

Symbols used here have their usual meanings

Group-A

Answer all the following questions

- ✓ 1. A manufacturer of patient medicine is preparing a production plant on medicine A and B. There are sufficient ingredients available to make 20000 bottles of A and 40000 bottles of B, but there are only 45000 bottles into which either of the medicine can be put. Furthermore it taken three hours to prepare enough material to fill 1000 bottles of A, it taken one hour to prepare enough material to fill 1000 bottles of B and there are 66 hours available for this operation. The profit is Rs. 8.00 per bottle of A and Rs. 7.00 per bottle of B. Formulate this as a linear programming problem to maximize the profit. [5]
2. Define convex combination and convex set. If x_1, x_2 be real, show that the $X = \{(x_1, x_2) | x_1^2 + x_2^2 = 16\}$ is not a convex set. [2+3=5]
- ✓ 3. Define Basic and non-basic variables. Verify that the set of vectors $S = \{(1, 0, -1), (1, 2, 1), (0, -3, 2)\}$ is a basis for E^3 . [2+5=7]
- ✓ 4. Make the graphical representation of the set of constraints in the following LPP:
 Maximize $Z = 10x_1 + 15x_2$
 Subject to $x_1 + x_2 \geq 2, 3x_1 + 2x_2 \leq 6,$
 $x_1 \geq 0, x_2 \geq 0.$
 and find the extreme points of the region of feasible solutions. Find also the maximum value of the objective function. [5]
- ✓ 5. Show that the vectors $(2, 1, 2)$ and $(8, 4, 8)$ are linearly dependent. [3]

Group - B

Answer all of the following questions

1. Evaluate the missing terms from the following table (without using difference table):

x	0	1	2	3	4	5
$f(x)$	0	-	8	15	-	35

- ✓ 2. What do you mean by E, μ, δ operators? What is the relation between E, Δ ?
 and Prove that: (a) $\delta = \Delta(1 + \Delta)^{-\frac{1}{2}} = \nabla(1 - \nabla)^{-\frac{1}{2}}$ (b) $\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$ [3+2+3=8]
- ✓ 3. Find the inverse of the matrix, by Gauss-elimination method:

$$\begin{bmatrix} 1 & 3 & 3 & 2 \\ 1 & 4 & 3 & 4 \\ 1 & 3 & 4 & 5 \\ 2 & 5 & 3 & 2 \end{bmatrix}$$
 [7]
- ✓ 4. Find the positive root of $3x - \cos x - 1 = 0$, by using Newton-Raphson method. [5]

Enrollment No.

S₄ (UCS04C17): CSE

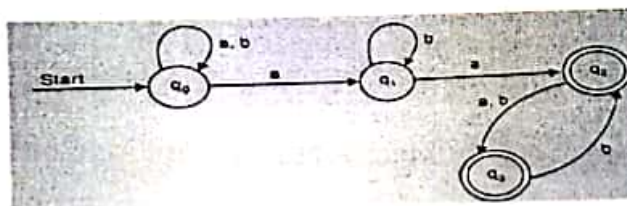
B.Tech 4th Semester Mid Term Examination- 2019
Formal Language & Automata Theory
UCS04C17

Full Marks: 50

Time: 2 hours

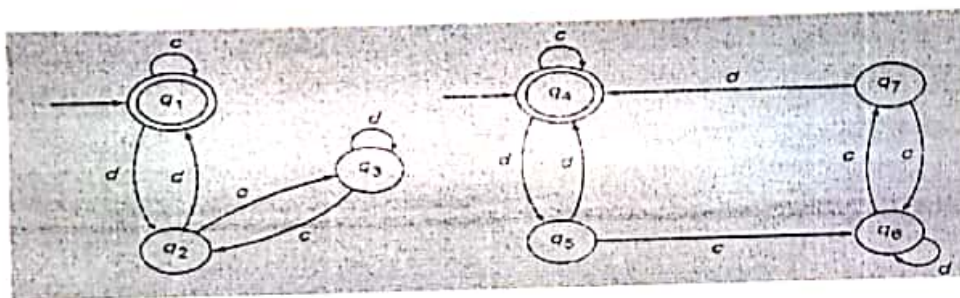
Q1. i) Convert the following NFA to Equivalent DFA

