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Reg. No. ☐☐☐☐☐☐☐☐

I Semester M.C.A. Degree Examination, June/July - 2024
COMPUTER SCIENCE
Theory of Computation
(CBCS Scheme 2020-21 - Y2K20)
Paper : 1MCA4

Time : 3 Hours   Maximum Marks : 70

Instructions to Candidates :

Answer All the Parts.

PART - A

Answer any **FIVE** questions.   (5×6=30)

1. Define automation and briefly outline the key characteristics of different automata types and their sub-classifications.

2. Design a DFA that reads a string of letters in the $L = \{W \mid W \in \{a, b \text{ and } |W| \bmod = 0\}$.

3. Define Regular Expression. Obtain an NFA for the regular expression a*+b*+c*.

4. Explain Chomsky's Hierarchy of languages.

5. What is ambiguous grammar? Is the following grammar ambiguous?

    $S \rightarrow aS \mid X$

    $X \rightarrow aX \mid a$

6. Compare Moore and Mealy machines.

7. Explain recursive languages and recursively enumerable languages.

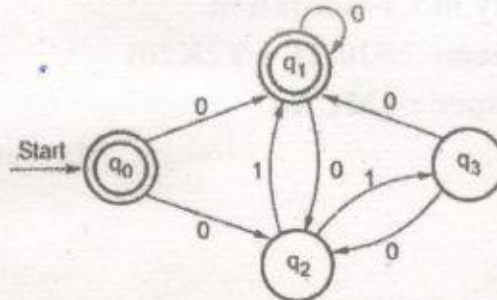8. What is a restricted Turing machine? Discuss any two restricted Turing machines.

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PART - B

Answer any **FOUR** questions.   (4×10=40)

9. a) What is NFA? Convert the following NFA to DFA.   (6)

    b) What does ε - closure represent? Provide an example to illustrate the usage   (4)

10. a) Minimize the following DFA using the table-filling algorithm.   (7)

δ	0	1
→ A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

    b) Obtain grammar to generate a string consisting of any number of a's and b's.   (3)

11. a) State pumping lemma. Show that $L = \{a^n b^n \mid n \geq 0\}$ is not regular.   (5)

    b) Optimize the CFG given below by reducing the grammar. Where S is the start
        symbol.

$S \rightarrow A|0C1$

$A \rightarrow B|01|10$

$C \rightarrow \varepsilon|CD$ (5)

12. Let language $L = \{a^n b^n \mid n \geq 1\}$

    a)   Obtain a Push Down Automata (PDA) for the given language.   (6)

    b)   Write the sequence of moves by PDA to accept the string aaabbb.   (2)

    c)   Is PDA corresponding to language deterministic? Justify your answer.   (2)

13. Obtain a Turing machine to accept the language $L(M) = \{0^n 1^n 2^n \mid n \geq\}$ with transition table and transition diagram.   (10)

14. Write a short note on

    a)   Halting Problem   (5)

    b)   Post Correspondence Problem   (5)

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I Semester M.C.A. Degree Examination June/July - 2024
COMPUTER SCIENCE
The Art of Programming
(CBCS Scheme Y2K20)

Time : 3 Hours   **Maximum Marks : 70**

Instructions to Candidates :

Answer any **Five** questions from Part A and any **Four** questions from Part B.

PART - A

Answer any **FIVE** questions. Each question carries **6** marks.   (5×6=30)

1. Define Algorithm and discuss the importance of asymptotic notations in the representaion of algorithms.

2. Write an algorithm to reverse the digits of the number 786.

3. Explain Loop Control Structures with examples.

4. Explain formatted and unformatted input and output functions with a suitable program.

5. Write an algorithm to remove duplicate elements from an ordered array without using temporary array.

6. Write a C program to find the Kth smallest element using Array Partitioning.

7. Write a C program to search an element using Hash Search.

8. Write an algorithm to search and replace a pattern in Text and illustrate using suitable example.

PART - B

Answer any **FOUR** questions. Each question carries **10** marks.   (4×10=40)

9. Write an algorithm to find an element using Linear Search and find its best case, worst case and Average Case complexity.

10. a) Write an algorithm for converting a decimal number to binary.   (5)

      b) State with example any five string functions in C.   (5)

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11. Discuss in detail 5 Decision making Control Statements. Write a C program to calculate factorial of a given number using while loop.

12. Explain how structure members can be accessed using pointers with a suitable example and write the C program to define, Assign and access the members of structure.

13. Write an algorithm to merge two sorted arrays into a single sorted array using simple merge method. Illustrate with an example.

14. Write an algorithm to sort the numbers using insertion sort. Sort the following list {4,1,3,9,0,2,6,5,7} using the algorithm.

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I Semester M.C.A. Degree Examination, June/July - 2024
COMPUTER SCIENCE
Discrete Mathematics
(CBCS Scheme Y2K20)
Paper : 1MCA2

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates :

1. Answer any **Five** questions from Part - A.

2. Answer any **Four** questions from Part - B.

PART - A

**Answer any FIVE of the following questions. Each carries 6 marks.**   (5×6=30)

1. Explain any three operations on sets with example.

2. Write Converse, Inverse and Contrapositive of the following statement:

   "If 2 is not a prime number then It is even number".

