

**Signature and Name of Invigilator**

1. (Signature) \_\_\_\_\_

(Name) \_\_\_\_\_

2. (Signature) \_\_\_\_\_

(Name) \_\_\_\_\_

Roll No. 

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(In figures as per admission card)

Roll No. \_\_\_\_\_

(In words)

**D-8709****Test Booklet No.**

Time : 2 1/2 hours]

**PAPER-III**

[Maximum Marks : 200

**COMPUTER SCIENCE AND APPLICATIONS**

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. Answer 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 Question 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 हुए 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 कागज की 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 ।**

**D-8709****P.T.O.**

## **COMPUTER SCIENCE & 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

This section contains **five (5)** questions from each of the electives/specializations. The candidate has to choose only **One** elective/specialization 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. **(5 × 12 = 60 Marks)**

#### ELECTIVE – I

21. Design Deterministic Finite Automata to accept the following sets of strings over the alphabet  $\{0, 1\}$
- (a) At strings containing exactly 3 “0”s and at least 2 “1”s.
  - (b) All strings whose binary interpretation is divisible by 5.
22. Consider the following two languages :
- $$L_1 = \{a^n b^{2n} c^m \mid m, n \geq 0\}$$
- $$L_2 = \{a^n b^m c^{2m} \mid m, n \geq 0\}$$
- Determine if the sets  $L_1 \cup L_2$  and  $L_1 \cap L_2$  are context free languages or not.
23. Determine using CYK algorithm if the string ‘abbab’ is present in the language of the following grammar :
- $$S \rightarrow ab B \mid aa S \mid b B \mid a \mid b$$
- $$A \rightarrow b B \mid a S$$
- $$B \rightarrow a A \mid b A \mid a \mid b$$
24. Write down the CFG for a small programming language which consists of only assignment, goto, if then else, I/O and stop statements. The maximum size of the variable can be 6 characters and they are made up of digits, underscore and small letters. The first character cannot be underscore character.
25. Design a Turing Machine to evaluate the square of an integer.

#### OR

#### ELECTIVE – II

21. What is a Huffman Code ? Give example. What is the Huffman’s no prefix property ?
22. (a) Let  $C = \{001, 101, 110\}$ . Determine whether  $C$  will detect the error patterns of 011, 001, 000.
- (b) For each of the following code  $C$  determine whether or not  $C$  detects  $u$  :
- $$C = \{00000, 10101, 00111, 11100\}$$
- (i)  $u = 10101$
  - (ii)  $u = 01010$
  - (iii)  $u = 11011$

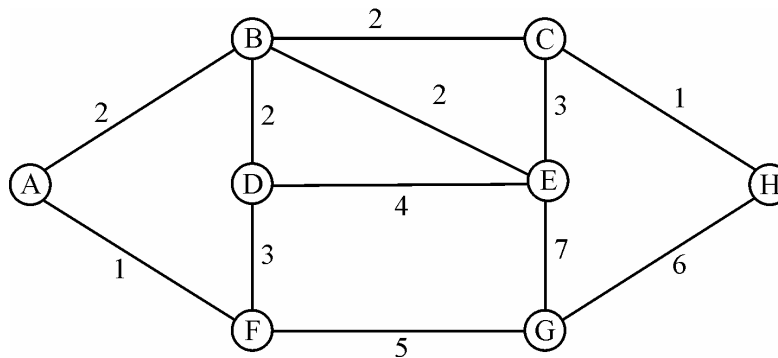
23. (a) Find a parity check matrix from each of the following codes :
- (i)  $C = \{000, 001, 010, 011\}$
- (ii)  $C = \{00000, 11110, 01111, 10001\}$
- (b) Prove that equivalent linear codes always have the same length, dimension and distance.
24. What is the importance of image registration in image processing ? Explain any one method of image registration.
25. Explain a method of image compression which are lossless compression.

**OR**

**ELECTIVE – III**

21. A necessary and sufficient condition for a vector  $X$  in a convex set  $S$  to be an extreme point is that  $X$  is a feasible solution satisfying the system  $AX = b$ ,  $X \geq 0$ . In other words, a point is a basic feasible solution to  $AX = b$  if and only if it is an extreme point of the convex set of the feasible solution.
22. Discuss the economic interpretation of Lagrangian multipliers, the duality theory and state and prove Kuhn-Tucker necessary and sufficient condition for a non-linear programming problem :
- Max  $Z = f(x)$  subject to the constraint
- $$g_i(x) \leq b_i \quad i = 1 - m$$
23. Solve the following convex programming problem :
- $$\text{Max } Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$
- Subject to
- $$x_1 + 2x_2 \leq 10$$
- $$x_1 + x_2 \leq 9$$
- $$x_1, x_2 \geq 0$$
24. Use dual simplex method to solve the following Linear Programming problem.
- Minimize  $Z = 3x_1 + x_2$
- Subject to the constraints
- $$x_1 + x_2 \geq 1$$
- $$2x_1 + 3x_2 \geq 2$$
- $$x_1, x_2 \geq 0$$

