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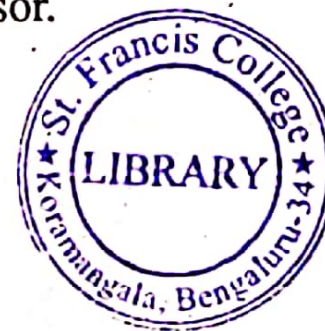
I Semester M.C.A. Degree Examination, July - 2022

COMPUTER SCIENCE**Computer Organization and Architecture****(CBCS 20-21 Scheme)****Paper : 1MCA3****Time : 3 Hours****Maximum Marks : 70****Instruction to Candidates:**

- 1) Answer any **Five** questions from Section A, each carries **Six** marks.
- 2) Any **Four** questions from Section B, each carries **Ten** marks.

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

1. Convert $(FADE)_{16}$ into decimal, octal and binary number system.
2. With a neat diagram explain Von-Neuman architecture.
3. Subtract $73_{(10)}$ from $28_{(10)}$ using 2's complement method.
4. Explain the different instruction formats.
5. Write a note on RISC and CISC.
6. Explain instruction level parallelism and its limitations.
7. Explain the characteristics of multiprocessor.
8. Explain virtual memory.

**SECTION - B****II. Answer any Four Full questions.****(4×10=40)**

9. a) With a neat circuit diagram and truth table, explain the working of full adder. **(5)**
- b) Simplify $F(ABCD) = \sum m(1, 2, 6, 11, 15) + \sum d(0, 3, 9, 10, 14)$ using k map and write the circuit diagram for the simplified expression. **(5)**

[P.T.O.]



10. a) Explain error detection using Hamming code. (5)
b) Explain binary counter. (5)
11. a) With a neat circuit diagram explain the working of JK flip flop. (5)
b) Explain interrupt cycle with a neat flow chart. (5)
12. a) Explain memory reference instruction and register reference instruction with an example. (5)
b) What is memory-mapped I/o and program controlled I/o. (5)
13. a) Define addressing mode and explain any 4 addressing mode. (5)
b) Explain the block diagram of DMA Controller. (5)
14. a) Explain MIMD architecture. (5)
b) What is inter process communication ? Explain shared memory method of process communication. (5)
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I Semester M.C.A. Degree Examination, July- 2022

COMPUTER SCIENCE

Data Structures

(CBCS Scheme)

Paper: 1MCA6

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

- 1) Part A: Answer any Five questions.
- 2) Part B: Answer any Four questions.

PART - A**A. Answer any Five. Each question carries Six marks.****(5×6=30)**

1. Define Asymptotic Notations. Explain its utility in analysis of an algorithm.
2. Describe briefly three types of structures used for storing Strings.
3. Explain linked list. Write an algorithm to count the number of nodes in a singly linked list.
4. Write the algorithm for push and pop stack operation. The following sequence of operations is performed on a stack: push (1), push(2), pop(), push (1), push (2), pop(), pop(), pop(), push (2), pop (). Determine the sequence of popped out values.
5. Define hashing, hash function and collision. Differentiate between static and dynamic hashing.

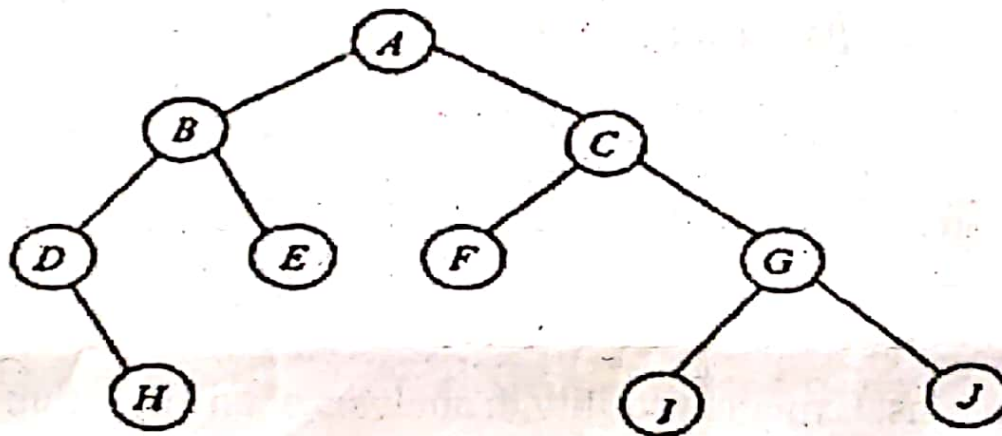
**[P.T.O.]**



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6. Write short notes on any two of the following:
- a) Topological sorting of a directed graph.
 - b) Sparse Matrix.
 - c) Lexicographic Search Trees.
7. Write a recursive algorithm to solve factorial of a number.
8. Traverse the given tree using inorder, preorder and postorder traversal.