(5)



ii) State whether two DFA's are equivalent or not

(5)



Q2. Design the following FA

(2.5 *4)

- i) Design a DFA that accepts $L = \{(ab)^n : n > 0\}$
- ii) Design NFA for $L = \{abab^n : n \geq 0\} \cup \{aba^n : n \geq 0\}$
- iii) Design a DFA which accepts set of all binary strings containing 1010 as substrings.
- iv) Build a FA that accepts set of all binary strings containing even numbers of 0's and even number of 1's.

Q3. Answer the following:

(5*2)

- i) Using a RE represent the set of all strings of a's and b's containing at least one combination of double letters
- ii) Find the RE for the language consisting of all strings of a's and b's without any combination of double letters.

iii) Draw FA for the following language $(1+10+110)^*0$

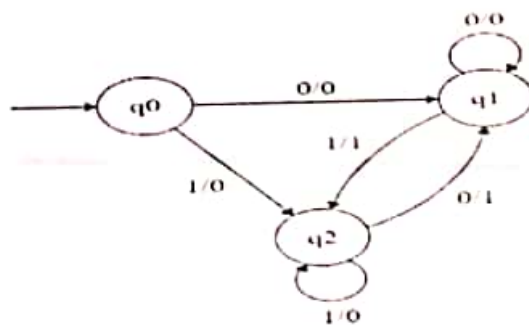
iv) Draw FA for the language $(111+100)^*0$

v) Give the RE for the set of all strings with even number of a's followed by odd number of b's.

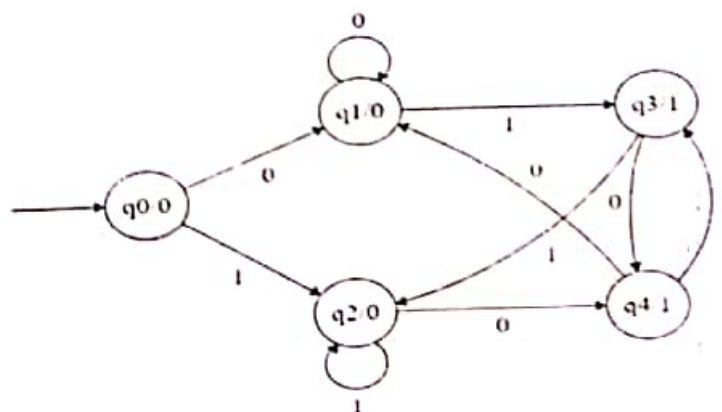
Q4. b) State the basic differences between DFA and NFA. Can a DFA be converted to equivalent NFA? If so justify your answer. (5)

a) Describe Chomsky classification of grammar with examples of each type. (5)

Q5. i) Convert following Mealy Machine to a Moore Machine. (5)



ii) Convert following Moore Machine to a Mealy Machine (5)



Enrolment No.

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B.Tech 4th Semester Mid Term Examination, 2019
Object Oriented Programming
 UCS04C18

Full Marks-50

Time: 2:00 Hrs

The figures in the margin indicate full marks for the questions

Answer all the questions

1. (2+2+1=5)
 - (a) Differentiate between class and object.
 - (b) What happens if we declare all member functions as private in a class?
 - (c) What is data abstraction?

2. (5+5+5=15)
 - (a) Write a program to create two classes *abc* and *pqr*. Each of them is having three integers. Find the greatest and the smallest value among all the six integers using friend function.
 - (b) Discuss the advantages of using inline function with example.
 - (c) Show the concept of function overloading in C++ with proper example.

