

Signature and Name of Invigilator

Roll No.

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(In figures as per admission card)

1. (Signature) _____
(Name) _____

2. (Signature) _____
(Name) _____

Roll No. _____
(In words)

Test Booklet No.

J-8709

**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.

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।

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 - III

Note : This section contains five (5) questions from each of the electives/ specialisations. The candidate has to choose only one elective/ specialisation and answer all the five questions from it. Each question carries twelve (12) marks and is to be answered in about two hundred (200) words.

(12x5=60 marks)

Elective - I

21. Show that the grammar G given by
 $G = (\{s\}, \{a, b\}, p, s)$
where $p = \{(s \rightarrow a s b), (s \rightarrow a)\}$ is LR(1). Symbols have usual meaning.
22. Show that the function
REV (x) = Reverse of binary representation of an integer x (ignoring non-significant zeros) is primitive recursive.
23. Show that
 $L = \{ 0^n | 0^n | n = 0, 1, 2, \dots \}$
is not a finite state language.
24. Distinguish between Moore and Mealy finite state machines.
25. State in algorithm for converting a transition graph into a regular expression and illustrate it by an example.

OR

Elective - II

21. What is the property which makes a tree a Huffman tree ? Write the steps of operations to update a tree to convert it into Huffman tree.
22. Describe briefly the encoding and decoding of LZ codes.
23. What are the main goals of JPEG compression of images ? Write main steps of JPEG compression of images.
24. Describe briefly the Discrete Fourier Transform for image representation and give its characteristics.
25. Let X be a random variable taking values x_i with probability $p_i, i = 1, 2, \dots, n$ respectively; Y be random variable taking values y_i with probability $q_i, i = 1, 2, \dots, m$. Prove that $H(x, y) \leq H(x) + H(y)$ with equality if and only if x and y are independent. Make your own assumptions if required. H is uncertainty function.

OR

Elective - III

21. Given

$$\begin{aligned} -2x_1 + x_2 + x_3 &= 2 \\ x_1 - 2x_2 + x_4 &= 2 \\ x_1 + x_2 + x_5 &= 5 \end{aligned}$$

Minimise $c = x_2 - x_1$ for non - negative x_i $i = 1, \dots, 5$.

22. Show that every tree is a bipartite graph. Construct an example of a bipartite graph which is not a tree.

23. Using Branch and Bound algorithm, solve the following assignment problem with the cost matrix.

$$\begin{array}{c} \begin{matrix} & 1 & 2 & 3 & 4 \\ \text{a} & \left[\begin{array}{cccc} 94 & 1 & 54 & 68 \\ 74 & 10 & 88 & 82 \\ 62 & 88 & 8 & 76 \\ 11 & 74 & 81 & 21 \end{array} \right] \end{matrix} \end{array}$$

24. What is a convex set ? State any algorithm for solving a convex programming problem and comment on the rate of convergence of iterative methods.

25. State and prove Max-flow Min-cut theorem.

OR

Elective - IV

21. Explain the following statement.

'Neural networks sum throughputs, whereas Fuzzy systems sum outputs.'

22. Show that the function

$$f(x) = \frac{1}{1 + e^{-cx}}$$

is sigmoidal, $c > 0$.

23. Distinguish between supervised learning and unsupervised learning.

24. Show that the switching function $x_1 + x_2x_3$ is linearly separable.

25. State and explain 'Perceptron Learning Theorem'.

OR

Elective - V

21. (a) Describe the data structures associated with file system of UNIX and give relationship among these, if any.
- (b) Describe the process subsystem of the structure of UNIX operating system.
22. (a) Explain the file system of UNIX operating system.
- (b) In UNIX how files are internally organized ? What is special file ? How does 'read' or 'write' operation on special files work ?

23. Write the shell script to do the following.

INPUT :

- (i) There are twelve master files having the name of the three letters (in capital) of the months of year (e.g. JAN, FEB, ..., DEC). These master files contain two fields (separated by one or more blank) : item name and Accepted price (in two decimal places)
- (ii) There is a TRANS file which contains three fields (each may be separated by one or more blanks) : month (the first three letters of month), item name and an quantity (integer number).

There can be any number of records for each item.

OUTPUT :

Process the TRANS file and print the report giving the amount spent on each item in whole year in the following format.

| Item | Amount |
|----------------------|------------|
| (Max. 15 characters) | (XXXXX.XX) |

Amount is to be obtained by multiplying the quantity by particular month's Accepted price.

24. What do you mean by MDI ? What is its use ? How the MDI is supported by the windows ? What is ActiveXcontrol ? What are its uses and importance ?
25. Write short notes on :
- (i) Tuner control
- (ii) Priority class and Thread priority class

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 one of the following topics.

(40x1=40 marks)

26. (a) Design a Turing machine for computing the LCM of two given integral numbers.
- (b) Design a finite state machine to check the divisibility by 7 and 11 of an input binary sequence with the least significant digit occurring first.

OR

- (a) Show that a longitudinal redundancy check of N bits can easily detect a burst error of N bits.
- (b) Show that the CRC-12 polynomial $x^{12} + x^{11} + x^3 + x^2 + x + 1$ will detect 99.97 percent of the time burst errors with a length of 12 or more

OR

$$\begin{aligned} \text{Maximise } & -2y_6 + 2y_7 + 5y_8 \\ \text{Subject to } & -2y_6 + y_7 + y_8 + y_1 = -1 \\ & y_6 - 2y_7 + y_8 + y_2 = 1 \\ & y_7 + y_4 = 0 \\ & y_6 + y_3 = 0 \\ & y_8 + y_5 = 0 \end{aligned}$$

For non negative y_1, y_2, y_3, y_4 and y_5 .

OR

Describe the backpropagation algorithm. Assume a feed forward neural network topology with a single hidden layer

OR

- (a) How does UNIX provide file protection ?
- (b) What is the fiber abstraction provided by windows XP ? How does it differ from threads abstraction ?

| 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