Signature and Name of Invigilator

1. (Signature) _____

   (Name) _____

2. (Signature) _____

   (Name) _____

Roll No. ☐☐☐☐☐☐☐

Roll No. _____

(In words)

Test Booklet No.

D–8708	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	**परीक्षार्थियों के लिए निर्देश**

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 ले। 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 big campus of a university has different departments located within it. Each department conducts examination of one or more programmes. Further, examination may not begin on the same date as well as time for each programme. Each department may or may not have sufficient number of invigilators to conduct the examination. You are required to carry out the following to automate the task of invigilator allocation which may not be limited to one's own department.

1.   Draw the E-R diagram including attributes.

2. Draw the UML diagram.

3. Draw the DFD upto 2nd level.

4. Prepare Data base Design including Data Dictionary.

5. Comment on the Security aspects and Information reporting.

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. Write the steps for generating frame based animation. Explain each step briefly.

7. Write an 8085 assembly language program that finds the largest of three given numbers.

8. The urn protocol is used with 200 users of whom 40 are ready to send. Determine the probabilities of collision and success.

7

9. With reference to average behaviour, determine the complexity of linear search.

10. How will you find x^{29} using Divide and Conquer Technique ?

8

11. What is partitioning in ORACLE ? What are its benefits ?

12. What is an XML Parser ? How parsers read in and deliver XML data to an application ?

13. Is '< > all' identical to 'not in' in SQL ? In either case, justify your answer by giving example.

14. Describe the various methods of passing parameters in procedural programming languages.

15. What are the advantages and disadvantages of prototyping model ?

16. List various types of coupling and explain three of them in detail.

17. What are the functions of data link layer ? Compare OSI data link layer with IEEE 802 with suitable examples.

18. Compare the main memory Organization schemes of contiguous memory allocation, pure segmentation and pure paging with respect to the following issues :
a — External Fragmentation
b — Internal Fragmentation
c — ability to share code across processes

19. What memory management technique is used in UNIX system ? How is system performance maintained with the particular memory management technique ?

20. Why is the use of hill climbing technique limited in AI ?

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.   Explain why a finite state machine can not recognise a palindrome.

22.   Determine if the grammar
      $G = (\{ S, A \}, \{ a \}, P, S)$
      Where $P = \{ (S \to A), (A \to aAa), (A \to a) \}$ is ambiguous.

23.   Show that the function

      $$LOG\ (x) = \begin{cases} 0 & \text{if } x = 0 \\ \lfloor \log_2 (x) \rfloor + 1 & \text{if } x > 0 \end{cases}$$

      is primitive recursive.

24.   Describe Chomsky classification of languages.

25.   Construct a Turing machine that enumerates $\{0^n\ 1^n / \ n \geq 1\}$.

OR

Elective - II

21.   What do you mean by lossy compression of images ? Describe one lossy compression technique for images.

22.   What do you mean by minimum distance of a linear code ? State and prove Hamming bound for a linear code over GF (q).

23.   Describe the construction of a typical parity check matrix for Hammig codes over GF(2). Give its code words and error correction capability.

24.   Define binary symmetric channel. Derive the expression for capability of symmetric channel and hence show that the capacity of binary symmetric channel is $1 - H\ (\beta,\ 1 - \beta)$. The symbols have the usual meaning.

25. Consider a binary symmetric channel with capacity C. Suppose the source produces binary digits at the fixed rate R digits per second.

Given R>C, $0 \le \lambda < 1$, show that for sufficiently large n, no code ($[2^{nR}]$, n) can have average probability of error less than λ.

**OR**

Elective - III

(Operations Research)

21. Describe Karmakar's method for solving linear programming problem and compare it with the ellipsoid method.

22. Using Dijkstra's shortest path algorithm, determine the shortest path from vertex V_0 to every other vertex :
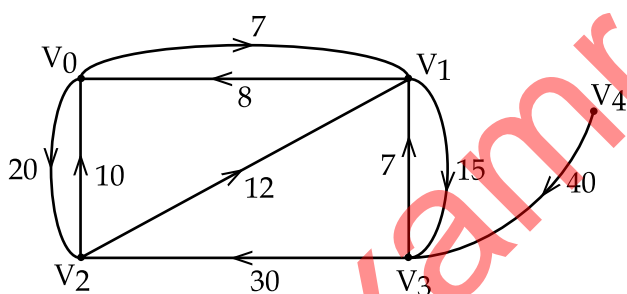
23. State and explain Kuhn-Tucker Conditions.

24. Explain the meaning of 'matroid'. Distinguish between graphic and cographic matroids.

25. Determine the maximum flow from source to sink :
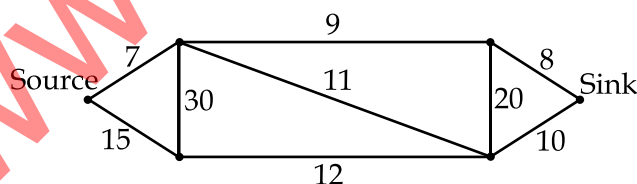
The capacities of the links are as indicated.

OR

Elective - IV

21. Distinguish between randomness and fuzziness.

22. Show that the EX-OR switching function is not linearly separable.

23. Explain the following statement : 'Fuzzy systems are shallow but fully interactive'.

24. State and explain differential Hebbian Learning Law.

25. What are fuzzy cognitive maps ? Describe their use.

OR

Elective - V

21. Describe which data structures are associated with processes. How are these affected by exec, fork and exit system calls ?

22. Draw the block diagram of the structure of UNIX operating system and explain each component of it.

23. Write a shell script which does the following :

    If the number of users are 50 or more, it should print the

    (i)   login names of users who have logged in last 5 minutes and

    (ii) login names of users who have logged out in last 5 minutes.

24. What is a thread ? How is a thread created in windows operating system ? What are priority class and thread priority class ? What are the advantages of using threads ? Explain thread priority with an example.

25. Write short notes on :

   (i)   Scroll bar control

   (ii) WM - COMMAND

   (iii) WM - TIMER

   (iv) Status bar messages with examples.

24

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) Draw a neat sketch showing a pushdown stack memory machine and explain it.

(b) Show that a pushdown stack memory machine has a power lying between finite state machine and the Turing Machine.

OR

(a) A source emits six symbols with the probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$ and $\frac{1}{32}$. Determine the Huffman Code. Determine the average length of the code.

(b) Describe JPEG compression of graphics.

OR

Consider a complete undirected graph with 8 nodes and the following distance matrix :

From\To	2	3	4	5	6	7	8
1	41	19	99	83	108	120	140
2		35	88	96	121	137	151
3			80	70	95	108	127
4				53	66	87	86
5					26	42	57
6						22	34
7							27

Show that the distance matrix has metric property. Using an approximate algorithm, obtain a solution to the travelling salesman problem for this graph.

OR

'B' is an N dimensional bit vector. p(B) is defined as follows :

$$p(B) = \begin{cases} 1 \text{ if B contains an odd number of 1's} \\ 0 \text{ if B contains an even number of 1's} \end{cases}$$

Construct a feedforward multilayer neural network that implements the parity function p(B) for 5 dimensional bit vectors.

<div align="center">OR</div>

(a)   Draw a neat sketch showing the architecture of Windows NT and explain it.

(b)   How is cache managed in Windows XP ?

31

39

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 ....