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–8704

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 : **11**

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 Test booklet, 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 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।**
10. **गलत उत्तर के लिए अंक नहीं काटे जायेंगे।**

COMPUTER SCIENCE & APPLICATIONS

PAPER – III

Note : This paper consists of **two parts** - (A and B). All questions are **compulsory.**

PART – A

Note : This part has **ten** short essay type questions of **16** marks each to be answered in about **three hundred** words each.

PART – A

1. Implement the switching function $F(x_1\, x_2\, x_3\, x_4) = x_1\, x_2 + \overline{x_1}\, x_3\, x_4$ by a static hazard free two level AND-OR gate network. **16**

OR

Determine the state table of a minimal machine which produces and maintains an output of 1 wherever it detects the sequence 001. The output returns to zero only when another sequence 010 is detected. **16**

2. (a) List and briefly describe four categories of databases and give an example of each. **8**

(b) Identify important factors in the success of databases design and what are the main steps associated with Conceptual database design. **8**

OR

(a) What are the responsibilities of DBA and how these can be implemented ? **8**

(b) Describe and contrast the concepts of aggregation and composition and provide an example of each. **8**

3. (a) Discuss the object space and image space methods of hidden surface removal. Explain Z-buffer algorithm and its limitations. **8**

(b) Explain the following graphical interactive techniques. **8**

(i) Zooming (ii) Dragging

OR

(a) Explain the working of plasma panel display. Give its advantages and limitations. **8**

(b) Explain the terms : **8**

frame buffer

refresh rate

aspect ratio

resolution

4. (a) Explain the concept of 'Horn clause'. Attempt to convert the following : Predicate calculus formula into Horn clause form. If it is convertible to Horn clause, then give the Horn clause form : **8**

$(\forall x)$ ($\neg$ literate $(x) \Rightarrow \neg$ write (x))

(b) Show that the following Grammer is LL(1) : **8**

$S \rightarrow A\ S \mid \in$

$A \rightarrow a\ A \mid b$

OR

(a) Explain the following programming language concepts : **8**

(i) Polymorphism

(ii) Lazy evaluation

(b) Is the following grammer SLR (1) ? Justify the answer. **8**

$S \rightarrow A\ S \mid b$

$A \rightarrow S\ A \mid a$

5. (a) Six nodes are equispaced and lie on a straight line. Using steiglitz's link deficit algorithm, design a 3-connected starting network **16**

OR

(a) Distinguish between public-key, private-key and secret-key with examples. **8**

(b) Define sockets. Discuss socket types. Draw and explain the operations for socket system calls for connection-oriented and connectionless service protocols. **8**

6. (a) Using any one of the three sorting algorithms (Insertion sort, Shell sort, Quick sort), sort the following list of numbers in ascending order. Show all the steps. **8**

15, 32, 9, 17, 3, 87, 45, 38, 53, 11

(b) Define the concept of "Priority Queue". Also give some of the possible applications of Priority Queue. **8**

OR

(a) Write a non-recursive algorithm for computing n^{th} Fibonacci number F(n) where **8**

$F(0) = 0$

$F(1) = 1$

$F(n) = F(n-1) + F(n-2)$

(b) What is the essential idea behind each of the following techniques : **8**

Dynamic programming and Greedy algorithms

Using dynamic programming technique, write a program to compute c(n, k) where c(n, k) is the number of ways in which k items can be picked up from n items.

7. (a) Explain with example, member functions that perform assignment and concatenation of strings. **6**

(b) "There are three ways to overload a binary operator" - Illustrate these three ways to overload " + " for the class : **6**

```
class integer
{ int x ;
  public :
// your method go here
} ;
```

(c) Write a code snippet to show a table having 3 rows and 2 columns, formatted to show alternative rows in different background color. **4**

OR

(a) Explain with examples the linearisation and renaming strategies of conflict resolution in multiple inheritance. **8**

(b) Write complete tags to show Image, Hyper Reference, Performated Text and List of items. **8**

8. (a) Name three main methodologies for object oriented analysis and design. Describe the essential features of Booch methodology. **8**

(b) What is 'Software Quality'? Can we measure software quality ? List the various factors that affect the software quality. **8**

OR

(a) What are Software Metrics ? Explain, how do Software Metrics help in Software Project Management ? List some important Software Metrics for Project Management. **8**

