COMPUTER SCIENCE & APPLICATIONS

Signature of Invigilators

PAPER–III

Roll No. ☐☐☐☐☐
(In figures as in Admit Card)

1. ....

2. ....

DEC–08/19

Roll. No. ....

....
(in words)

Name of the Areas/Section (if any)..................

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

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page.
2. Write name of your Elective/Section if any.
3. Answer to short answer/essay type questions are to be written in the space provided below each question or after the questions in test booklet itself. No additional sheets are to be used.
4. Read instructions given inside carefully.
5. Last page is attached at the end of the test booklet for rough work.
6. If you write your name or put any special mark on any part of the test booklet which may disclose in any way your identity, you will render yourself liable to disqualification.
7. Use of calculator or any other Electronics Devices is prohibited.
8. There is no negative marking.
9. You should return the test booklet to the invigilator at the end of the examination and should not carry any paper outside the examination hall.

પરીક્ષાર્થીઓ માટે સૂચનાઓ :

૧. આ પૃષ્ઠના ઉપલા ભાગે આપેલી જગ્યામાં તમારી ક્રમાંક સંખ્યા (રોલ નંબર) લખો.

૨. તમે જે વિકલ્પનો ઉત્તર આપો તેનો સ્પષ્ટ નિર્દેશ કરો.

૩. ટૂંકનોંધ કે નિબંધ પ્રકારના પ્રશ્નોના ઉત્તર દરેક પ્રશ્નની નીચે આપેલી જગ્યામાં જ લખો. વધારાના કોઈ કાગળનો ઉપયોગ કરશો નહીં.

૪. અંદર આપેલી સૂચનાઓ ધ્યાનથી વાંચો.

૫. આ ઉત્તર પોથીમાં અંતે આપેલું પૃષ્ઠ કાચા કામ માટે છે.

૬. આ ઉત્તર પોથીમાં કયાંય પણ તમારી ઓળખ કરાવી દે એવી રીતે તમારું નામ કે કોઈ ચોક્કસ નિશાની કરી હશે તો તમને આ પરીક્ષા માટે ગેરલાયક ગણવામાં આવશે.

૭. કેલ્ક્યુલેટર અથવા ઈલેક્ટ્રોનિક્સ સાધનોનો ઉપયોગ કરવો નહીં.

૮. નકારાત્મક ગુણાંક પદ્ધતિ નથી.

૯. પ્રશ્નપત્ર લખાઈ રહે એટલે આ ઉત્તર પોથી તમારા નિરીક્ષકને આપી દેવી. પરીક્ષાખંડની બહાર કોઈ પણ પ્રશ્નપત્ર લઈ જવું નહીં.

FOR OFFICE USE ONLY
MARKS OBTAINED

Question Number	Marks Obtained	Question Number	Marks Obtained	Question Number	Marks Obtained
1.		18.			
2.		19.			
3.		20.			
4.		21.			
5.		22.			
6.		23.			
7.		24.			
8.		25.			
9.		26.			
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					

Total Marks obtained ....

Signature of the co-ordinator ....
(Evaluation)

SEAL

2

COMPUTER SCIENCE AND APPLICATIONS
PAPER - III

Note :   This paper contains four sections. You are required to attempt all of them.

Note : Read the following paragraph and answer **Questions (1-5)** given below in **30 words** each. Attempt **ALL** questions.   **[Marks : 5×5=25]**

SECTION I

Product ABC is composed of parts A, B and C. Each time a new product ABC is created, it must be added to the product inventory, using the PROD-QOH in a table named PRODUCT. And the parts inventory, using the PART-QOH in a table named PART, must be reduced by one each of parts A, B and C. The sample database contents are shown in the following tables.

Table Name : PRODUCT		Table Name : PART	
PROD_CODE	PROD-QOH	PART_CODE	PART-QOH
ABC	1205	A	567
		B	98
		C	549

Based on the above information, answer the questions :

1.   How many database requests can you identify ? Write each request briefly.

2.   Write each database request using SQL.

3.   Write the transaction log as per the following layout :

Sr. No.	TRX-NUM	Operation	Table	Attribute	Before Value	After Value

4. Using the above transaction log, trace the recovery procedure (which follows deferred update) when a crash occurs after executing and logging the first update.

5. Using the transaction log created while answering Q. 3 above, trace the recovery procedure (which follows immediate update) when a crash occurs after executing and logging the first update.

SECTION II

Note :—Question Number **6-20** are to be answered in upto **30** words each in the space provided after each question. **(Marks 5×15=75)**

6.   What is the difference between a combinational circuit and a sequential circuit ?

7.   What is the basic difference between a latch and a flip-flop ?

8. Define COMMIT and ROLLBACK.

9. Prove that two successive reflections about any coordinate axes is equivalent to a single rotation about the origin.

10. Explain different types of parallel projection.

11. What is polymorphism and why is it used in programming languages ? Give a simple illustrative example from object oriented or functional language.

12. Explain IP tunnelling and how it is useful in providing security to IP packets.

13. Under which conditions one should use open loop protocol such as Hamming code over a feedback type protocol (with acknowledgement).

14. What is the worst-case complexity (max number of comparisons) of the Quick-sort algorithm ? Under what conditions does this worst case behaviour happen and how can we improve this ?

15. What can be achieved using inheritance can also be achieved using composition ? In the light of this fact suggest design guidelines.

16. Explain the need of XHTML when HTML is already well-accepted and well-supported by the software community.

17. Clearly state the benefits of spiral model over waterfall model.

18. Distinguish between black-box testing and white-box testing, stating the purpose of each type of testing.

19. What are the approaches for deadlock prevention ? Explain briefly the advantages/disadvantages.

20. Explain with illustration, the use of cut predicate in prolog.

SECTION III

Note : Question number **21-25** are all to be attempted from a single elective only. Each question may be answered in upto **200** words each.