3. (5+5+5=15)
 - (a) Write a program to create a class *employee* with data members to display the salary structure. Using array of object display the salary structure of 10 employees.
 - (b) With the help of an example discuss the use of copy constructor in C++.
 - (c) Write a program to create two classes named as *Rectangle* and *Square*. Define the constructors for each of the classes to initialize the data members. Define a member function *area* for class *Square* which will find the area for both rectangle and square and print the values.

4. (5+5+5=15)

Write short notes on:

 - (a) Scope resolution operator
 - (b) Access Specifier
 - (c) Constructor and destructor.

B.Tech 4th Semester Mid Term Examination-2019

Department of Computer Science & Engineering

Design & Analysis Of Algorithm

UCS04C15

Full Marks: 50 Marks

Time: 2Hrs

The figures in the margin indicate full marks for the questions

Instructions:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.

1. a) What do you mean by asymptotic time complexity?

b) What is Ω notation? Compare order of growth $n!$ and 2^n .

c) Using recursion tree method, solve the following recurrence

$$T(n) = T(n/4) + T(n/2) + n^2 \text{ and } T(1) = \Theta(1)$$

d) Write the Master theorem for solving recurrence problems.

$$2 + 3 + 2 + 3 = 10$$

2. a) How time complexity of an Algorithm is determined?

b) What is the running time of Quicksort when elements of array A have same value?

c) Write Quicksort Algorithm and derive the time complexity.

$$2 + 1 + 7 = 10$$

3. a) Sort the sequences 3, 1, 4, 1, 5, 9, 2, 6, 5, 14, 8 using insertion sort.

b) Illustrate the operation of Max-Heapify on the array

$$A = \{7, 17, 3, 16, 15, 11, 13, 10, 1, 5, 7, 12, 4, 18, 9\}$$

c) Show that the maximum number of nodes in a binary tree of height h is $2^{h+1} - 1$.

d) What is the minimum number of nodes in an AVL tree of height 15?

$$3 + 4 + 2 + 1 = 10$$

4. a) Write some disadvantages of Binary Search Trees.

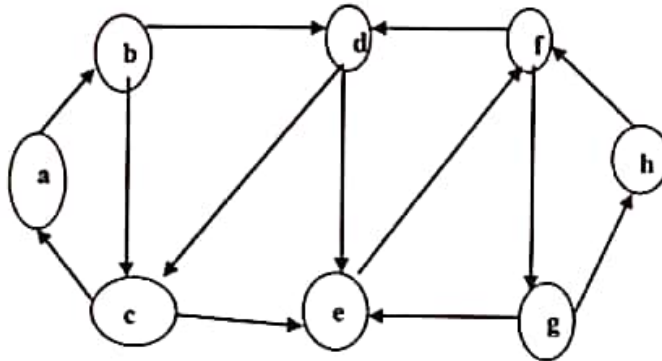
b) Discuss the Insertion procedure of AVL tree.

c) Show the result of inserting 2, 1, 4, 5, 9, 3, 6, 7 into an initially empty AVL Tree.

$$2 + 5 + 3 = 10$$

5. a) Write the algorithm for Breadth First Search. Give example.

b) Perform depth first search on the following graph and list all the possible search paths from node 'd'.



(6+ 4 = 10)

Symbols used here have their usual meanings

Group-A

Answer all the following questions

- ✓ 1. A company produces two types of presentation goods A and B that require gold and silver. Each unit of type A requires 3 g of silver and 1 g of gold while B requires 1 g of silver and 2 g of gold. The company can produce 9 g of silver and 8 g of gold. If each unit of type A brings a profit of Rs. 40 and that of type B Rs. 50, determine the number of units of each type that should be produced to maximize the profit.

[10]

- ✓ 2. One unit of product A contributes Rs. 7 and requires 3 units of raw material and 2 hours of labour. One unit of product B contributes Rs. 5 and requires one unit of raw material and one hour of labour. Availability of raw material at present is 48 units and there are 40 hours of labour.

(a) Formulate this problem as a linear programming problem.

(b) Write its dual.

