



End Semester Examination

CSPE32 – Combinatorics and Graph Theory
Course/Department : B.Tech./CSE
Semester/Section : III
Date and Time : 21-07-2023 & 09.30 AM – 11.30 PM
Batch : 2021-2025
Session : Summer/2023
Marks : 50

**Answer ALL Questions with proper steps and justification.
Draw diagrams wherever necessary.**

1.
 - a) In how many ways can the letters in ARRANGEMENT be arranged so that there are exactly 2 pairs of consecutive identical letters? In how many ways can these letters be arranged so that there are at least 2 pairs of consecutive identical letters? (4)
 - b) A hospital committee consists of 20 doctors and 5 staffs. Of these doctors, there are 5 General Physician, 3 Cardiologist, 4 Pulmonologist, 2 Psychologist and others. Some members of the hospital committee are selected to form a special committee to handle the COVID wing. COVID special committee consists of Chairman, Vice-Chairman, Secretary and two volunteers. Volunteers should be selected from staffs. In how many ways can this COVID special committee be formed with a Pulmonologist as Chairman and General Physician as Vice-Chairman? In how many ways can this COVID special committee be formed with at least one Pulmonologist? (3)
 - c) 23 people are to be seated at 3 round tables. One of these table can occupy 9 people and other two can occupy 6 and 8 people. In how many ways can the people be seated? (2)
 - d) Mary is collecting money from her cousins to host a party for uncle. If 8 of the cousins plan to give 2, 3, 4, or 5 dollars each, and two others give 5 or 10 dollars each, in how many ways can Mary collect exactly 40 dollars? Solve the problem using generating functions. (3)
2.
 - a) Prove that a simple graph, G, with $n(>=3)$ vertices is Hamiltonian, if $d(v) \geq n/2$ for every vertex v of G. (2)
X State and prove Havel-Hakimi theorem. (3)
 - b) Prove that a vertex $v \in V(G)$ is a cut vertex of G if and only if $\exists u, w \in V(G), u, w \neq v$ such that v is on every $u-w$ path of G. (2)
X Prove that every circuit has an even number of edges in common with any cut-set. (3)
3.
 - a) Construct edge induced (S1) and vertex induced (S2) subgraphs from the given graph G. Edge set, $E(S1) = \{e_1, e_5, e_4, e_8, e_7\}$, and vertex set, $V(S2) = \{a, h, g, c, b\}$. Perform ring sum operation on S1 and S2 to obtain S3. Fuse vertices e and f of graph G. Show the resultant subgraphs. (2)

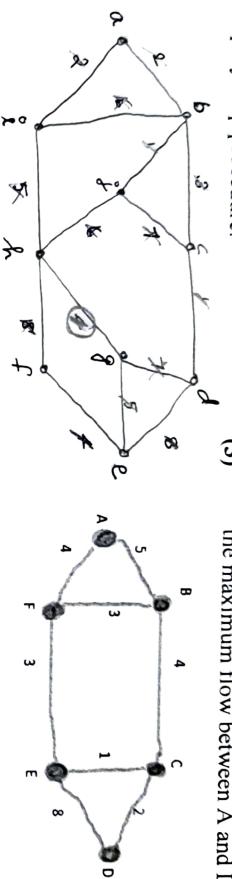
The diagram shows a graph G with 8 vertices labeled a, b, c, d, e, f, g, and h. The edges are labeled e1 through e12. The edges are: e1 (a-f), e2 (a-h), e3 (a-g), e4 (b-f), e5 (b-h), e6 (b-g), e7 (c-f), e8 (c-h), e9 (c-g), e10 (d-f), e11 (d-h), e12 (d-g). Vertex a is connected to b, c, and f. Vertex b is connected to a, c, and h. Vertex c is connected to a, b, and g. Vertex d is connected to c, f, and g. Vertex e is connected to f, h, and g. Vertex f is connected to a, b, and e. Vertex g is connected to b, c, and e. Vertex h is connected to a, b, and d.

b)

Identify whether Euler path or circuit exist in the graph given in question 3a. If so, trace one such path/ circuit. Also, provide a suitable matrix representation of this graph.

c)

Construct the minimal spanning tree and find its cost using the Prim's algorithm showing the step-by-step procedure. (3)



4.

a) Draw Ferrer's graph for any distinct partition for 9. Find the generating function for the number of partitions of a positive integer n into distinct summands. (2)

b) Find the chromatic number and chromatic polynomial of the given graph. (3)

c) Check whether the given graph is planar or not by performing elementary reduction. (2)



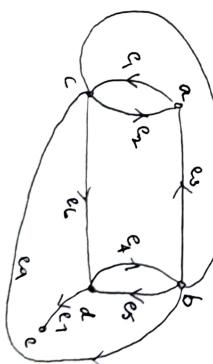
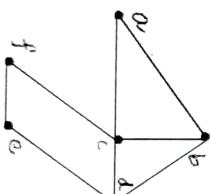
5.

a) Three boys B1, B2, B3 and four girls G1, G2, G3, G4 are such that (4)

- B1 is a cousin of G1, G3, G4
- B2 is a cousin of G2 and G4
- B3 is a cousin of G2 and G3.

