

**I Semester M.C.A. (Two Years Course) Examination, Aug./Sept. 2021
(CBCS) (2020-2021 and Onwards)**

COMPUTER SCIENCE

1MCA 1 : The Art of Programming

Time : 3 Hours

Max. Marks : 70

PART – A

Note : Answer any five. Each question carries six marks : (5×6=30)

1. What is complexity of an algorithm ? What is the best case, worst case and average case complexity ?
2. Write an algorithm to generate fibonacci series upto the number n.
3. Write an algorithm to reverse the digits of an integer. Check your algorithm for the input 1234.
4. What is the advantage of Binary search ? Write the binary search algorithm.
5. Write a note on control structures in C high level language.
6. How are matrices stored using row major representation ? Represent the following matrix using row-major order.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \\ 10 & 11 & 12 \end{bmatrix}_{4 \times 3}$$

How does the compiler find the location of a_{ij} th element ?

7. What is pass by value and pass by reference ? Explain with suitable example.
8. What is a structure ? Write a structure for the members : name, gender and salary. How are the members of the structure accessed in C high level language ?

**PART – B****Note : Answer any four. Each question carries 10 marks :****(4×10=40)**

9. What is 2-way merge sort algorithm ? Given the following two sets, merge the elements using 2-way merge sort

List 1 : 3 4 6 9 11 14 23

List 2 : 1 2 5 7 8 13 17 19

10. Write selection sort algorithm. Sort the following number using selection sort :

7 1 4 3 9 2 0 8

show the numbers after each pass.

11. Write an algorithm to multiply two matrices.

12. Write an algorithm to remove duplicates from a given list. Trace your algorithm for the following list :

1 2 2 4 5 6 7 7 8 9 9 9

13. Write an algorithm to find a sub text in a given text. What is pattern searching ? How do you search for a key word in a given text ?

14. Write a C program to find the maximum number in a given list. Trace your algorithm for the following list :
{4, 6, 3, 2, 9, 8, 13, 5}

**I Semester M.C.A. (2 Years Course) Degree
Examination, August/September 2021
(CBCS Scheme) (2020 – 2021 and Onwards)**
COMPUTER SCIENCE
1MCA2 : Discrete Mathematics

Time : 3 Hours

Max. Marks : 70

Instruction : Answer any five from Part – A and any four from Part – B.

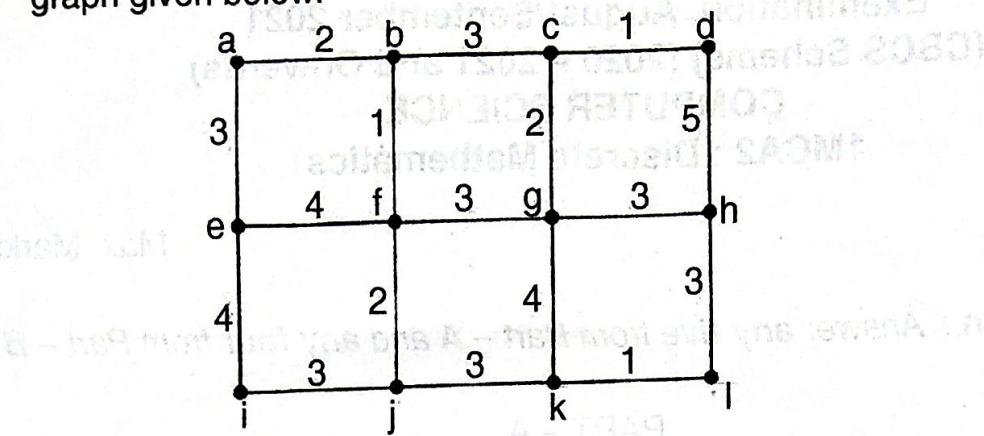
PART – A

Answer any five questions. Each question carries six marks. **(5x6=30)**

1. a) If A, B and C are three sets, then prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$. 3
- b) Prove that "null set is a subset of every set". 3
2. a) Define one-to-one and on-to functions with example. 3
- b) Show that $p \vee (q \wedge r) = (p \vee q) \wedge (p \vee r)$. 3
3. a) Let x be the set of factors of 12 and let \leq be the relation divisor i.e., $x \leq y$, if and only if x divides y. Draw the Hasse diagram of (x, \leq) . 3
- b) Find the values of the extended binomial coefficients $\binom{-2}{3}$ and $\binom{\frac{1}{2}}{3}$. 3
4. Obtain an explicit form for the following sequence a_n defined recursively by $a_n = 2a_{n-1} + 1$ for $n \geq 2$, with $a_1 = 3$. 6
5. What is the expected value of the sum of the numbers that appear when a pair of fair dice is rolled ? 6
6. a) A sequence of 10 bits is randomly generated. What is the probability that at least one of these bits is 0 ? 3
- b) Let E_1 and E_2 be events in sample space S. Then show that $p(E_1 \cup E_2) = p(E_1) + p(E_2) - p(E_1 \cap E_2)$. 3