(c) Solve the dual by the simplex method and find the optimal product mix and the shadow prices of the raw material and labour.

[3+2+10=15]

3. A company has three warehouses O_1 , O_2 and O_3 . It is required to deliver a product from these warehouses to four customers D_1 , D_2 , D_3 and D_4 . The warehouses availabilities and customers requirements are as follows:

Warehouse	: O_1	O_2	O_3	Customer	: D_1	D_2	D_3	D_4
No. of units	: 6	1	10	No. of units	: 7	5	3	2

The table below shows the costs of transporting one unit from warehouse to the customer.

		Customer			
		D_1	D_2	D_3	D_4
Warehouse	O_1	2	3	11	7
	O_2	1	0	6	1
	O_3	5	8	15	9

Find initial basic feasible solution for given problem by using (a) North-west corner method (b) Matrix minima method (c) Vogel's approximation method. Find the optimal transportation routes taking the initial basic feasible solution obtained by Vogel's approximation method.

[5+5+5+10=25]

P.T.O.

Group – B
Answer all of the following questions

Marks: 50

1. (a) Given that, $\frac{dy}{dx} - x^2 - y = 4$, $y(0) = 1$, compute $y(0.05)$ using simple Euler's method, $y(0.1)$ using improved Euler's method and $y(0.15)$, using modified Euler's method with $h = 0.05$.

- (b) State the relation between the differential operators (D) and the forward difference operator (Δ) and prove it.

[7+3]

2. (a) The function $f(x)$ is tabulated below, for different values of x :

x	0	5	10	15	20
$f(x)$	1.5708	1.5738	1.5828	1.5981	1.6200

Compute the first and second derivatives of $f(x)$ at $x = 3$.

- (b) Compute the root of $x \ln x = 1$ by Regula-Falsi method, correct upto three decimal places.

[5+5]

3. (a) Evaluate $\int_{0.4}^{1.6} \frac{x}{\sinh x} dx$, using composite Weddle's rule of integration, by dividing the interval of integration into 12 equal sub-intervals.

- (b) Compute $f(2)$, from the following table:

x	0	1	3	4
$f(x)$	5	6	50	105

[6+4]

4. (a) Solve the system of equations, by Gauss-Seidel method:

$$20x_1 + 5x_2 - 2x_3 = 14$$

$$3x_1 + 10x_2 + x_3 = 17$$

$$x_1 - 4x_2 + 10x_3 = 23$$

Correct upto 3 significant figures.

- (b) Evaluate: $\int_0^{\frac{\pi}{2}} \sqrt{1 - 0.162 \sin^2 \phi} d\phi$, by Simpson's One-third rule, correct up-to 2 decimal places, taking three points.

[6+4]

5. State Lagrange's inverse interpolation formula. Find the values of $y(0.2)$ and $y(0.4)$, using Runge-Kutta method of fourth order with $h = 0.2$, given that $\frac{dy}{dx} = \sqrt{x^2 + y}$, $y(0) = 0.8$.

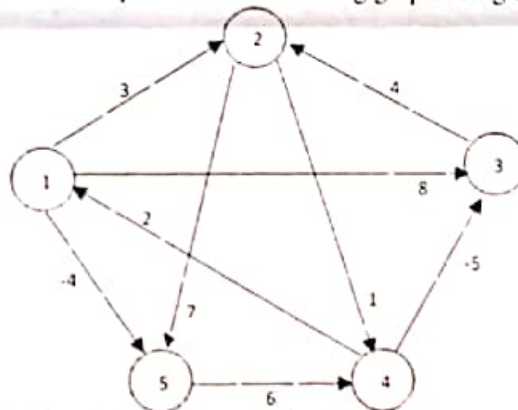
[3+7]

BTech 4th Semester End Term Examination- 2019
Department of Computer Science & Engineering
Name of Subject: Design & Analysis Of Algorithm
Paper Code: UCS04C15