PART - B

B. Answer any Four . Each question carries Ten marks.

(4×10=40)

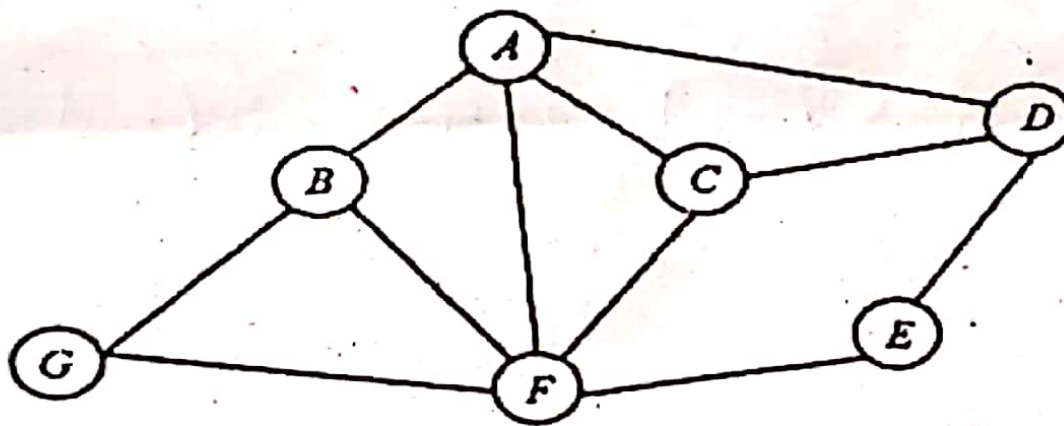
9. a) Calculate the number of comparisons required to match the given pattern using Naïve string-matching algorithm.
- b) Analyse how the efficiency is increased by the pre-computed tables in Boyer Moore algorithm with the following example. (5+5)

Text: GCAATGCCTATGTGACC

Pattern: T A T G T G



10. a) Describe the steps to convert infix to postfix expression.
- b) Show the detailed contents of stack to convert the given infix expression $((A+B)^C)-((D*C)/F)$ to postfix expression. Evaluate it for the given values $A=6$, $B=3$, $C=2$, $D=4$, $F=2$. Priorities are of the order $C, \wedge, * \& \gamma, + \& -$ (5+5)
11. a) Write an algorithm to insert a NEWNODE at the beginning of a singly linked list and delete a node at the end of a singly linked list.
- b) Differentiate between circular queue and doubly ended queue. Calculate the minimum number of queues required to implement a priority queue. (5+5)
12. a) Show the Binary Search Tree that is obtained after inserting the key 8, 11, 5, 7, 9, 6, 10, 14, 12. Redraw the tree after deleting the Root.
- b) Apply Breadth first Search (BFS) on the following graph. (5+5)



13. a) Illustrate the working of Heap sort algorithm on the following input: 35, 15, 0, 1, 60
- b) Build an AVL tree with the following values: 15, 20, 24, 10, 13, 7, 30, 36, 25, 42, 29. (5+5)
14. a) Show the tracing of the following list of numbers writing a merge sort algorithm. 8, 2, 4, 6, 9, 7, 10, 1, 5, 3.
- b) Explain the Binary Search technique using an algorithm. Search 5 in the list. {1, 2, 4, 5, 9, 18, 21} (5+5)



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I Semester M.C.A. Degree Examination, July - 2022

COMPUTER SCIENCE

Discrete Mathematics

(CBCS Scheme)

Paper : 1MCA2

Time : 3 Hours

Maximum Marks : 70

Instruction to Candidates:

Answer any 5 questions from Part A, any 4 questions from Part-B.

PART - A

Answer any Five questions. Each carries Six marks.