7. Use Kruskal's algorithm to find a minimum spanning tree in the weighted graph given below.

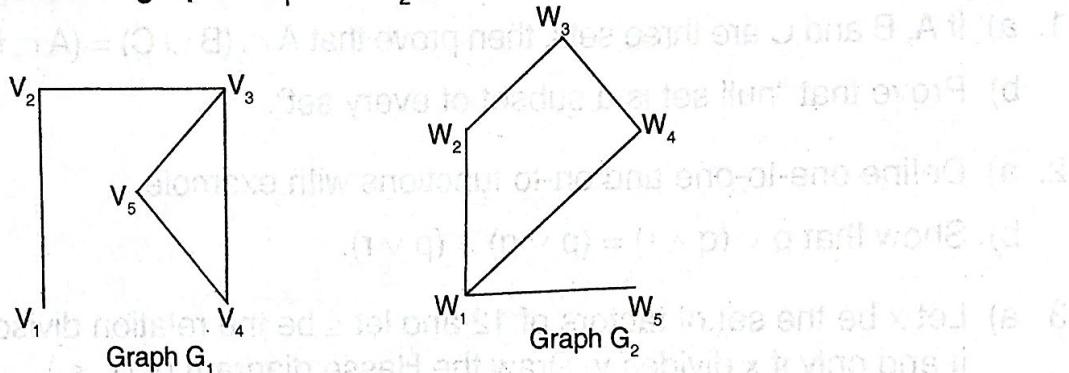


8. a) Define a bipartite graph. Show that the hypercube Q_3 is a bipartite graph.
b) Check whether graphs G_1 and G_2 are isomorphic.

6

3

3



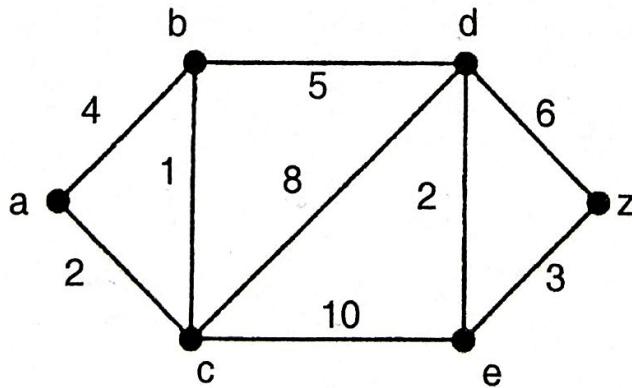
PART – B

Answer any four questions. Each question carries 10 marks.

(4x10=40)

9. a) Prove that $(p \rightarrow q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg(q \vee p)$.
 b) A survey among 100 students shows that of the three ice cream flavors Vanilla, Chocolate and Strawberry, 50 students like Vanilla, 43 like Chocolate, 28 like Strawberry, 13 like Vanilla and Chocolate, 11 like Chocolate and Strawberry, 12 like Strawberry and Vanilla and 5 like all of them. Find the number of students surveyed who like each of the following flavors.
 i) Chocolate but not Strawberry.
 ii) Chocolate and Strawberry but not Vanilla. (5+5=10)
10. a) By mathematical induction, prove that for every integer n , the number $A_n = 5^n + 2 \cdot 3^{n-1} + 1$ is a multiple of B.
- b) The matrix of a relation on the set $A = \{1, 2, 3\}$ is given by $M_R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$.
 Show that R is an equivalence relation. (5+5=10)