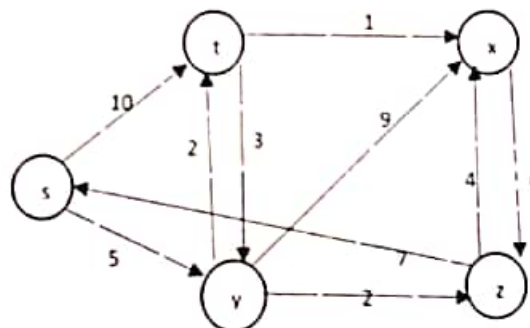
Full Marks: 100**Time: 3 Hours****Instructions:**

- 1) Attempt any five questions.
 2) Figures to the right indicate full marks.

1. (i) What are asymptotic time complexity? Why they are used? Outline different asymptotic notations.
 (ii) Solve the given recurrence relation using master's method:
 i. $T(n) = 7T(n/2) + n^2$
 ii. $T(n) = 3T(n/4) + n \lg n$
 (iii) What are the factors affecting the sorting algorithms? Briefly illustrate the effect on different sorting algorithms with suitable examples. (5+5+10)
2. (i) Write an algorithm to construct a max heap. Construct a max heap for following input array:
 45, 63, 34, 54, 4, 64, 23, 6, 33, 65, 57, 34, 57, 54
 (ii) What is the advantage of Merge sort over quick sort algorithm? Briefly explain citing examples.
 (iii) Write down the algorithms for QUICK-SORT and PARTITION. When best case and worst case partitioning will occur in quick sort? (5+5+10)
3. (i) Find the all pair shortest path for the following graph using Floyd – Warshall Algorithm.

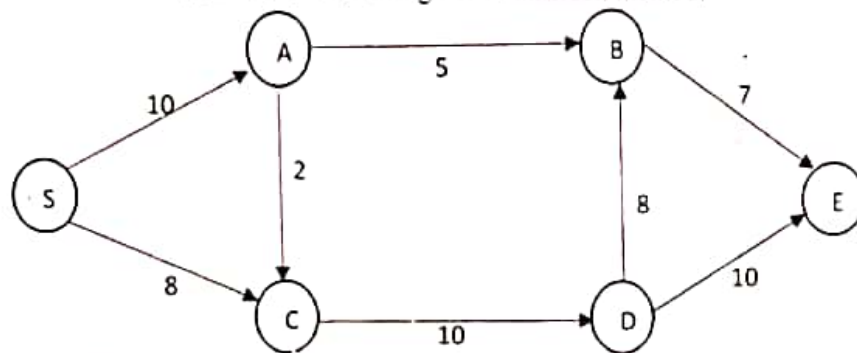


- (ii) Find The shortest path from node "s" to all the other nodes of the graph given below:

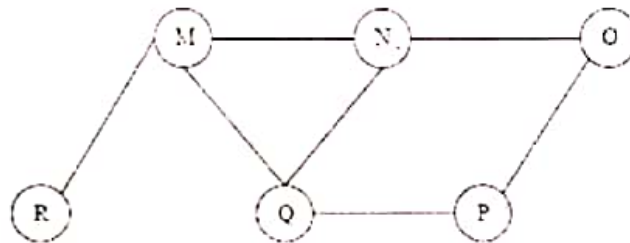


- (ii) Define Spanning Tree. Write Kruskal's algorithm for finding minimum cost spanning tree. Describe how Kruskal's algorithm is different from Prim's algorithm for finding minimum cost spanning tree. (5+5+10)

4. (i) Find out the maximum flow from S to T using Ford Fulkerson method:



- (ii) The Breadth First Search algorithm has been implemented using the queue data structure. What is the possible order of visiting the nodes of the following graph starting from Q.



- (iii) Give a brief note on N, NP and NP-Complete problem? Explain citing suitable example. (5+5+10)

5. (i) Write short notes on the following:

- Binary search tree.
- B-Tree

- (ii) Define AVL tree? Construct AVL tree for following data (Mention type of rotation for each case)

1, 2, 3, 4, 8, 7, 6, 5, 11, 10, 12.