If boys must marry a cousin girl. Find the possible set of such couples using graph.

b) From the graph given below, find Maximal Independent sets, and center of the graph. Derive your answer by showing required steps. (3)



(2)

(4)



Compensation Cycle Test

CSPE32 – Combinatorics and Graph Theory

Course/Department : B.Tech./CSE

Batch : 2021-2025

Semester/Section : III B

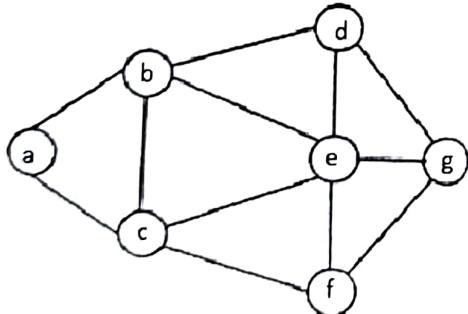
Session : July/2022

Date and Time : 25-11-2022 & 05.00 PM – 06.00 PM

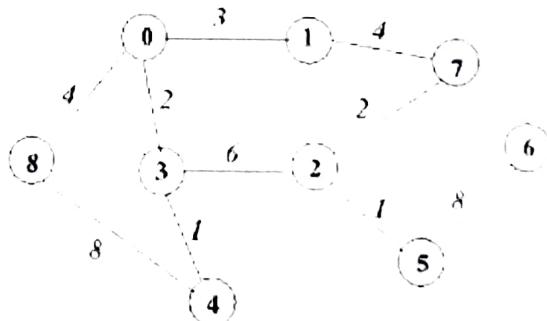
Marks : 15

**Answer ALL Questions with proper steps and justification.
Draw diagrams wherever necessary.**

1. In how many ways can one travel in the XY-plane from (1, 2) to (6, 8) if each move is one of the following types: $R: (x, y) \rightarrow (x + 1, y)$; $U: (x, y) \rightarrow (x, y + 1)$; $D: (x, y) \rightarrow (x + 1, y + 1)$. (2)
2. Maria bought 12 burgers and 18 sandwiches. She gave burgers and sandwiches to her friends Susan, Livia, John and Swathi in such a way that Swathi gets at least 3 sandwiches and one burger, others get at most 5 sandwiches and at least 2 burgers. (2)
3. State and prove multinomial theorem. (2)
4. How many arrangements of the letters in HIMALAYAM has no consecutive A's? (1)
5. Prove that in any tree with n vertices (where $n \geq 2$) have at least 2 pendant vertices. (2)
6. Is the degree sequence $<5, 5, 4, 3, 2, 2, 2>$ graphical? Derive your answer by showing required steps. (2)
7. Find the vertex connectivity and edge connectivity of the graph. Write down the corresponding cut-set and vertex cut/cut-vertex of the graph. Is there an articulation point in the graph? (2)
8. Construct the minimum spanning tree from the graph using Kruskal's method. (2)



(2)





Cycle Test 2

CSPE32 – Combinatorics and Graph Theory

Course/Department : B.Tech./CSE

Batch : 2021-2025

Semester/Section : III B

Session : July/2022

Date and Time : 27-09-2022 & 03.00 PM – 04.00 PM

Marks : 15

Answer ALL Questions with proper steps and justification.

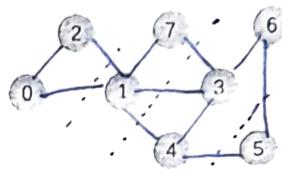
Draw diagrams wherever necessary.

Q1

Find the unique solution for $2a_n - 3a_{n-1} = 0$, $n \geq 1$, $a_4 = 81$. (2)

Q2

Find the vertex connectivity (1) and edge (2) connectivity of the graph. Write down the corresponding cut-set and vertex cut/cut-vertex of the graph. Is there an articulation point in the graph? (2)



Q3

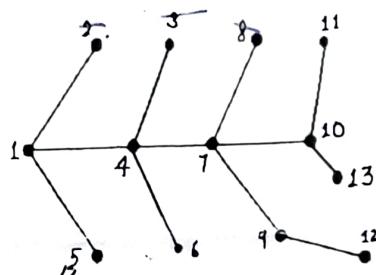
Prove that every tree has either one or two centers. (2)

Q4

State and prove Havel-Hakimi theorem. — ~~✓~~ (2)

Q5

Generate Prüfer sequence from the labeled tree and also construct a tree from the generated sequence. (Cayley's Formula) (2)

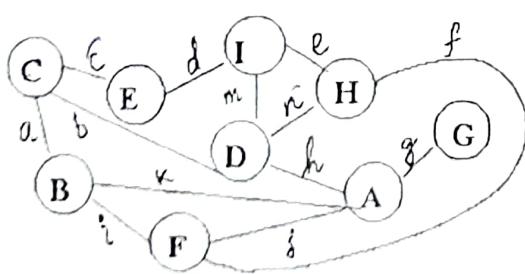


Q6

Construct induced subgraphs S1 and S2 from the graph given below using (2)

edge set, $E(S1) = \{c, n, h, g, d, k, i\}$ and vertex set, $V(S2) = \{C, A, D, H, G, E, I\}$.