11. a) Shirts numbered consecutively from 1 to 20 are worn by students of a class. When any 3 of these students are chosen to be debating team from the class, the sum of their shirt numbers is used as the code number of the team. Show that if any 8 of the 20 are selected, then from these 8 we may form at least two different teams having the same code number.
- b) A committee of eight people is formed from two mathematicians and ten economists. In how many ways can it be done, if the committee must include at least one mathematician ? (5+5=10)
12. a) State and prove the Bayes' theorem.
- b) The probability distribution of a discrete random variable is given below :
- | | | | | | | |
|------|-----|----|-----|----|-----|---|
| x | -2 | -1 | 0 | 1 | 2 | 3 |
| P(x) | 0.1 | K | 0.2 | 2K | 0.3 | K |
- Find : i) K ii) Mean and iii) Variance. (5+5=10)
13. a) Two cards are drawn from a pack of cards at random. What is the probability that it will be
- i) a diamond and a heart
 - ii) a king and a queen
 - iii) two kings ?
- b) State and prove the first theorem in Graph theory. Further, prove that the number of vertices of odd degree in a graph is always even. (5+5=10)
14. a) Define an Eulerian graph. If G is an Eulerian graph, then show that all the vertices of G are of even degree.
- b) Use Dijktra's algorithm, find the shortest path between a to z in the weighted graph.



(5+5=10)

**I Semester M.C.A. (2 Years Course) Examination, August/September 2021
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COMPUTER SCIENCE

1MCA4 : Theory of Computation

Time : 3 Hours

Max. Marks : 70

Instruction : Part – A : Answer any five questions.

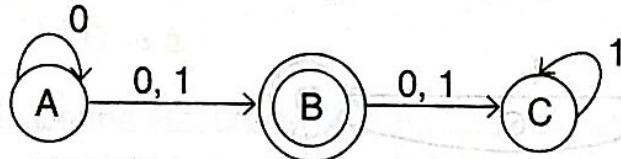
Part – B : Answer any four questions.

PART – A

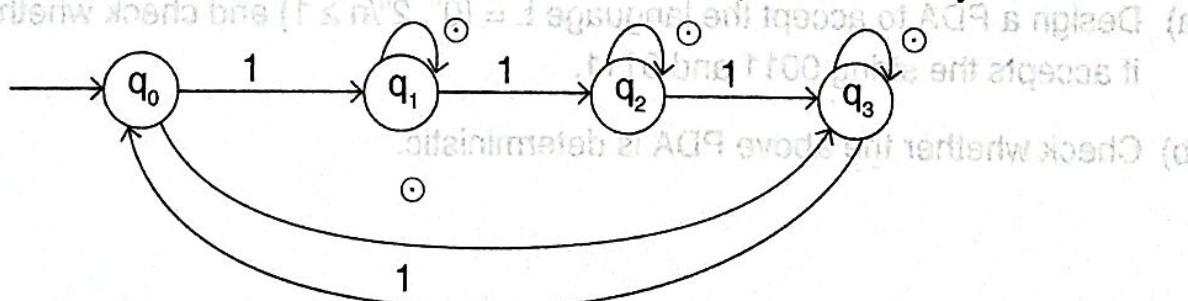
Answer any five full questions.

(5×6=30)

1. Define DFA, NFA and E-NFA with examples.
2. Convert the following NFA to DFA.



3. State and prove pumping lemma for regular languages and show that $L = \{ww/w \text{ belongs to } \{a, b\}^*\}$.
4. Write the left most and right most derivation for the following production and check whether it is ambiguous.
 $S \rightarrow iCtS/iCtSeS/a$
 $C \rightarrow b$
5. Explain with examples Chomsky hierarchy of languages.
6. Convert the following Moore Machine to an equivalent Mealy Machine.



Given $\lambda(q_0) = a$, $\lambda(q_1) = b$
 $\lambda(q_2) = c$, $\lambda(q_3) = d$.

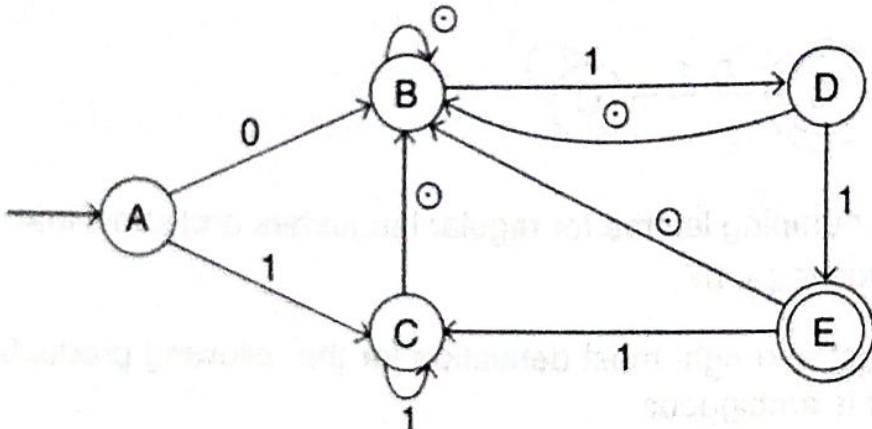
7. Explain Turing Machine and instantaneous description of Turing machine.
8. Define post correspondence problem. Check whether the lists
 $A = \{b, bab^3, ba\}$ and $B = \{b^3, ba, ba\}$
have a PCP solution.