(5×6=30)

1. a) Determine the sets A and B, given that $A - B = \{1, 2, 4\}$, $B - A = \{7, 8\}$ and $A \cup B = \{1, 2, 4, 5, 7, 8, 9\}$
b) For any three sets A, B, C prove that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
2. Let $A = \{1, 2, 3, 4, 6\}$. Define a relation R on set A defined by $R = \{(a, b) : a, b \in A \text{ and } a \leq b\}$.
 - i) Write down elements of R
 - ii) Matrix representation of R and
 - iii) Digraph of R
3. Prove by Mathematical Induction $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$ for all positive integers 'n'.
4. Prove that the proposition $[p \rightarrow (q \rightarrow r)] \leftrightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology.
5. How many ways can the letters of the word ASSASSINATION be arranged so that all the S's are together?



[P.T.O.]



6. If $P(A)=0.8$, $P(B)=0.5$, $P(B/A)=0.4$ then find
- $P(A \cap B)$
 - $P(A/B)$
 - $P(A \cup B)$
7. Find the coefficient of $x^9 y^3$ in the expansion of $(2x-3y)^{12}$
8. Define the following with an example.
- Pseudo graph
 - Complete graph
 - Planar graph

PART - B

Answer any **Four** questions. Each carries **Ten** 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. (4)
- b) In a class consisting of 120 students, 30 are studying C++, 40 are studying Python and 45 are studying Java, 15 studying both C++ and Python, 20 studying both Python and Java, 12 studying both C++ and Java, 8 are studying all the three. How many do not take any of these subjects? How many take only one language? (6)
10. a) Show that $[p \rightarrow (q \wedge r)] \equiv [(p \rightarrow q) \wedge (p \rightarrow r)]$. (5)
- b) Determine the validity of the following argument. Either Anchal will run or Vibha will speak. If Vibha speaks then Abhi will fly and the Rose is purple. The rose is not purple, therefore Anchal will run. (5)
11. a) State and prove Pigeonhole principle. (5)
- b) Solve recurrence relation $a_n = 4a_{n-1} + 5a_{n-2}$ with initial conditions $a_1 = 2$ and $a_2 = 6$. (5)



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12. a) Define Conditional Probability. (2)

b) A random variable X has the following probability distribution. (8)

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K^2	$2K^2$	$2K^2+K$

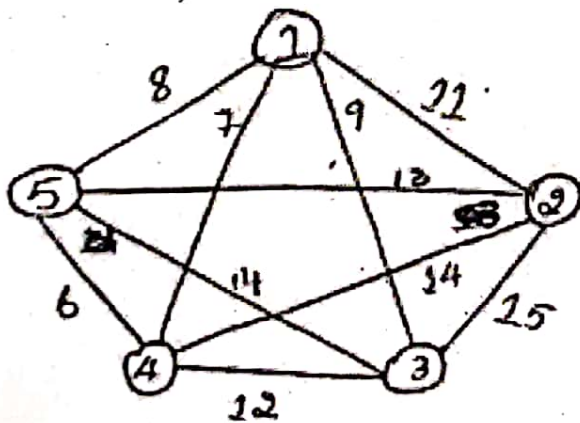
Find :

i) K

ii) $P(x < 3)$ iii) $P(x > 6)$ iv) $P(0 < x < 3)$

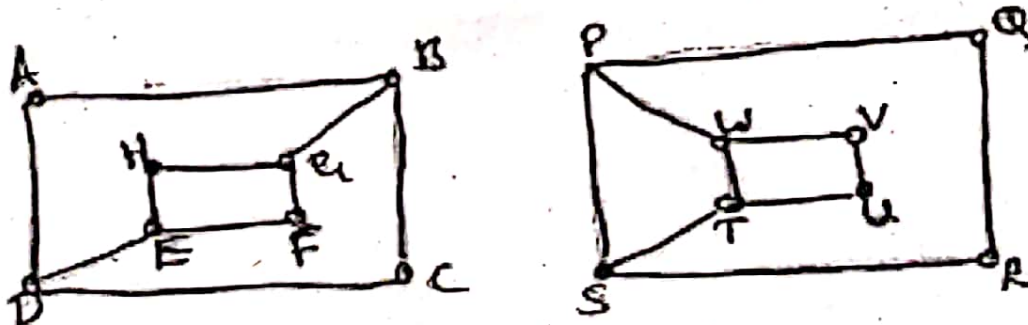
13. a) Define spanning tree with an example. (4)

b) Find the minimum weight spanning tree by Prim's Algorithm (6)