Perform ring sum operation on S1 and S2. Show the resultant graphs. (2)



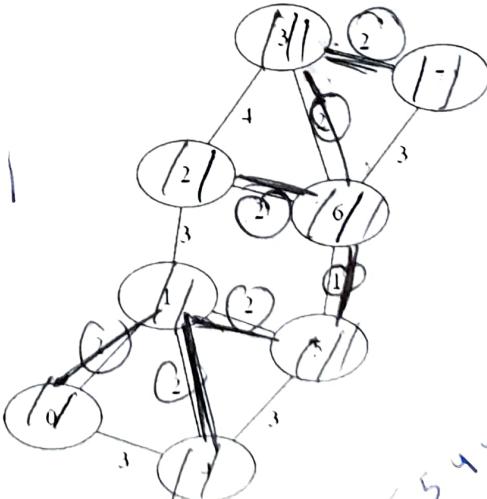
$$2+3+3+1+1+1$$

Q10



Q7

Construct the minimum spanning tree from the graph using Prim's method. Find the cost of the minimum spanning tree. (3)



$$2 + 1 + \frac{1}{2} + \frac{1}{1/2}$$

$$= 5 - 2$$





NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CSPC32- Data Structures

Programme: B.TECH

Date: 07.07.2023

Cycle Test-1

Session: Summer -JULY/2023

Duration: 1 Hour

Total Marks: 25

Answer all the questions

1. Convert the given infix expression to postfix expression using stack. Show the Step by step conversion and evaluate postfix expression using stack with $a=2, b=3, c=4, d=35, e=6, f=1, g=3, h=4$ $a+(b*c(d/e^f)*g)*h$ [5 M]

2. Find the Time complexity for the following function [2 M]

void fun (int n) {

 for (int i=1; i<=n; i++)

 for (int j=1; j <= n; j += i)

 printf ("HI"); }

3. How can you implement a stack using a linked list? Derive the time complexity for push and pop operations [4 M]

4. Write a program for circular queue using arrays [4 M]

5. Write a program for merging two sorted linked lists into a single sorted list? [5 M]

6. Write a program for circular doubly linked list for following functions [5 M]

- (a) Insert a node at k^{th} position (b) Delete k^{th} position node



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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CSPC32- Data Structures

Programme: B.TECH

Date: 17.07.2023

Session: Summer -JULY/2023

Cycle Test-2

Duration: 1 Hour

Total Marks: 25

Answer all the questions

1. Compare AVL tree and BST tree. Discuss the different rotations and construct an AVL tree with the following elements
[5 M]
10, 42, 40, 30, 101, 70, 110, 100, 20, 90, 60, 50, 120, 140, 130.
2. Write a function to find the level in which minimum value node is presented in a binary tree and what is the time complexity of the algorithm [5 M]
3. Write a function for deleting an element from the BST and write the time complexity of the function [5 M]
4. How will you construct a BST from given preorder traversal? Explain with an example and discuss its time complexity. [5M]
5. Find all possible BFS and DFS orders for the following adjacency matrix [5 M]

	A	B	C	D	E	F
A	0	1	1	1	0	0
B	1	0	1	0	1	1
C	1	1	0	1	0	1
D	1	0	1	0	0	0
E	0	1	0	0	0	0
F	0	1	1	0	0	0



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CSPC32- Data Structures

Programme: B.TECH

Compensation Assessment

Session: JULY/2022

Date: 28.11.2022

Duration: 1 Hour

Total Marks: 20

Answer all the questions

- 1 Write an algorithm to check the given single linked list is palindrome or not. The size of the linked list is n . Your algorithm time complexity should not be more than $O(n)$. [3 M]
- 2 Write a function to find the level in which maximum value node is presented in a binary tree and what is the time complexity of the algorithm [3 M]
- 3 Write a function for deleting an element from the BST and write the time complexity of the function [4 M]
- 4 Discuss the different rotations and construct an AVL tree with the following elements [4 M]

150, 80, 40, 30, 10, 70, 110, 100, 20, 90, 60, 50, 120, 140, 130.