PART - B

(4×10=40)

Answer any four full questions.

9. a) Design a DFA to accept strings of a's and b's starting with atleast two a's and ending with atleast two b's. 4
- b) Minimize the following DFA. 6



10. a) Construct an E-NFA for the regular expression $0(0 + 1)^* 01$. 5
- b) Prove that context free languages are closed under union, concatenation and star. 5
11. a) Design a PDA to accept the language $L = \{0^n, 2^n | n \geq 1\}$ and check whether it accepts the string 0011 and 0111. 8
- b) Check whether the above PDA is deterministic. 2



12. a) Convert the following grammar into equivalent CNF.

6

$$S \rightarrow OA/IB$$

$$A \rightarrow OAA/IS/I$$

$$B \rightarrow IBB/OS/O.$$

- b) Define GNF and write the steps to convert CFG to GNF.

4

13. a) Write short notes on Rice theorem and Halting problem.

6

- b) Obtain a PDA for the CFG given below.

4

$$S \rightarrow aABB/aAA$$

$$A \rightarrow aBB/a$$

$$B \rightarrow bBB/A$$

$$C \rightarrow a.$$

14. Define Recursive and Recursively enumerable languages and prove that the union of two recursive languages is recursive.

10

**I Semester M.C.A.(2 Years Course) Degree
 Examination, August/September 2021
 (CBCS Scheme) (2020 – 2021 and Onwards)
 COMPUTER SCIENCE**

1MCA3 : Computer Organization and Architecture

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **any five from Section – A and any four from Section – B.**

SECTION – A

Answer **any five** of the following. Each question carries **six** marks : **(5×6=30)**

1. Convert the following :

i) $7562_{(10)} = \underline{\hspace{2cm}}$ (16)

ii) $1110101_{(2)} = \underline{\hspace{2cm}}$ (10)

iii) $F3A7_{(16)} = \underline{\hspace{2cm}}$ (8)

2. Construct the basic logic gates using NOR logic gate.

3. Differentiate CISC and RISC.

4. Explain different instruction formats with an example for each.

5. Explain the limitation of Instruction level parallelism.

6. DMA has Priority over the CPU when both request a memory transfer. Justify your answer.

7. Explain the characteristics of multiprocessors.

8. Explain different types of ROM.



SECTION - B

(4x10=40)

Answer any four of the following. Each question carries 10 marks.

5

9. a) Minimize the following expression using K-Map

$$Y = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}CD + \bar{A}\bar{B}CD$$

5

- b) Design a combination logic circuit that form the arithmetic sum of three input bits.

10. a) Construct a 4-to-1 line multiplexer using logic gates. Explain its working procedure.

5

- b) Implement the following Boolean function using 8 : 1 multiplexer.

5

$$F(A, B, C, D) = \sum m(1, 3, 5, 6)$$

11. Discuss any two addressing modes of any generic microprocessor with an example for each.

10

12. Explain distributed memory MIMD architecture with neat diagram.

10

13. Explain three state – buffer with all supporting diagrams.

10

14. What is multithreading with respect to any generic microprocessor / OS ?

Discuss multithreaded processor architecture in detail with neat diagram.

10

I Semester M.C.A. (2 Years Course) Degree
Examination, August/September 2021
(CBCS)
(2020-2021 and Onwards)
COMPUTER SCIENCE
1MCA5 : Object Oriented Programming

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **any five** from Section – A and **any four** from
Section – B.

SECTION – A

Answer **any 5** questions. **Each** question carries **six** marks :

($5 \times 6 = 30$)

1. Define encapsulation and inheritance. Explain the purpose of 'this' and 'super' keyword in Java with example.
2. Explain different looping structures in Java.
3. Write a note on abstract method and abstract class.
4. What is a package ? Explain user defined package with example.
5. Explain final variable, final method and final class with example.
6. Write a Java program to read and write data to a file.
7. Write a note on Applet Life Cycle.
8. Explain five methods of graphics class with example.