25. Apply Moore's and Dijkstra's algorithms to find the shortest path from A to H in the following network :



**OR**

#### **ELECTIVE – IV**

21. Following medical documentation exists concerning the relations of symptoms  $S_1$ ,  $S_2$  and  $S_3$  to diseases  $d_1$  and  $d_2$  :
- Symptoms  $S_1$  occurs very seldom in patients with disease  $d_1$ .
  - Symptoms  $S_1$  often occurs in patients with disease  $d_2$  but seldom confirms the presence of disease  $d_2$ .
  - Symptom  $S_2$  always occurs with disease  $d_1$  and always confirms the presence of disease  $d_1$ ;  $S_2$  never occurs with disease  $d_2$  and (obviously) its presence never confirms disease  $d_2$ .
  - Symptom  $S_3$  very often occurs with disease  $d_2$  and often confirms the presence of  $d_2$ .
  - Symptom  $S_3$  seldom occurs in patients with disease  $d_1$ .
- Model the above stated fuzzy information. You may construct relations.  $R_o$ ,  $R_c$  for symptoms and diseases ('o' for occurs and 'c' for confirmed respectively) and  $R_s$  to represent degree of presence of symptoms in patients.
  - What could be the information provided by the following ?
    - $R_s \circ R_o$
    - $R_s \circ R_c$
    - $R_s \circ (1 - R_o)$
  - How would you construct a nonsymptom indication relation in this case ?
  - For your constructed  $R_o$ ,  $R_c$  and  $R_s$ , compute the values of  $R_s \circ R_o$ ,  $R_s \circ R_c$ , and  $R_s \circ (1 - R_o)$



22. Think of the parameters that cause noise in the interpersonal communication. Explain how fuzzy set theory could be employed to enhance the speech signals (speech signals could be sentences and parts of sentence) to facilitate a quality conversation. Remember, the psychological states of the senders and the receivers as well add noise to the interpersonal communication. How would you extend your ideas to the man-machine interaction ? Discuss at least one specific application of your proposal.
23. (a) How would you compare the abilities of ANNs with that of Von Neuman machine ? Hence or otherwise discuss the models of ANN classifiers for  
 (i) Linearly separable data  
 (ii) Multilinearly separable data  
 (iii) Non-linearly separable data  
 (b) Following are 2 arguments. Accept or refute them by providing proofs or counter examples to support your stand.  
 (i) ANNs are black boxes.  
 (ii) If an architecture cannot represent knowledge it cannot learn it either.
24. Describe an ANN solution to the handwritten character recognition problem. Provide mathematical analysis of the learning algorithm that you propose. Comment on the performance of your model in comparison with the conventional algorithms (if employed any) along with its cost analysis in this context.
25. Discuss with a suitable case study of your choice, how fuzzy logic enhances the capability of an ANN solution and conversely show that ANN could help in defining more appropriate fuzzy values in the fuzzy control system.

**OR**

**ELECTIVE – V**

21. (a) Compare parent and child process of Unix operating system. **6**  
 (b) Compare Unix system calls and library functions. **6**
22. What is the context of a process ? What are different situations under which Kernel needs to save the context of a process ? **12**
23. Write Unix shell script to :  
 (a) opening a device file.  
 (b) putting a process to sleep.  
 (c) waking up sleeping process.
24. (a) What is multithreading ? Explain how thread synchronization can be achieved using events.  
 (b) Distinguish between model and modeless.
25. Explain the differences between :  
 (i) Static link library and dynamic link library.  
 (ii) MFC extension DLL, MFC regular DLL and Non-MFC DLL.

























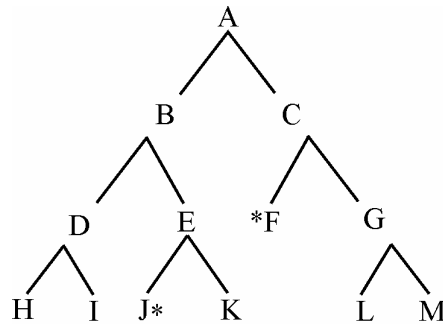
### SECTION-IV

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. **(1 × 40 = 40 Marks)**

26. (a) Consider the following grammar :
- $S \rightarrow a s b \mid s \times s \mid s y \mid z$
- Determine which of the following strings are ambiguous (i.e. have more than one parse tree)
- $axbxz, azxzbyxz, zxzy, azbxazb$  **15**
- (b) Write a parallel program for matrix multiplication. **15**
- (c) Explain with an example how dynamic polymorphism is implemented in C++. **10**

**OR**

- (a) Define Decision-making process. Explain Herbert-Simon model of DSS. What are the different aspects of information quality in terms of the perceptions of the decision maker ? **20**
- (b) For the search tree use BFS and list the elements of the queue just before selecting and expanding each next state until a goal node is reached. Goal states designated with '\*'. **10**



- (c) Discuss the approaches of conflict resolution. **10**

**OR**

26. (1) Write a function in C/C++ to delete the root node of a Binary Search Tree. **15**
- (2) Determine the running time of linear search in average and worst case. **10**
- (3) Design and analyse a divide-and-conquer algorithm for finding the maximum element in a list of n elements. **15**























<b>FOR OFFICE USE ONLY</b>	
Marks Obtained	
Question Number	Marks Obtained
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Total Marks Obtained (in words) .....

(in figures) .....

Signature & Name of the Coordinator .....

(Evaluation)

Date .....