X Define Max heap. Construct a max heap for the following elements {12, 15, 9, 8, 10, 18, 7, 20, 25, 29, 50} [3 M] W.A.P for BFS ✓

- 5 Sort the following list of elements by using Insertion sort. What are the number of comparisons and swaps you have done during the sorting process of following list of elements and write the time complexity of bubble sort. [3 M]

25, 2, 6, 14, 81, 20, 57, 100, 32, 28 insertion



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CSPC32- Data Structures

Programme: B.TECH

Date: 08.12.2022

Final Assessment

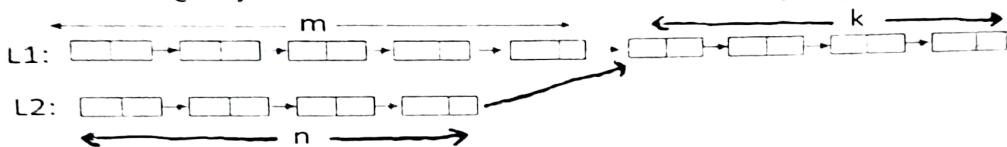
Duration: 3 Hours

Session: JULY/2022

Total Marks: 40

Answer all the questions

1. Write a program to reverse the stack elements using only stack operations (push() and pop()). What is the time complexity? [4 M]
2. Two linked lists, L1 and L2, are given as shown in the diagram. The first Linked list L1 length is ($m+k$) and the second Linked list L2 length is ($n+k$). Assume that you know the first node addresses of the both lists. Write an algorithm or function to find the intersection point node using only the stack data structure. What is the time complexity? [4 M]



3. Write a program or function to display the single linked list elements from the end (Do not use the other data structures). Your program time complexity should be $O(n)$. [4 M]

4. Write a program or function to find the addition of two polynomials using linked list. [4M]

5. Write a function to find the level of a binary tree that has maximum number of nodes. [4M]

6. Write a program for finding a next immediate higher value for given array elements. Use a suitable data structure to solve this problem. You are allowed to traverse the array only once. **Input:** 5,2,1,4,7,3,8 **Output:** 7,4,4,7,8,8,-1 (Next immediate higher values for the elements 5,2,1,4,7,3,8 are 7,4,4,7,8,8,-1, respectively. The next immediate higher value for the last element assumes as -1) [4 M]

7. Write a function to find the occurrence of a given pattern in a given text. [4 M]

8. Show the step by step process of Heap sort to solve the following list of elements. Derive the time complexity of the Heap sort. 10, 6, 7, 17, 26, 56, 32, 72, 20, 57, 100, 38, 128 [4M]

9. Compare Red-Black and AVL trees. List the properties of Red-Black Trees. Construct the Red-Black tree with the following elements. [4 M]
18, 17, 16, 4, 61, 131, 109, 203, 25, 191, 157, 10, 52, 3, 58

10. Explain linear probing and quadratic probing with examples and write the disadvantages of both techniques. [4 M]



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CSPC32- Data Structures

Programme: B.TECH

Date: 01.11.2022

Session: JULY/2022

Cycle Test-2

Duration: 1 Hour

Total Marks: 20

Answer all the questions

- Derive the time complexities for searching operation in BST and AVL tree? What is the height balancing factor, why height balancing is required in AVL trees? Explain with suitable examples [2 M]
- Write a function to find the second largest element in BST and write the time complexity of the algorithm [3 M]
- Write a function for inserting an element into the BST and write the time complexity of the function [3]
- Discuss the different rotations and construct an AVL tree with the following elements [4 M]

48 7 26 44 6 13 9 23 25 91 57 100 5 32

- Sort the following list of elements by using bubble sort. What are the number of comparisons and swaps you have done during the sorting process of following list of elements and write the time complexity of bubble sort. [4 M]

25, 2, 6, 14, 81, 20, 57, 100, 32, 28

- Find all possible BFS and DFS orders for the following adjacency matrix [4 M]

	A	B	C	D	E	F
A	0	1	1	1	0	0
B	1	0	0	0	1	1
C	1	0	0	1	0	1
D	1	0	1	0	0	0
E	0	1	0	0	0	0
F	0	1	1	0	0	0

Scoring notes - A



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CSPC32- Data Structures

Programme: B.TECH

Date: 20.09.2022

Cycle Test-1

Duration: 1 Hour

Session: JULY/2022

Total Marks: 20

Answer all the questions

- Convert the given infix expression to postfix expression using stack. Show the Step by step conversion and evaluate postfix expression using stack with $a = 5$, $b = 2$, $c = 10$. [3 M]

$$c * (a - b * (c/a) + b) + c$$

- Discuss advantages and disadvantages of arrays and linked lists [2 M]
- Write *Enqueue ()* and *Dequeue ()* functions for a circular queue using arrays [3M]
- Write *Push ()* and *Pop ()* functions for a stack using linked list. [3 M]

- Write a function to remove duplicate elements in a sorted linked list [3M]

Ex: Input linked list is 1->5->10->12->12->15->36->36

Output Linked list: 1->5->10->12->15->36

- Write a function to swap the pairwise nodes (without swapping the data) in a single linked list. [3 M]

