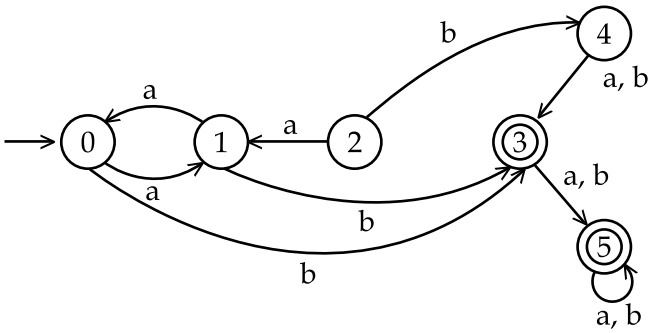
(i) $S \rightarrow ABa$
$A \rightarrow aab$
$B \rightarrow Ac$

(ii) Convert the following grammar to GNF
$S \rightarrow AB$
$A \rightarrow aA \mid bB \mid b$
$B \rightarrow b$

23. Write a PDA for the language

$L = \{a^n b^n \mid n \geq 1\}$

24. Minimize the mates of the following Deterministic Finite Automata (DFA).



25. Write a Turing machine for the following language.

$L = \{a^n b^n \mid n \geq 1\}$

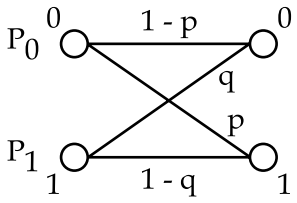
OR

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 :

$$\min \quad 3x_1 + 4x_2 - 54x_3$$

$$\text{S.t} \quad 4x_1 - 11x_2 \geq 7$$

$$3x_1 - 8x_3 \leq -11$$

$$4x_2 - 6x_4 = 8$$

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

Convert the above numerical

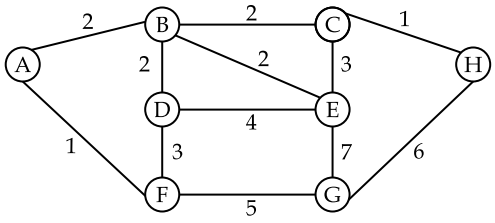
Problem to :

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

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 converrt 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.

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid a \mid b \mid c$$

(b) Trace the recursive calls for the input

$$a * b + c$$

FOR OFFICE USE ONLY							
Marks Obtained							
Question Number	Marks Obtained	Question Number	Marks Obtained	Question Number	Marks Obtained	Question Number	Marks Obtained
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	
25		50		75		100	

Total Marks Obtained (in words) .....

(in figures) .....

Signature & Name of the Coordinator .....

(Evaluation) Date .....