3. Prove by mathematical induction that $1^3 + 2^3 + 3^3 + \ldots + n^3 = \dfrac{n^2(n+1)^2}{4}$

4. Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements,

   (a) Do the words start with P.

   (b) Do all the vowels always occur together.

5. Let $A = \{1,2,3,4,6\}$ and R be the relation on A defined by aRb if a divides b.

   a) Write the relation R in Roster form.

   b) Determine the relation matrix of R

   c) Construct the directed graph that is associated with R.

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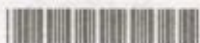
6. Let a pair of dice be thrown and the random variable X be the sum of the numbers that appear on the two dice. Find the mean, variance and standard deviation of X.

7. Explain different tree traversals with example.

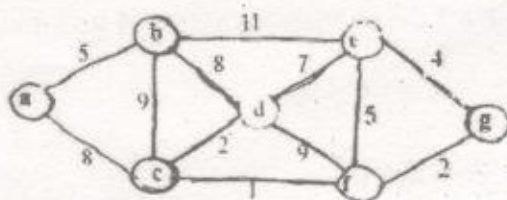8. Examine whether the following graphs are isomorphic or not

G.   G.
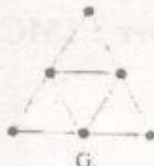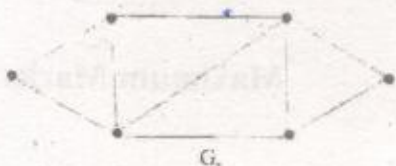
PART - B

Answer any FOUR questions. Each carries 10 marks.   **(4×10=40)**

9. (a) For any three sets A, B, C Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ using venn diagram.

   (b) A college awarded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?   **(5+5)**

10. (a) Let $f : N \to Y$ be a function defined as $f(x) = 4x + 3$, where Y is range of f. Show that f is invertible. Find the inverse of f.

   (b) A Committee of eight is to be formed from 16 men and 10 women. In how many ways can the committee be formed if.

     i) There must be 4 men and 4 women.

     ii) There should be an even number of women.   **(5+5)**

11. (a) Find the middle terms in the expansion $\left(\dfrac{x}{3} + 9y\right)^{10}$.

   (b) Explain recurrence relation with example of Fibonacci numbers.   **(5+5)**

12. (a) Show that the compound proposition $(p \to q) \leftrightarrow [(\sim p \vee q) \to (q \wedge \sim r)]$ is tautology.

   (b) If $P(A) = 6/11$, $P(B) = 5/11$ and $P(A \cup B) = 7/11$ find

     (i) $P(A \cap B)$ (ii) $P(A/B)$ (iii) $P(B/A)$ **(5+5)**

13. (a) An insurance Company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accident are 0.01, 0.03 and 0.05 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter drive?

    (b) If a fair coin is tossed 10 times, find the probability of

    (i) Exactly six heads   (ii) Atleast six heads   (iii) At most six heads.   (5+5)

14. (a) Define Euler and Hamiltonian graph. Give an example of a graph which is Hamiltonian but not Eulerian and Vice Versa.

    (b) Find the minimum cost spanning tree by Kruskal's algorithm.   (5+5)

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I Semester M.C.A. Degree Examination June/July - 2024
COMPUTER SCIENCE
Object Oriented Programming
(CBCS Y2K20 2020-2021 Scheme)

Time : 3 Hours   **Maximum Marks : 70**

Instructions to Candidates :

Answer any **Five** from Section-A and any **Four** from Section-B.

SECTION - A

Answer **any Five** questions. Each question carries **6** marks: (5×6=30)

1. Explain final variable, final method and final class.

2. What is an interface? With an example explain how multiple inheritance is implemented throw interface in Java.

3. Explain the features of Java.

4. Explain Java thread life cycle with methods.

5. Explain difference between String and String Buffer classes in Java with example.

6. Write a note on Applet life cycle with methods.

7. What is the use of Super keyword in Java? Explain with example.

8. What is Polymorphism? Explain method over loading and method over riding in Java.

SECTION- B

Answer **any Four** questions. Each question carries **10** marks.

                                                        (4×10=40)

9. What is a Constructor, Copy Constructor? Explain Constructor overloading with an example program in Java.

10. Define inheritance. Explain different types of inheritance with example in Java.

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11. A)   Explain different looping structures in Java.   (5)

    B)   How to declare two dimensional arrays in Java? Explain with simple program.   (5)

12. A)   Explain character stream and byte stream classes.   (5)

    B)   Write a note on abstract class and abstract method.   (5)

13. Define package. Explain the creation using of a package using a suitable example program.

14. What is an exception? Explain how exception handling is achieved in Java.

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I Semester M.C.A. Degree Examination June/July - 2024
COMPUTER SCIENCE
Data Structures
(CBCS Scheme Y2K20)
Paper : IMCA6

Time : 3 Hours   **Maximum Marks : 70**

Instructions to Candidates :

Part A :- Answer any five questions.

