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.

D-8709

Time : **2 1/2** hours] [Maximum Marks : **200**

PAPER-III
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 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 ।**

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-I

This section contains **five (5)** questions based on the following paragraph. Each question should be answered in about **thirty (30)** words and carries **five (5)** marks. **(5 × 5 = 25 Marks)**

Read the passage given below and answer the questions that follow based on your understanding of the passage :

A travel company is in an air-line service. It has two types of aircrafts and has three classes – Executive, Business and Economy with different fare structure and facilities.

Ticket bookings are computerised and done through agents or directly on phone or in person at the company's booking offices. Booking can be preponed, postponed or cancelled. Only cancellations at any time before 12 hours is charged 20%, after 12 hours but before one hour charged 40% and after that it is charged 60% but in case of loss of ticket there is no refund.

Customers are offered a choice of veg, non-veg meals in flight. The customers are allowed to carry one piece of hand baggage of permitted size and weight. Excess weight baggage is charged separately.

The full ticket amount is to be paid at the time of issue of ticket by cash, cheque, credit card or debit card is given for 15 days to accredited agents. Draw UML diagrams.

1. Use case diagram

2. Class diagram

3. Sequence diagram

4. Activity diagram

5. State chart diagram

SECTION-II

This section contains **fifteen (15)** questions, each to be answered in about **thirty (30)** words. Each question carries **five (5)** marks. **(15 × 5 = 75 Marks)**

6. Implement the following with NAND and NOR logic

$F = (A + \overline{B})(\overline{C} + D)$

7. Write assembly language program to execute
A * B / C + M

8. Given the set of functional dependencies

$\{A \rightarrow BCD, CD \rightarrow E, E \rightarrow CD, D \rightarrow AH$

$ABH \rightarrow BD, DH \rightarrow BC\}$

Find a non-redundant cover. Is this the only non-redundant cover ?

9. Why are fragmentation and data replication useful in DDBMS ? What are the main types of fragmentations ? What sort of considerations are used to decide about the type and extent of Data fragmentation and replications ?

10. Draw the line between (30, 20) and (40, 28) by determining the pixel locations table using DDA technique.

11. Define – Aspect ratio, refresh rate, resolution.

12. Explain the layer of OSI model, which is responsible for providing node-to-node communications with reliable service.

13. Why do asynchronous communications require additional start and stop bits ? What is wrong with letting the first bit in a transmission act as a start bit and the last one act as a stop bit ?

14. Consider an array of 10 integers
5, 3, 8, 9, 1, 7, 0, 2, 6, 4
using quick sort's algorithm, using 5 as pivot value. Write down the resulting array after 1st iteration/partition.

15. Write an applet that display the string "COMPUTER SCIENCE & APPLICATION" in the different font sizes at the centre of the screen.

16. Write recursive function code in C to reverse the given integer.

17. What is difference between validation and verification ?

18. Define reliability and explain its importance in software development models.

19. What are differences between binary sema-phore and general sema-phore ?

20. Given the following information draw a timeline for using Round-robin Scheduling techniques :

Job No.	Arrival Time	CPU Cycles
1	0	10
2	1	2
3	2	3
4	3	1
5	4	5

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 :
    $S \rightarrow ab\ B \mid aa\ S \mid b\ B \mid a \mid b$
    $A \rightarrow b\ B \mid a\ S$
    $B \rightarrow a\ A \mid bA \mid a \mid b$

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

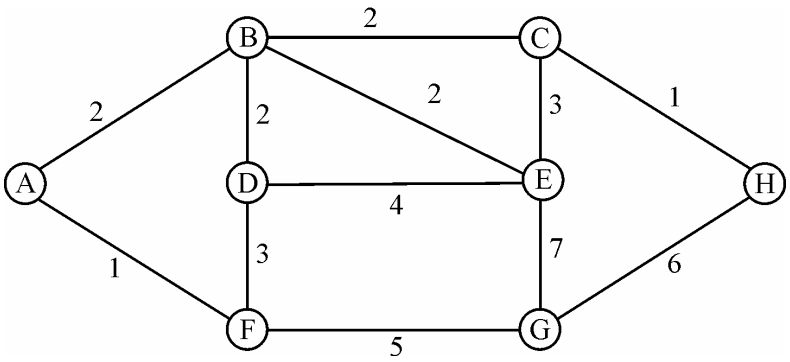
21. A necessary and sufficient condition for a vector X in a convex set S to be an extreme point is that X is a feasible solution satisfying the system AX = b, X ≥ 0. In other words, a point is a basic feasible solution to AX = b if and only if it is an extreme point of the convex set of the feasible solution.

22. Discuss the economic interpretation of Lagrangian multipliers, the dulity theory and state and prove Kuhn-Tucker necessary and sufficients condition for a non-linear programming problem :
Max Z = f(x) subject to the constraint
gi(x) ≤ bi i = 1 – m

23. Solve the following convex programming problem :
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 :

(i) Symptoms S_1 occurs very seldom in patients with disease d_1.

(ii) Symptoms S_1 often occurs in patients with disease d_2 but seldom confirms the presence of disease d_2.

(iii) 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.

(iv) Symptom S_3 very often occurs with disease d_2 and often confirms the presence of d_2.

(v) Symptom S_3 seldom occurs in patients with disease d_1.

(a) 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.

(b) What could be the information provided by the following ?

(a) $R_s \, O \, R_o$ (b) $R_s \, O \, R_c$ (c) $R_s \, O \, (1 - R_o)$

(c) How would you construct a nonsymptom indication relation in this case ?

(d) For your constructed R_o, R_c and R_s, compute the values of $R_s \, O \, R_o$, $R_s \, O \, R_c$, and $R_s \, O \, (1 - R_o)$

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 Nauman 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)

a*x*b*x*z, az*x*zby*x*z, z*x*zy, azb*x*azb **15**

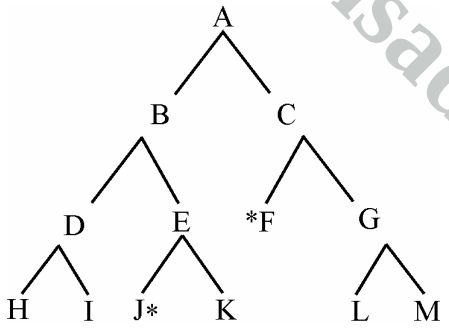
(b) Write a parallel program for matrix multiplication. **15**

(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 differents 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**

FOR OFFICE USE ONLY	
Marks Obtained	
Question Number	Marks Obtained
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Total Marks Obtained (in words) .....

(in figures) .....

Signature & Name of the Coordinator .....

(Evaluation) Date .....