SECTION – B

Answer **any 4** questions. **Each** question carries **10** marks :

($4 \times 10 = 40$)

9. Explain salient features of Java language. 10
10. What is a constructor ? Explain constructor overloading with an example program. 10



11. Define different types of inheritance. Explain how Java achieves multiple inheritance with an example. 10
12. Explain life cycle of a thread with a neat diagram. 10
13. What is an exception ? Explain how exception handling is achieved in Java. 10
14. Write a note on :
 a) Static variable and static methods. 5
 b) Stream classes. 5

SECTION - A

(Ques=3x3)

1. Define different types of inheritance. Explain how Java achieves multiple inheritance with an example.

Ans: In Java there are three types of inheritance:

a) Single Inheritance: It is the process of inheriting properties from one parent class to its child class.

b) Multiple Inheritance: It is the process of inheriting properties from two or more parent classes to a single child class.

c) Interface Inheritance: It is the process of inheriting properties from an interface to a class.

In Java, multiple inheritance is achieved through interfaces.

Ques: Explain the life cycle of a thread.

Ans: The life cycle of a thread in Java consists of the following stages:

a - MONITOR

(Ques=3x3)

1. Define what is meant by thread synchronization. Explain how threads can be synchronized.

Ques:

Explain the concept of thread死锁 (deadlock).

Ques:

Explain the concept of thread starvation.

Ques:

Explain the concept of thread priority.

**I Semester M.C.A. (2 Years Course) Examination, August/September 2021
 (CBCS Scheme)
 (2020 – 2021 and Onwards)
 Computer Science
 1MCA6 : DATA STRUCTURES**

Time : 3 Hours

Max. Marks : 70

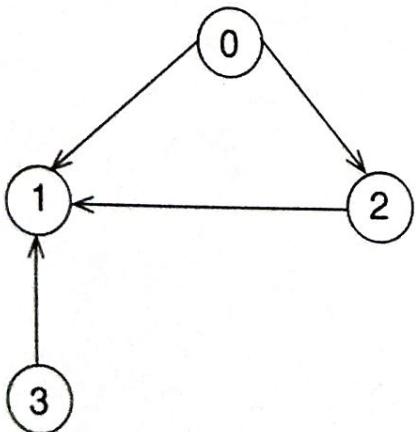
- Instructions :** 1) Answer all the Sections.
 2) Answer any five from Section – A, Answer any four from Section – B.

SECTION – A

Answer any five of the following. Each question carries six marks. (5×6=30)

- Define data structure and explain the operations performed on the linear data structure. 6
- Explain abstract data type. What is the importance of abstract data type in data structure ? 6
- What are the ways in which a two dimension array is stored? Write any two limitations of array. 6
- Given the following sparse matrix,

$$\begin{bmatrix} 0 & -1 & 0 & 0 & 2 \\ 3 & 0 & 4 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 2 & 0 & 1 & 0 \end{bmatrix}$$
. Design an algorithm to search an item in sparse matrix. 6
- What is weighted graph ? Write the adjacency matrix for the following graph. 6





6. Convert the following infix expression to postfix using stack
 $A * B - (f + D) + E.$
7. Explain different collision resolution strategies for hashing.
8. Explain Quick sort algorithm in detail with an example.

6

6

6

SECTION – B

Answer any four of the following. Each question carries ten marks. $(4 \times 10 = 40)$

9. a) Explain string as ADT. 6
 b) Write an algorithm to delete a substring from a given string. 4
10. a) Write an algorithm to traverse in a single linked list. 6
 b) Write an algorithm to insert a node at the beginning of a singly linked list. 4
11. a) Write an algorithm for push and POP operations on stack. 6
 b) Write an algorithm to find GCD of two numbers using recursion. 4
12. a) Explain directed and undirected graph with an example. 6
 b) Discuss the importance of graph and tree in data structure. 4
13. a) Explain depth first search algorithm to traverse a graph. 6
 b) Explain linear search with its merits and demerits. 4
14. a) Write bubble sort algorithm. Sort the following using bubble sort.
 $\{5, 1, 6, 2, 4, 3\}$. 6
 b) Explain Binary search algorithm. 4