Part B :- Answer any four questions.

PART - A

I. **Answer any Five questions. Each carries 6 marks.**   (5×6=30)

1. What do you mean by data structures? Explain the different types of data structures.

2. Write short notes on Asymptotic notations for complexity of Algorithms.

3. What is a linked list? Write an algorithm to search an element in a sorted linked list.

4. Convert the following infix expression to a postfix expression using stack.
   $(a+b)/(c-d)*(e+f-g)$.

5. Construct a heap tree for the following data [max heap tree]
   35,33,42,10,14,19,27,44.

6. Perform DFS Traversal for the following Graph.
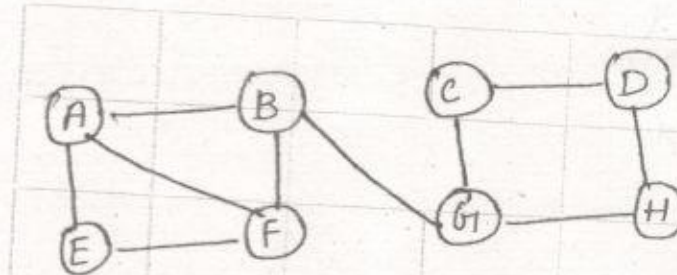
7. Sort the numbers 12,11,10,6,13,5,4,7,1 using the insertion sort algorithm.

8. What do you mean by hashing? Explain any two hashing techniques.

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PART - B

II. Answer any four questions. Each carries 10 marks. (4×10=40)

9. (a) Explain the concept of Abstract Data Type with a neat and labelled diagram. (5)

   (b) Write a C program to perform concatenation of two strings without using inbuilt string function. (5)

10. (a) What is a two dimensional array? What are the different storage representations of a 2D array? (5)

    (b) What is a header linked list? What are the different types of a header linked list? (5)

11. (a) What is a postfix expression? Evaluate the following postfix expression:
    123+*54 - +. (5)

    (b) Write the insertion and deletion operation in a queue. (5)

12. (a) Construct a binary search tree for the following:
    45,15,79,90,10,55,12,20,26,32. (5)

    (b) Write Inorder, Preorder, Postorder algorithm for the above BST. (5)

13. (a) Explain the sequential search using an example. (5)

    (b) Perform merge sort algorithm on the following
    50,60,10,1,86,90,72,3,12,4. (5)

14. (a) What do you understand by collision? Explain any two collision resolution techniques. (5)

    (b) Perform topological sort on the following graph. (5)
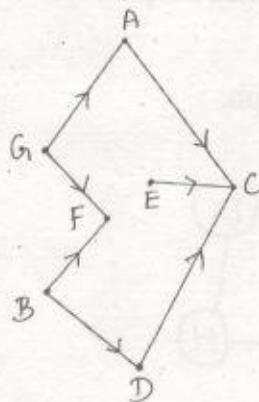
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I Semester M.C.A. Degree Examination June/July - 2024
COMPUTER SCIENCE
Computer Organization and Architecture
(CBCS Scheme Y2k20)

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates :

Answer all the questions.

PART - A

Answer any FIVE of the following questions.

$(5\times6=30)$

1. Convert $257_{(10)}$ to Binary, Octal and Hexa decimal number system.

2. Explain 4×1 Multiplexer and 1×4 De-Multiplexer with a neat diagram.

3. Explain difference between CISC and RISC.

4. Write a note on error detection and correction code using Hamming Code.

5. Explain the register set connected to common bus in computer organization.

6. With an example, explain the different instruction formats.

7. Explain Stack Organization and its operation.

8. Explain data hazarads in instruction level parallelism.

PART - B

Answer any FOUR of the following questions.

$(4\times10=40)$

9. (a) Minimize the following expression using K-map and write the equivalent circuit diagram for the minimized expression.

$$F(\omega,x,y,z) = \Sigma(m_1,m_2,m_5,m_{13},m_{15}) + \Sigma d(m_4,m_9,m_{10},m_{12},m_{14}).$$ **(6)**

    (b) Write a note on Von-Neumann architecture.   **(4)**

10. (a) Explain the working of Half Adder and Full Adder. Implement the same using NAND gates only.   **(6)**

    (b) With an example explain any four addressing modes.   **(4)**

[P.T.O.

11. (a) With a neat flow chart explain instruction cycle. (6)

    (b) Explain shift instruction with an example. (4)

12. (a) Explain DMA Controller in detail. (6)

    (b) Discuss Internal and External Interrupts. (4)

13. (a) Explain memory hierarchy in computer organization. (6)

    (b) Briefly explain the levels of RAID technology. (4)

14. Write short notes on:

    (a) Flynn's Taxonomy

    (b) Ripple Counter (5+5)