(b) What are the main objectives of 'Software Testing' ? Explain the various levels of Software Testing Signifying the importance of each level of testing. **8**

9. (a) State and explain Belady's anamoly. **8**

(b) If FIFO page replacement is used with four page frames and eight pages, how many page faults will occur with the reference string 0172327103 if the 4 frames are initially empty. Repeat the problem for LRU. **8**

OR

(a) It takes 100 ns to access a page table and 20 ns to access an associative memory. If the average access time is 28 ns, determine the hit ratio. **5**

(b) Compare and contrast the handling of system calls and exceptions. **8**

(c) Explain wake-up processes. **3**

10. (a) Translate the following sentences given in English language into Propositional/Predicate calculus : **8**

(i) All employees earning more than Rs. 60,000/- per year, pay income tax.

(ii) Everyone except Rita likes Seema.

(iii) For every natural number, there is another natural number greater than it.

(b) Give characteristic features of an Expert System (E. S.) which make E. S. different from conventional computer program/system. **8**

OR

(a) Describe briefly AO* algorithm as a search method to solve an A. I. problem. **8**

(b) Express the following concepts as a Semantic Network with interconnected nodes and labelled arcs.

Company sof-Tel is a software company. Three departments in the company are : Sales, Administration and Programming. Abdul is a manager of programming. John and Prakash are programmers. Prakash is married to Sita. They have three children viz Alok, Savita and Amol. **8**

PART – B

Note : This part has only **one** question of **40** marks to be answered in about **(800) Eight hundred** words.

11. (a) Show that the language $L = \{a^n b^n : n \geq 0\}$ is not regular. **15**

(b) Construct a pushdown automaton to accept the language $\{\omega \omega^R : \omega \in \{a, b\}^*\}$, where x^R denotes the string obtained by reversing the order of letters in x. **15**

(c) Show that context free languages are closed under union and kleene closure. **10**

OR

(a) Explain cyclic redundancy check code used in error detection mechanism with an example. Compare this coding method with Huffman Coding Method. **15**

(b) A series of 1000-bit frames is to be transmitted using an idle RQ protocol. Determine the link utilization for the following types of data link, assuming a data transmission rate of (i) 1 Kbps (ii) 1 Mbps. The velocity of propagation of link is 2×10^8 ms^{-1} and bit error rate is negligible. **15**

(a) A twisted pair cable 1 km is length

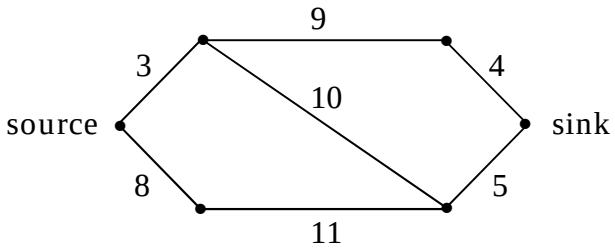
(b) A leased line 200 km in length

(c) A satellite link of 50,000 km

(c) Explain a method of image compression which is a lossless compression method. **10**

OR

(a) Find the maximum flow from source to sink in the following network. The capacities of the links are as indicated. **20**



(b) Give the KUttN-TUCKER (KT) optimality conditions for non-linear program. Apply KT method to solve the following : **20**

(i) Min $Z = x_1^2 + x_2$

s.t. $x_1^2 + x_2^2 - 9 = 0$

$-(x_1 + x_2^2) + 1 \geq 0$

$x_1 + x_2 \leq 1$

(ii) Min $(2x_1^2 + x_2^2 + 4x_1 - 6x_2)$

s.t. $x_1 + 3x_2 \leq 3;\ x_i \geq 0\ (i = 1, 2)$

OR

(a) Show that for every fuzzy partial ordering on x, the sets of undominated and underminating elements of x are non-empty. **10**

(b) Describe the significance of Boltzman Learning Law and discuss its difficulties. **10**

(c) Describe briefly fuzzy functions. **10**

(d) Describe briefly fuzzy relations. **10**

OR

(a) Compare and contrast the 'paste' command and the 'cat' command. **10**

(b) Write an address in 'ex' command to define a block of lines containing lines 30 to 50. **10**

(c) What does the term 'awk' stand for ? What is the format for an instruction in 'awk' ? Distinguish between simple and range pattern for 'awk'. **10**

(d) What is command substitution ? What is the token for command substitution in the Korn Shell ? Justify. **10**

Space For Rough Work

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 .....