14. a) Explain Hamilton path and Hamilton Circuit with examples. (4)

b) Examine whether the following graphs are isomorphic or not. (6)





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I Semester M.C.A. Degree Examination, July- 2022

COMPUTER SCIENCE

Object Oriented Programming
(CBCS Scheme)

Paper: 1MCA5

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

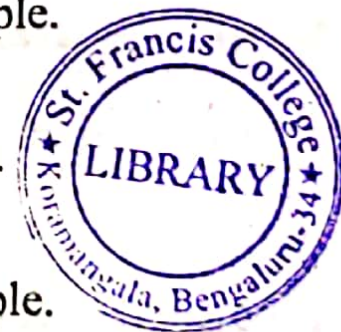
1. Answer any Five questions from Section A, each carries Six marks.
2. Answer any Four from Section B, each carries Ten marks.

SECTION - A

I. Answer any Five questions. Each question carries Six marks.

(5×6=30)

1. Explain the different features of JAVA. (6)
2. Write syntax for switch... case and illustrate switch to display First class if choice=1, Second class if choice=2 and Pass class if choice=3. (6)
3. Explain runtime polymorphism with Java programming example. (6)
4. Define interface and explain with Java programming example. (6)
5. What is the use of super keyword in Java? Explain with example. (6)
6. Write a JAVA program to demonstrate String class and its methods. (6)
7. Explain the life cycle of a Thread. (6)
8. Define final variable, final method and final class with example. (6)



[P.T.O.]



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SECTION - B

II. Answer any Four questions. Each question carries Ten marks.

(4×10=40)

9. a) Explain the structure of Java program with example.

b) Why Java is called platform independent language? Justify.

(5+5)

10. a) Explain different types of Constructor with example.

b) Discuss abstract class in Java?

(5+5)

11. Define inheritance. Explain different types of inheritance with example.

(10)

12. a) Write the steps to create and access package and give the example program.

b) Explain exception handling mechanism in JAVA.

(5+5)

13. a) What are the different methods to create thread and Give examples.

b) Explain character stream and byte stream classes.

(5+5)

14. a) Write a JAVA program to demonstrate static member data and static member methods.

b) Write the difference between method overloading and overriding.

(5+5)



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I Semester M.C.A. Degree Examination, July - 2022

COMPUTER SCIENCE

The Art of Programming

(CBCS Scheme)

Paper : 1MCA1

Time : 3 Hours

Maximum Marks : 70

PART - A

Answer any FIVE. Each carries SIX marks.

(5×6=30)

1. Write an algorithm to find $1^2+3^2+5^2+...+n^2$ Find the complexity of the algorithm.
2. Write an algorithm to reverse the digit reverse 786 using your algorithm.
3. Write an efficient algorithm to find GCD of two numbers. Find GCD of 512 and 36 using your algorithm.
4. Write an algorithm to search for an element in the list using binary search. Find 7 in the list {1, 4, 5, 6, 9, 13, 15} using your algorithm.
5. What is the difference between while-do and repeat control structures.
6. Give an example for pass by value and pass by address. Discuss the differences.
7. Write an algorithm to find Pseudo random number.
8. Write an algorithm to multiply two matrices of the order $m \times n$ and $n \times p$.

PART - B

Answer FOUR. Each carries TEN marks.

(4×10=40)

9. What is complexity of an algorithm, and rate of growth? Define Big oh notation. Write an algorithm to find an element using Linear search, and find its best case, worst case complexity.
10. Write an algorithm to sort the numbers using insertion sort. Sort the following list. {4, 1, 3, 9, 0, 2, 6, 5, 7}. Trace your algorithm. Suppose the elements given for sorting were to be {1, 2, 3, 4, 6, 7} how many comparisons you make.

[P.T.O.]