- (iii) Discuss the following algorithm design techniques-

Divide & Conquer approach, Dynamic Programming and Greedy approach. (5+5+10)

6. (i) What is Convex hull problem? Derive the Complexity of any convex hull algorithm.

- (ii) Define a knapsack problem? Write an algorithm to find the solution of Binary and Fractional Knapsack. Justify your solution with proper examples. (10+10)

BTech Fourth Semester End Term Examination- 2019
Name of Subject: Formal Language and Automata Theory
Paper Code: UCS04C17

Full Marks: 100**Time: 3 Hours****Instructions:**

- i) All questions are compulsory.
- ii) Marks are given to the right of every question.
- iii) Draw neat diagrams wherever necessary.

1. ~~(a)~~ Construct a FA and transition table of a machine that accepts even number of zeros and odd number of ones.
~~(b)~~ Write the regular expression for the set of all strings of 0's and 1's not containing 1010 as substring.
 (c) Write formal definition of regular expression with suitable example. State Arden's theorem and its use.
~~(d)~~ Determine DFA from a given NFA:
 $M = (\{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_1\})$ where δ is given by
 $\delta(q_0, 0) = \{q_0, q_1\}, \delta(q_0, 1) = \{q_1\}, \delta(q_1, 0) = \phi, \delta(q_1, 1) = \{q_0, q_1\}$ (4*5=20)
2. (i) Define the following and give appropriate examples
 - ~~a.~~ Non-Deterministic Automata(NFA)
 - ~~b.~~ Ambiguity
 - ~~c.~~ Derivation Tree
 - ~~d.~~ Context free grammar~~(ii)~~ Construct a DFA equivalent to the following grammar: $S \rightarrow S10 / 0$
 (iii) Explain Chomsky's Hierarchy with examples. (10+5+5=20)
3. (i) What is Push down Automata (PDA). Explain when is a PDA said to be deterministic.
 (ii) Explain Pumping Lemma for Context Free Language with example.
~~(iii)~~ Define a PDA that checks wellformedness of parentheses. Simulate PDA for " $\{(){}(){}()\}$ ". (5+5+10=20)
4. ~~(i)~~ Design a Turing machine to recognize the language $L = \{1^n 2^n 3^n \mid n \geq 1\}$. Simulate a TM for "112233"
~~(ii)~~ Give the formal definition of a Push Down Automata and Turing Machine (15+5=20)
5. (i) Write short notes on:
 - ~~a.~~ Church Turing Hypothesis
 - ~~b.~~ Post Correspondence Problem~~(ii)~~ Comment on the power of a Finite State machine, PushDown Automata and a Turing Machine.
~~(iii)~~ Write notes on NP Complete Problems and Polynomial time reduction (10+5+5=20)

B.Tech 4th Semester End Term Examination- 2019Enrollment No.

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Name of Subject: Computer Organization

Paper Code: UCS04C16

Full Marks: 100

Time: 3 Hours

[The figures in the margin indicate full marks for the question]

1. a) How many 128 X 8 RAM chips are needed to provide a memory capacity of 1024 bytes? (2+3+4=10)
 b) How many address lines must be used to access 1024 bytes of memory? How many of their lines will be common to all chips?
 c) How many lines must be decoded for chips select? Specify size of decoders.
 d) Design the memory connection diagram to CPU.

2. a) Give the hardware implementation of following: (4+6=10)
 $Y_{T2}: R2 \leftarrow R1, R1 \leftarrow R2.$

b) Explain concept of virtual memory with help of diagram. Explain how virtual addresses are mapped to actual physical address.

3. Convert the equation written in C language into: (5+5=10)

a) Zero address instruction format b) One address instruction format

$$Y = (A - B + C) / (G + H)$$

4. a) How IR and PC registers are used for fetching the instruction for execution. (4+6=10)

b) Explain the direct mapping in cache memory with an example.