Ex: Input Linked list: 1->5->10->12->15->36

Output Linked list: 5->1->12->10->36->15

- Find the time complexity of the below functions [3 M]

(a)

```
Fun (int n)
{
    for (i=0; i<n; i++)
    {
        for (j=0; j<i ; j++)
            printf (" HI");
    }
}
```

(b)

```
Fun (int n)
{
    for(int i=0; i<n; i++)
        for( int j=i ; j<i*i ; j++)
            if(j%i==0)
                for(int k=0; k<j; k++)
                    printf("HI");
}
```

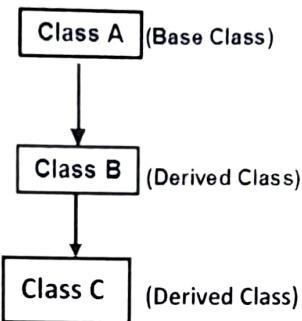
(c)

```
Fun (int n)
{
    k=0;
    for( i=1; i<=n; i=i*2)
    {
        k++;
        for ( j=1; j<k; j=j*2)
        {
            printf ("HI")
        }
    }
}
```

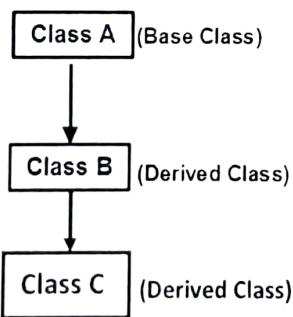
Compensation Lab

30.11.2022

1. Write a C-program that contains two structures (S1 and S2) with same type and number of variables. Create two instances of both S1 and S2 each.
 - Try to assign any one instance of S1 to the other instance of S1
 - Try to assign any one instance of S1 to any one instance of S2
2. Implement the following hierarchy with the following properties.

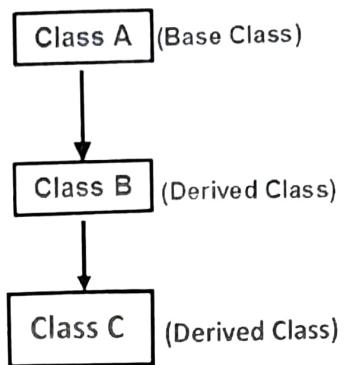


- (i) All classes should have constructor (parameterized) and destructor
 - (ii) Create objects for classes A, B and C in such a way that the methods of class B and Class A can be called using the object of Class C
 - (iii) Inside try {} of main function, create an object of Class B, raise an exception and write a handler for the same.
3. Write a sample C++ program that replicates the following diagram.



- (i) Make Classes A and B as Abstract
- (ii) Try to create object for all Classes
- (iii) Execute the methods in Class A and Class B using the object of Class C

4. Implement the following hierarchy with the following properties.



- (i) Class A should have some private variables and methods
- (ii) Allow Class B alone to access all the private variables and methods of Class A
- (iii) Allow a global method to access private variables of Class A

----- XXX -----



National Institute of Technology
Tiruchirappalli, Tamil Nadu – 620 015

CSPC31 – Principles of Programming Languages

Compensation Exam

Date: 28.11.2022

Duration: 1 Hour

Time: 05:30 – 06:30 PM

Total Marks: 20

Note: MCQ may have multiple answers. In such case, you have to write all the correct choices. Otherwise, mark will not be awarded for that question.

1. In Extended BNF, the term `<identifier_List> → <Identifier> {, <Identifier>}` refers to _____
(1 M)
(a) Indefinite occurrence **(b)** 0 occurrence **(c)** Both 0 or Indefinite occurrence
(d) None of the above
2. Draw the complete descriptor, case and discriminated union tables for the following datatype. (Consider the tag as Integer datatype)
(4 M)

```
union
{
    int a;
    float b;
    char c;
}
```

3. What is the value of “a” and “b” in subtract() if: (i) Shallow Binding; (ii) Deep Binding; and (iii) Ad hoc Binding techniques are used?
(4.5 M)

```
void addition()
{
    int a = 5, b = 6, c = 6, add;
    add = b + c;

    int subtract()
    {
        return (a - b);
```

```
}

int multiply()
{
    int a, b;
    a = 3, b = 6;
    return (a * b);
}

int division(subtract)
{
    int a = 4, b = 5;
    return subtract();
}

division(subtract);
}
```

(1 M)

4. What is the output of the following statement?

```
int a = 15, b= 10;  
sum = (a > b)?: 0: ;  
printf("%d", sum);
```


5. Using the following grammar, generate a leftmost derivation and parse tree for the following sentence: a + b + c + d **(2.5 + 2.5 M)**

$$\begin{array}{l} <S> \rightarrow <A> \\ <A> \rightarrow <A> + <A> \mid <id> \\ <id> \rightarrow a \mid b \mid c \mid d \end{array}$$

6. Consider that there exists a 2-Dimensional array A of size 10×10 which stores integer elements of size 16-bits. **(4.5 M)**

How is this information passed to the compiler during the execution of code?