11. Write an algorithm to remove the identical numbers in a list. Trace your algorithm for removing the identical numbers for the following list {1, 3, 3, 5, 6, 7, 7, 8, 10, 10}
 12. What is structured programming? Write a C program to find factorial of a number using functions. Call the function to find factorial of 3 & factorial of zero.
 13. Write an efficient algorithm to raise the power of a number by a large number.
 14. Write algorithm to merge two sorted arrays. Trace your algorithm to merge the following two list.
{1, 4, 6, 9, 13, 18}
{2, 3, 5, 7, 8, 15, 19, 21}
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I Semester MCA Degree Examination, July - 2022

COMPUTER SCIENCE

Theory of Computation

(CBCS Y2k20 Scheme)

Paper : 1MCA4

Time : 3 Hours

Maximum Marks : 70

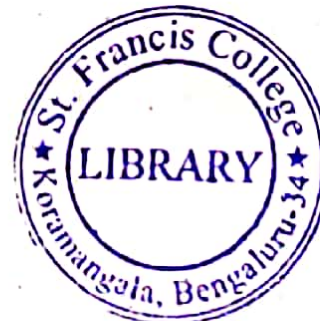
Instructions to Candidates:

- 1) Answer any **FIVE** questions from **Part - A**.
- 2) Answer any **FOUR** full questions from **Part - B**

PART - AAnswer any **FIVE** questions.

(5×6=30)

1. Define DFA ad NFA. Explain differences between NFA ad DFA. (6)
2. What is Regular expression? Prove that regular languages are closure under intersection?(6)
3. Define deterministic Push down Automata. Explain with example. (6)
4. Explain different types of Turing machines. (6)
5. Design a DFA to accept binary strings divisible by 3. and verify '1010' string is accepted or rejected. (6)
6. Explain chomsky's hierarchy of languages. (6)
7. Prove that complement of recursively enumerable language is recursive. (6)
8. Eliminate unit productions from the grammar: (6)

 $S \rightarrow Aa / B / Ca$ $B \rightarrow aB / b$ $C \rightarrow Db / D$ $D \rightarrow E / d$ $E \rightarrow ab$ 

[P.T.O.]



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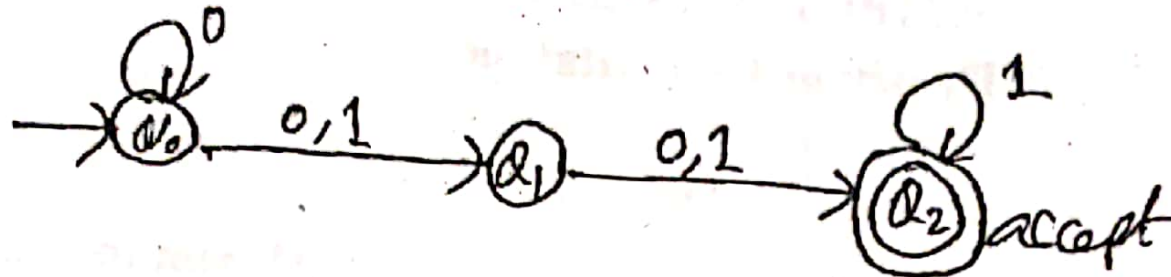
PART - B

Answer any FOUR full questions.

9. a) Convert the following NFA to its equivalent DFA:

(4×10=40)

(7)



- b) Explain the applications of finite Automata.

(3)

10. a) Show that $L = \{a^i b^j / i > j\}$ is not regular, where L is a Language.

(5)

- b) Convert the following CFG into CNF :

(5)

$S \rightarrow OA / IB$

$A \rightarrow OAA / IS / I$

$B \rightarrow IBB / OS / O$

11. a) Obtain a PDA to accept the language $L(m) = \{ W C W^R / W \in (a+b)^* \}$ where W^R is reverse of W by a final state and also verify the string 'aabCbaa' is accepted or not.

(7)

- b) Discuss the difference between moore machine and mealy machine.

(3)

12. a) Design a Turing machine to accept the language $L = \{0^n 1^n / n \geq 1\}$ and verify the string $W = 0011$ is accepted or rejected.

(7)

- b) Write a short note on Halting problem in TM.

(3)

13. a) Define Derivation Tree. Explain left most derivation tree and Right most derivation tree.

(4)

- b) Show that the following grammar is ambiguous.

(6)

$S \rightarrow aB / bA$

$A \rightarrow aS / bAA / a$

$B \rightarrow bS / aBB / b$

on a string 'aabbab'?

14. Write a short note on:

- a) Universal languages.

(5)

- b) Decision properties of Regular languages.

(5)