5. Consider the following reference string of pages made by a processor: (5+5=10)

1,3,2,4,2,1,5,1,3,2,6,7,5,4,3,2,4,2,3,1,4

Assume that the number of page frames allocated in the main memory is THREE. Compute number of page faults generated using FIFO and LRU page replacement policy.

6. a) What is page fault? How page fault is handled by memory management software? (4+6=10)

b) Main memory access time is 100ns. The access time for a cache is 1000ns. It is estimated that 90% memory request read and remaining 10% for write. The hit ratio for read access is 0.8. A write-through is used following:

i) What is the average access time of the system considering only memory read cycle?

ii) What is the average access time for the system for both read and write operation?

iii) What is the hit ratio taking into consideration of the write operation?

7. a) What are the arithmetic microoperations? Consider the following equation: (10)

$$D = A + Y + C_{in}$$

Draw the 4-bit arithmetic circuit with truth table.

8. a) What is meant by pipelining? Why do we require instruction pipelining? Explain with example? Discuss the pipeline performance measure? (2+4+4=10)

9. Write the following term (5x4=20)

a) Associative Mapping
 c) Replacement algorithm

b) RTL
 d) Memory Hierarchy

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Enrolment No.

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S₂(UCS04C18):B.Tech

B.Tech 4th Semester End Term Examination, 2019

Name of Subject: Object Oriented Programming

Paper code: UCS04C18

Full Marks-100

Time: 3:00 Hrs

The figures in the margin indicate full marks for the questions

Section A

5X8=40

- ✓ 1. Explain briefly the characteristics of OOP language and mention advantages of OOPS approach over functional/procedural programming
- ✓ 2. Explain the meaning and types of Data Conversion with example
- ✓ 3. Differentiate between Data encapsulation and Data abstraction. Function overloading/Function overriding.
- ✓ 4. Discuss with example the concept of ambiguity in inheritance.
- ✓ 5. Why destructors cannot be overloaded but constructors can be overloaded ✓
- ✓ 6. What is type casting. Explain various types of type casting ✓
- ✓ 7. What are the different types of inheritance, explain
- ✓ 8. Write the concept of Friend function and friend class with examples

Section B

4X5=20

Find the output

```
9. #include <iostream.h>

int main()
{
    int i = 0;
    cout << (i = 0 ? 1 : 2 ? 3 : 4);
    return 0;
}
```

```
10. #include <iostream.h>

int main()
{
    int i = 0, j = 0, k;
    i++;
    j++ ++;
    k = (i++) + j;
    cout << i;
    cout << j;
    cout << k;
    return 0;
}

11. #include <iostream>
```

```

using namespace std;
class Base1 {
public:
    Base1()
    { cout << "Base1's constructor called" << endl; }
};

class Base2 {
public:
    Base2()
    { cout << "Base2's constructor called" << endl; }
};

class Derived public Base1, public Base2 {
public:
    Derived()
    { cout << "Derived's constructor called" << endl; }
};

int main()
{
    Derived d;
    return 0;
}

```

2. #include <iostream>

```

using namespace std;

int fun(int a, int b = 1, int c = 2)
{
    return (a + b + c);
}

int main()
{
    cout << fun(12, 2);
    return 0;
}

```

3. #include <iostream>

```

using namespace std;

class Test
{
private:
    int x;
public:
    void setX (int x) { Test::x = x; }
    void print() { cout << "x = " << x << endl; }
};

int main()
{
    Test obj;
    int x = 40;
    obj.setX(x);
    obj.print();
}

```

```
return 0;  
;
```

Section C

4X10=40

- ✓ Write a program where you have overloaded unary '++', binary '=', binary '- ' operators
- ✓ Class A is base class. Its constructor takes two parameters. Class B is inherited from A publicly and B's constructor takes 3 parameters. Implement using c++ codes
- ✓ Write a program using concept of inheritance to override a function of base class in derived classes
- ✓ Write a program for reading and writing from and to a file.