[Hint: Starting memory address of A is 100; Number of bits that a memory location can hold is 8-bits; Write the name of the required Table(s) and draw the same]

----- END -----



National Institute of Technology
Tiruchirappalli, Tamil Nadu – 620 015

CSPC31: Principles of Programming Languages–End Exam Date: 21.07.2023

Jul 2023 (Redo)

Duration: 2.30 Hrs

Time: 02:30 – 05:00 PM

Total Marks: 40

Note: MCQ may have multiple answers. In such case, you have to write all the correct choices. Otherwise, mark will not be awarded for that question.

1. Whether function overloading will be successful in the following class or not? State the reason. **(1 M + 1 M)**

```
class base
{
    int add(int a, int b)
    {
        return (a + b);
    }
    float add(int a, int b)
    {
        c = a + b;
        return c;
    }
}
```

2. Draw the Inheritance diagram and complete Class Instance Record (with vtable) for the following program. **(1 M + 6 M)**

```
class Base
{
public:
    int a, b, c;
    void add() { ... }
    int sub() { ... }
    void mul() { ... }
}
class Derived : public Base
{
```

```

public:
    int w, x;
    void add() { . . . }
    int sub() { . . . }
    int div() { . . . }
}

```

3. Function overriding will be successful only when the following things match **(2 M)**
- (a) Type of Argument
 - (b) No. of Arguments
 - (c) Return type of Method
 - (d) Virtual keyword is present in the base class
 - (e) All the above
 - (f) None of the above

4. In the following program, which catch will match the try? **(2 M)**

```

int main()
{
    try
    {
        throw 'a';
    }
    catch (int x) ←———— A
    {
        cout << "Default Exception\n";
    }
    catch (...) ←———— B
    {
        cout << "Caught " << x;
    }

    return 0;
}

```

- (a) Catch at point “A”
 - (b) Catch at point “B”
 - (c) None of the above
5. Pictorially represent the difference between single, multiple and multi-level inheritance. **(3 M)**

6. When should one use the “delete” keyword in C++ program in order to delete an object? **(1 M)**

7. Will the following function compile correctly? **(1 M)**

```

void fun(int*ptr, intx) throw ()
{
    if (ptr==NULL)
        throw ptr;
    if (x == 0)
        throw x;
}

```

- (a) Yes
- (b) No

8. For the following program:

- (i) Write the basic Activation Record Instance. **(2 M + 1 M + 6 M)**
- (ii) Write the order in which the function calls are made.
- (iii) Draw the Activation Record Instance [Hint: Mark all the possible locations of EP and SP using dotted arrows].

```
procedure Main_2 is
    X : integer;
    procedure Bigsub is
        A, B, C : Integer;
        procedure Sub1 is
            A, D : Integer;
            begin -- of Sub1
                A := B + C;
                procedure Sub2(X : Integer is
                    B, E : Integer;
                    procedure Sub3 is
                        C, E : Integer;
                        begin -- of Sub3
                            E := B + A;
                            end; -- of Sub3
                        begin -- of Sub2
                            Sub3;
                            .
                            A := D + E;
                            end; -- of Sub2
                        Sub2(7);
                        end; -- of Sub1
                    begin -- of Bigsub
                    sub1();
                    end; -- of Bigsub
                begin -- of Main_2
                .
                Bigsub;
                .
                end; -- of Main_2
```

9. When and in what order, the destructor will be called in the following C++ program?

(2 M)

```
void main()
{
    Base b();
    b.add(); ← A
    Derived d();
    d.sub(); ← B
} ← C
```

10. Consider that a program has 2 classes namely "A" and "B". Class B is a subtype of Class A. Also, Class A and class B has 1 variable each namely "x" and "y" respectively. Suppose, you create an object b1 of type class A and b2 of type class B in stack memory. What will happen if you execute the following statement: $b2 = b1$ (2 M)

- (a) Value of "x" in b2 is alone copied to "x" in b1
- (b) Both "x" and "y" values of b2 will be copied to b1
- (c) Throws error
- (d) None of the above

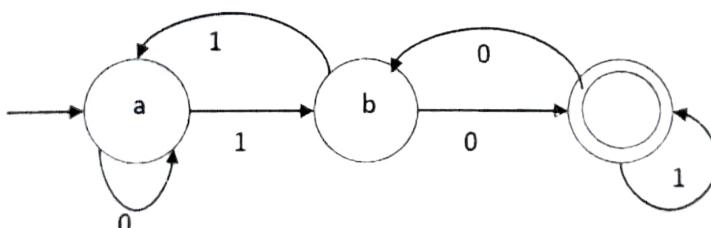
11. In C++ program, a throw keyword without any value/variable_name can _____ (1 M)

