

Signature and Name of Invigilator

Roll No.

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(In figures as per admission card)

1. (Signature) _____
(Name) _____

Roll No. _____
(In words)

2. (Signature) _____
(Name) _____

Test Booklet No.

D-8707

PAPER – III
COMPUTER SCIENCE
AND APPLICATIONS

[Maximum Marks : 200]

Time : 2½ hours]

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 अर्थात् 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 प्वाइंट पेन 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)

Design a database for storing the data of all the employees in a business firm and create queries for extracting the following information, on the following lines. Only the relevant information and codes need to be written.

1. Create a table/tables for storing the personal data and also specify the keys.

2. Write SQL queries for getting the list of all employees in the age group of 40 to 50.

3. Create a table/tables to store the pay and service details of the employees and also specify the keys.

4. Write SQL queries for getting the list of employees who have an annual income of more than 4 lakhs considering the salary and other income of the recent-past 12 months.

5. Write SQL queries to generate the names and ages of all employees with one or two children and with one of the child is a female child.

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. Design an algorithm to compute x^n , where n is a positive integer, using divide and conquer technique.

7. State whether $L = \{a^n b a^m b a^l : l, m, n \geq 1\}$ is regular or not. Justify your claim.

8. Write a function in C/C++ to reverse a linked list without using more than constant amount of extra space.

9. Implement a half subtractor using only NOR gates.

10. Distinguish between memory mapped I/O and I/O mapped I/O.

11. What are the differences between OSI and TCP/IP reference model ?

12. Explain how a semaphore that can hold an arbitrary value be implemented using only binary semaphores and ordinary machine instructions.

13. What is an expert system ? How does it differ from a conventional computer program ?

14. Describe the waterfall model of a software process.

15. State the relative merits of digital vector generator and analog vector generator.

16. Distinguish between MS - WINDOWS and MS - DOS.

17. Compare Object Oriented DBMS with RDBMS.

18. What is encapsulation ? Explain the benefits with an example using private and public keys.

19. Show by an example that virtual functions are hierarchical.

20. Give the postfix notation for $(9 - 5) + 7$ and $8 - (7 + 3)$.

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. Let $\Sigma = \{a, b\}$. Write a regular expression for the following language :
 $L = \{\text{All strings in } \Sigma^* \text{ with a number of a's divisible by three}\}.$
22. Design a finite automaton that accepts the following language :
 $L = \{w \in \{a, b\}^* : w \text{ does not contain three consecutive b's}\}$
23. Show that the intersection of two context free languages is not context free.
24. Design a Turing machine C which transforms string $\$ \omega \$$ to $\$ \omega \$ \omega \$$ where $\$$ represents a blank, $\$$ shows the position of the head of the tape and ω is a string with no blanks. Give the diagrammatic representation of C.
25. Design a push down automaton for the following language :
 $L = \{a^m b^n : m \neq n\}$

OR

Elective - II

21. Using Shannon's result, show that extremely wideband signals can be used to achieve error free communication as long as sufficient SNR exists.
22. State the properties of block codes.

23. Explain how the (7, 4) Hamming code can be used to correct burst errors.
24. The chirp transforms of a vector $a = (a_0, a_1, a_2, a_3, \dots, a_{n-1})$ is the vector $y = (y_0, y_1, y_2, \dots, y_{n-1})$ where $y_k = \sum_{j=0}^{n-1} a_j z^j$ and z is any complex number. Show that the DFT is a special case of the chirp transform.
25. Explain how sub-band coding can be used for speech compression.

OR

Elective - III

21. Describe the properties of a solution to the LP problem.
22. State personnel-assignment problem. Why is it called a variation of the transportation problem ?
23. Is the shortest path tree unique ? Justify your answer with a suitable example.
24. Show that every tree is a bipartite graph. Give an example of a bipartite graph which is not a tree.
25. State and explain Kuhn-Tucker conditions.

OR

Elective - IV

21. Describe the McCulloch - Pitts model of a neuron.
22. Show that a linear neuron may be approximated by a sigmoidal neuron with small synaptic weights.
23. Describe the following learning rules :
 - a. Error correction learning
 - b. Hebbian learning
24. Explain the following statement :
"Fuzzy systems are shallow but fully interactive".
25. State and explain fuzzy entropy theorem.

OR

Elective - V

21. What is meant by portability ? How has it been made easy for porting UNIX to various platforms ?
22. List out any 10 features of UNIX and explain any two of them.
23. Describe the two methods used in UNIX to change the access permissions.
24. Describe the differences between Windows 98 and Windows NT.
25. Using a neat sketch, describe the structure of Windows 2000.

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SECTION - IV

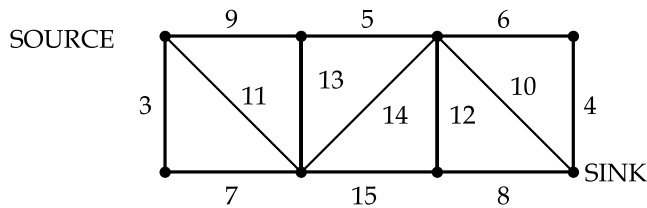
Note : This section consists of one question carrying (40) marks to be answered in about one thousand (1000) words on any of the following topics

(40x1=40 marks)

26. (a) Distinguish between a microprocessor and a microcontroller.
 (b) Using a neat sketch, describe the functional organization of 8085 microprocessor.
 (c) Write an 8085 assembly language program to determine and print the largest of five given integers.

OR

- (a) The capacities of all the links in a network are made unity and the maximum flow from source to sink determined. What is the physical significance of the number so obtained ?
 (b) Write an explanatory note on the exponential behaviour of Ford and Fulkerson's algorithm.
 (c) For the following network, determine the maximum flow from source to sink using the labeling algorithm. The capacities of the links are as indicated :



OR

- (a) State the key advantage of pop-up threads.
 (b) Describe Coffman's four conditions for deadlock.
 (c) State the producer-consumer problem and explain how it can be solved.

OR

- (a) Show that any point on the line segment joining two points in E_n can be expressed as a convex combination of the two points.
 (b) Consider a diet of two foods x and y and, nutrient constraints involving thiamine phosphorous and iron. The amount of each nutrient in each of the foods (in milligrams per ounce) is given in the following table :

Nutrient	x	y
Thiamine	0.15 mg/oz	0.10 mg/oz
Phosphorus	0.75 g/oz	1.70 mg/oz
Iron	1.30 g/oz	1.10 mg/oz

The diet should contain at least 1.00 mg of thiamine, 7.50 mg of phosphorous and 10.0 mg of iron. The cost of x is 2 cents/oz while the cost of y is $5/3$ cents/oz. Write the corresponding linear programming formulation and solve the problem by revised simplex method.

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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