(Marks 12×5=60)

21. Construct a finite state Automation that accepts all strings over the alphabet {0, 1} in which the number of 1s is odd and the number 0s is also odd.

22. How can we prove that a language L is not regular ? Use this method to show that the language $L = \{0^n 1^n \mid n > 0\}$ is not regular.

23. What is meant by Chomsky Normal form of a context free grammar ? Give a grammar G in Chomsky Normal form to produce the language :
    $$L = \{a^{2n} b^n \mid n > 0\}.$$

24. What is a recursively enumerable language ? Let L_1 and L_2 be recursively enumerable. Is the union $L_1 \cup L_2$ also recursively enumerable ? Is the intersection $L_1 \cap L_2$ also recursively enumerable ?

25. What is an NP-complete problem ? Give an example. How can we show that a problem PI is NP complete ?

Or

21. What is the optimal Huffman coding for the following set of frequencies—
    $a : 1, b : 1, c : 2, d : 3, e : 5, f : 8, g : 13, h : 21$?

22. How is parity used for error detection ? What is the advantages of using a parity check matrix over a single parity bit ?

23. Sketch the relative frequency response of the low pass Butterworth filter of order 1 to 5.

24. If a 12-bit Hamming code whose hexadecimal value is OXE4F arrives at a receiver, what was the original value in hexadecimal ? Consider that no more than 1 bit is in error.

25. What is data compression ? Differentiate between lossy and lossless compression. Explain in brief the PPM method for text compression.

Or

21. A firm manufacturers three products A, B and C. Their profits per unit are Rs. 300, Rs. 200 and Rs. 400 respectively. The first has two machines

and the required processing time in minutes on each machine for each product is given in the following table :

Product

		A	B	C
Machine	1	4	3	5
	2	2	2	4

Machines 1 and 2 have 2000 and 2500 machine-minutes, respectively. The upper limit for the production volumes of the products A, B and C are 100 units, 200 units and 50 units respectively. But, the firm must produce a minimum of 50 units of the product A. Develop a LP model for this manufacturing situation to determine the production volume of each product such that the total profit is maximized.

22. The Sun Ray Transport Company ships truck loads of grain from three silos to four mills. The supply (in truck-loads) and the demand (also in truck-loads) together with the unit transportation costs per truck load on the different routes are summarized in the transportation model in the following table.

Mill

		1	2	3	4	Supply
Silo	1	10 X_{11}	2 X_{12}	20 X_{13}	11 X_{14}	15
	2	12 X_{21}	7 X_{22}	9 X_{23}	20 X_{24}	25
	3	4 X_{31}	14 X_{32}	16 X_{33}	18 X_{34}	10

The unit transportation costs, C_{ij}, (shown in the north-east corner of each box) are in hundreds of rupees. The purpose of the model is to determine the minimum cost shipping schedule between the silos and the mills. Determine a starting basic flexible solution using Vogel approximations methods.

23. Consider the problem of assigning four sales persons to four different sales regions as shown below such that the total sales is maximized.

Sales Region

		1	2	3	4
	1	5	11	8	9
	2	5	7	9	7
Salesman	3	7	8	9	9
	4	6	8	11	12

The cell entries represent annual sales figures in crores of rupees. Find the optimal allocation of the sales persons to different regions.

24. Solve the following LP using simplex method :

Maximize $Z = 6X_1 + 8X_2$

Subject to

$$5X_1 + 10X_2 \leq 60$$
$$4X_1 + 4X_2 \leq 40$$
$$X_1, X_2 \geq 0$$

25. Define and illustrate through examples convex set and convex function. Determine whether the following sets are convex :

(i) $Q = \{(X_1, X_2) | X_1 + X_2 \leq 1, X_1, X_2 \geq 0\}$

(ii) $Q = \{(X_1, X_2) | X_1 \geq 1 \text{ or } X_2 \geq 2\}$

21. Explain how Hopfield network can work as content addressable memory. Also mention the relation between the size of the network and the patterns that can be stored.

22. Describe any *one* application for which the Kohonen network is the most suitable network.

23. Explain why XOR problem can not be solved by perceptron.

24. Consider the fuzzy sets $\tilde{A}$ and $\tilde{B}$ defined on the interval X = [0, 10] of real numbers by the membership grade functions :

$$\mu_{\tilde{A}}(x) = \frac{x}{x+2}$$

and $\mu_{\tilde{B}}(x) = \dfrac{1}{1 + 10(x - 2)^2}$

   (*i*) Define the cuts from each of the above fuzzy sets for $\alpha = 0.2$ and $\alpha = 0.9$

   (*ii*) Draw graphs of $\tilde{A}$ and $\tilde{B}$.

   (*iii*) Mathematically formulate and draw graphs of $\tilde{A} \cup \tilde{B}$ and $\tilde{A} \cap \tilde{B}$.

25. (*i*) Explain the concept fuzzy measures.

   (*ii*) Explain belief and feasibility measures.

   (*iii*) Compare the concepts of fuzzy sets and fuzzy measures by considering the example of degree of education of a person and the age of a painting.

Or

21. What is a "filter" as used in Unix shell programming ? Why is it useful ? Illustrate with a single example.

22. What is Unix file system ? Explain the structure of file system, file system types and special directories in brief.

23. Differentiate between Modal and Modeless dialog boxes. Explain when to use each type of dialog box with justification.

24. Explain the synchronization problem in the context of thread-based multi-tasking, giving illustrative example.

25. In Windows operating system, compare the database connectivity via ODBC and direct connection to database via port.