- (a) Occur only inside a handler
- (b) Occur anywhere inside a program
- (c) Occur only inside a try loop
- (d) None of the above

12. Any object that is created inside a try loop _____ (1 M)

- (a) Will be deleted at the end of that try loop
- (b) Will be active even outside that try loop
- (c) Will be active throughout the whole program
- (d) None of the above

13. Which of the following sentences are generated by the following automaton? (2 M)



- (a) 00000110000
- (b) 110000011
- (c) 01100000011
- (d) None of the above

14. What will be the output of the following codes? (1 M + 1 M + 3 M)

- a) (CAR 'A)
- b) (CDR '((A B) C D))
- c) (CADDAR '((/\\ B (C) D) E))

----- END -----

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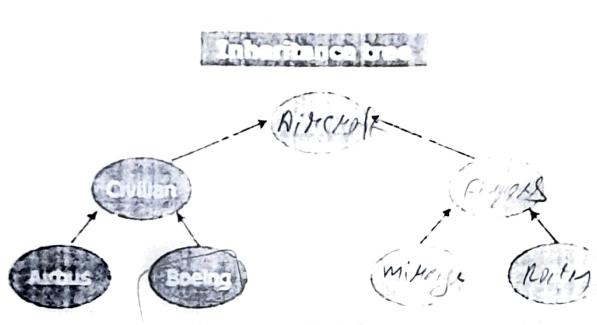
Exercise 3

16.11.2022

1. Create the following inheritance tree with the following characteristics:

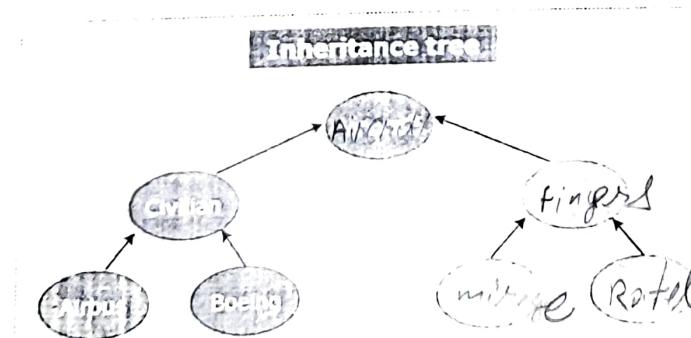
A) Classes should have – One constructor and destructor. (i) At least, 3 variables and 3 functions (Of which one variable and one function should be made publicly available; one variable and one function should be made accessible only for the corresponding class and the remaining variable and one function should be made available only for the derived classes – Try to use access specifier in both during declaration and class derivation). (ii) Each class should have one more class variable to count the number of objects created for that class.

- Create multiple objects for any one class and print the number of objects created.
- Call the method of any base class using the object of derived class and observe logical error.
- Call the same method using a proper object and print the output.



2. Create the following inheritance with the following properties.

- Make the classes Aircraft, Civilian and Fighters as an Abstract one
- Use Functional overloading concept in Aircraft class
- Create an object of any one child class and try to assign to its parent through reference. Then, call some function in the child class which is overridden.
- Create an object of any one parent class and try to assign to its child through reference. Then, call some function in the child class which is overridden.



----- XXX -----

1 | Page

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15.**

**CSPC32 - Digital Systems Design
Section - B
Retest - Nov 2022**

Date: 29.11.2022

Answer ALL Questions

Max: Marks: 20

- 1. a.** Obtain the truth table of the function $(b \oplus cd)(c \oplus bd)$, and express each function in sum-of-minterms and product-of-maxterms form. (1)

- b.** For the Boolean function, Use Boolean algebra to simplify the function to a minimum number of literals. (2)

a. $xy'z + x'y'z + w'xy + wx'y + wxy$

b. $(x + y')(x' + y') = x'y'$

- c.** Simplify the following Boolean expressions, using four-variable maps: (1)

a. $A'B'C'D' + A'C'D' + B'CD' + A'BCD + BC'D$

- 2.** Simplify the following function, and implement them with two-level NOR gate circuits:

$F = wx' + y'z' + w'yz$

(3)

- 3.** Using a decoder and external gates, design the combinational circuit defined by the following three Boolean functions: (3)

$F_1 = x'yz' + xyz$

$F_2 = xy'z' + x'y$

$F_3 = x'y'z + xy$

- 4.** Implement the following Boolean function with a multiplexer. (2)

a. $F(A, B, C, D) = \sum(0, 2, 5, 8, 10, 14)$

b. $F(A, B, C, D) = \prod(2, 6, 11)$

- 5.** Construct a BCD adder-subtractor circuit. Use block diagrams for the components. (3)

- 6.** Design a sequential circuit with two D flip-flops A and B and one input x-in. (5)

(a) When x-in = 0, the state of the circuit remains the same. When x-in = 1, the circuit goes through the state transitions from 00 to 01, to 11, to 10, back to 00, and repeats.

(b) When x-in = 0, the state of the circuit remain the same. When x-in = 1, the circuit goes through the state transitions from 00 to 11, to 01, to 10, back to 00, and repeats.

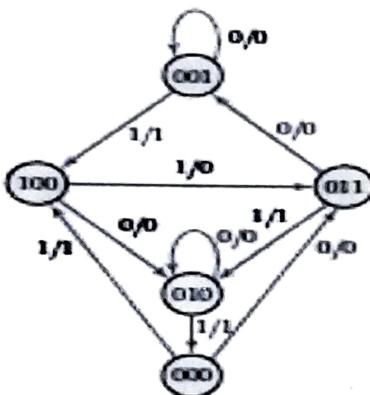
NATIONAL INSTITUTE OF TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Re-Do- Cycle Test -2
CSPC22 –DIGITAL SYSTEMS DESIGN

Answer ALL Questions:

Max:Marks:20

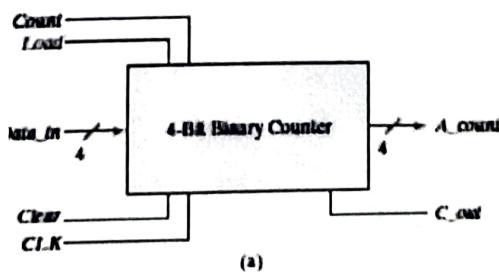
Date:18/7/2023

1. Design a sequential circuit with two D flip-flops A and B, and one input x_{in} .
 (i) When $x_{in} = 0$, the state of the circuit remains the same. When $x_{in} = 1$, the circuit goes through the state transitions from 00 to 01, to 11, to 10, back to 00, and repeats.
 (ii) When $x_{in} = 0$, the state of the circuit remains the same. When $x_{in} = 1$, the circuit goes through the state transitions from 00 to 11, to 01, to 10, back to 00, and repeats.
2. A sequential circuit has three flip-flops A, B, C ; one input x_{in} ; and one output y_{out} . The state diagram is shown in Figure below. The circuit is to be designed by treating the unused states as don't-care conditions. Analyze the circuit obtained from the design to determine the effect of the unused states. (i) Use D flip-flops in the design. (ii) Use JK flip-flops in the design. (5)



3. For the circuit given below, give three alternatives for a mod-10 counter (i.e., the count evolves through a sequence of 12 distinct states). (10)

- (a) Using an AND gate and the load input.
 (b) Using the output carry.
 (c) Using a NAND gate and the asynchronous clear input.





NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CSPE42 – Design Thinking

Final Assessment

Class: II year (B)

Programme: B.TECH

Session: JAN/2023

Date: 15-05-2023

Duration: 3 Hour

Total Marks: 40

Answer all the questions

- ✓ 1. What is S.C.A.M.P.E.R? /CO1, CO5/ (2M)
- ✓ 2. What are the characteristics of successful design product? explain them? /CO1, CO3/ (5M)
- ✓ 3. (i) What are the steps of design thinking process? /CO2, CO5/ (5M)
a) Define > Empathize > Ideate > Prototype > Test b) Empathize > Define > Ideate > Prototype > Test
c) Empathize > Design > Ideate > Implement > Prototype d) Understand > Define > Ideate > Produce > Test
- ✓ 4. In design, where does the information used to put together to make a problem statement?
a) The Design Stage b) The Define Stage c) The Empathize Stage d) The Testing Stage
- ✓ 5. (ii) Design thinking typically helps in _____
a) Innovation b) Data analytics c) Marketing d) Financial Planning
- ✓ 6. (iv) Which of the following does not belong to the methods of developing insights into designer ways of thinking?
a) Synthesize information b) Modelling c) Simulation d) Experimental Studies
- ✓ 7. (v) During which step do you create an interactive representation or model of your idea or solution?
a) Prototype b) Ideate c) Test d) Define
- ✓ 8. Illustrate the customer journey mapping template with an example? /CO1, CO3, CO5/ (5M)
- ✓ 9. Assume during summer vacation, you planned for a tour with family. And throughout the trip, you are the coordinator for every activity, such as visiting places, food, etc. Use your cognitive thinking and draw a mind map for this family trip with at least seven branches and two subbranches, and justify your mind map diagram? /CO1, CO2, CO4/ (5M)
6. What is the purpose of four quadrant framework of napkin pitch? /CO4/ (2M)
- ✓ 7. What are the three dimensions of prototype fidelity? /CO4/ (2M)
- ✓ 8. What is the next stage after rapid prototyping, and illustrate its types? /CO4, CO5/ (5M)
9. Describe the steps for effective design on ramp? /CO2, CO4/ (5M)
- ✓ 10. Explain the process of learning launch tool? /CO4, CO5/ (4M)

****All the Best****