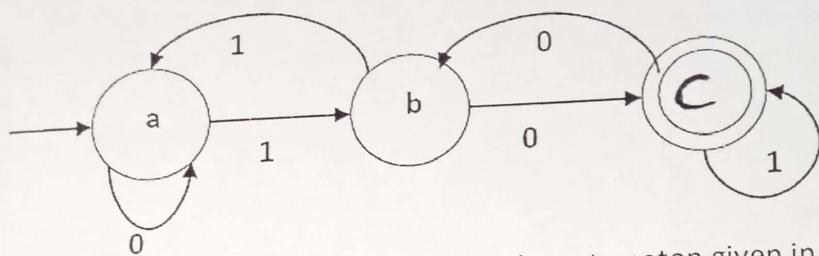


(1 M + 2 M)

3. (i) State whether the following diagram is NFA or DFA.



- (ii) Which of the following sentences are generated by the automaton given in 3 (i)?  
(a) 00000110000    (b) 110000011    (c) 0110000011    (d) None of the above

4. (i) For the statement,  $123.55^*2^*e^{+10}$  derive the leftmost derivation and corresponding parse tree using the following grammar.

(5 M + 3 M)

digit  $\rightarrow 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9$

digits  $\rightarrow$  digits digit

| digit \*

| digit

optionalFraction  $\rightarrow . \text{ digits}^* \text{ digits}$

optionalExponent  $\rightarrow e^{+} \text{ digits}$

|  $e^{-} \text{ digits}$

number  $\rightarrow \text{ digits} \mid \text{ optionalFraction} \mid \text{ optionalExponent}$

Digits

- (ii) Is the grammar given in 4 (i) left recursive? If yes, write the name of the left recursion and also rewrite the particular rule without left recursion.

5. (i) What is the output of lexical analyzer called?

(1 M + 3 M)

- (ii) What outputs are generated by lexical analyzer while parsing the following two statements?

[Hint: Consider d, e, f and g are all integer datatypes; \_ represents Space character]

(a) int\_d=\_e+\_f\_\*\_\_\_\_g\_; // Assignment Operation

(b) printf(\_"HelloHowAreYou"\_); //Print Statement

----- END -----



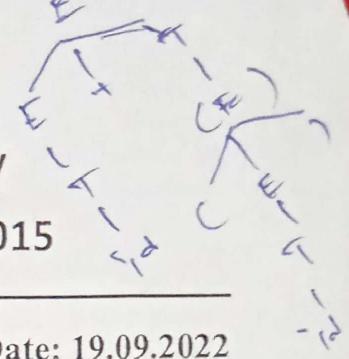
$E \rightarrow E + T$   
 $E \rightarrow (E)$   
 $E \rightarrow (T)$   
 $E \rightarrow id$

$E \rightarrow E + id$   
 $E \rightarrow T + id$

$T \rightarrow id$   
 $T \rightarrow id + T$   
 $T \rightarrow id + (E)$   
 $T \rightarrow id + (T)$   
 $T \rightarrow id + (id)$

**National Institute of Technology**

Tiruchirappalli, Tamil Nadu – 620 015



CSPC31: Principles of Programming Languages – CTI

Date: 19.09.2022

Duration: 1 Hour

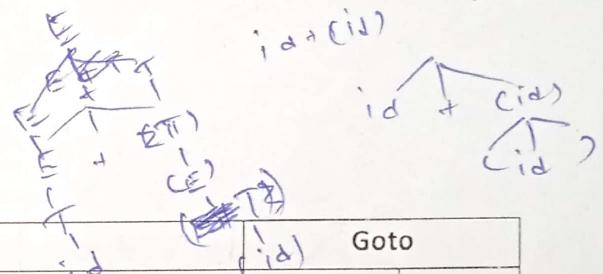
Time: 04:00 – 05:00 PM

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. Using the following grammar and table, check whether the string  $id + (id)$  will be accepted or not: (4 M)

1.  $E \rightarrow E + T$
2.  $E \rightarrow T$
3.  $T \rightarrow (E)$
4.  $T \rightarrow id$



State	Action						Goto	
	id	+	(	)	/ \$	E	T	
0	S4			S3			1	2
1		S5				Accept		
2	R2	R2	R2	R2	R2			
3	S4		S3				6	2
4	R4	R4	R4	R4	R4			
5	S4		S3					8
6		S5		S7				
7	R3	R3	R3	R3	R3			
8	R1	R1	R1	R1	R1			

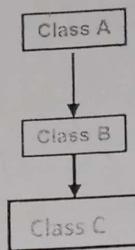
2. What operation does the operator  $+ . x$  do? (1 M)

- (a) Addition Operation only
- (b) Multiplication Operation only
- (c) Addition followed by Multiplication
- (d) Multiplication followed by Addition

## Exercise 4

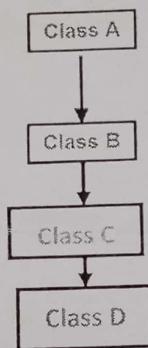
23.11.2022

1. Implement the following hierarchy with the following properties.



- (i) All classes should have constructor (parameterized) and destructor
- (ii) Perform function overloading and function overriding
- (iii) Inside try {} of main function, create an object of any class, raise and handle an exception.
- (iv) Print clearly when a constructor and destructor of an object is being called

2. 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 the private variables of Class A
- (iv) Perform function overloading in Class C
- (v) Perform function overriding between Classes C and D

3. Create a simple calculator application using Java programming.

*[Hint: Use Event-driven programming concept]*

Input 1	<input type="text"/>	
Input 2	<input type="text"/>	
Result	<input type="text"/>	
1	2	3
4	5	6
7	8	9
Add	0	

----- XXX -----

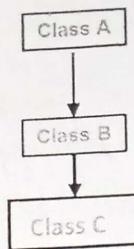
1 | Page

Dr. R. Bala Krishnan, Dept. of CSE, NIT, Tiruchirappalli – 620 015

## Exercise 4

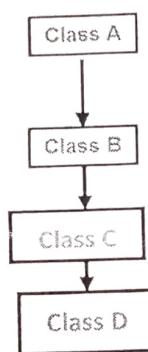
23.11.2022

1. Implement the following hierarchy with the following properties.



- (i) All classes should have constructor (parameterized) and destructor
- (ii) Perform function overloading and function overriding
- (iii) Inside try {} of main function, create an object of any class, raise and handle an exception.
- (iv) Print clearly when a constructor and destructor of an object is being called

2. 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 the private variables of Class A
- (iv) Perform function overloading in Class C
- (v) Perform function overriding between Classes C and D

3. Create a simple calculator application using Java programming.

Hint: Use Event-driven programming concept]

Input 1	<input type="text"/>	
Input 2	<input type="text"/>	
Result	<input type="text"/>	
1	2	3
4	5	6
7	8	9
Add	0	

----- XXX -----

1 | Page

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI  
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING  
CYCLE TEST -II

Subject Code/ Name: CSPC34/ Computer Organization  
Marks: 20

Date: 2 / 11 / 2022  
Time: 11:00AM–12:00 PM

Answer all the questions

1. Calculate  $1.666015625 \times 10^0 \times (1.9760 \times 10^4 + -1.9744 \times 10^4)$  by hand, assuming each of the values are stored in the 16-bit half precision format. Assume 1 guard, 1 round bit, and 1 sticky bit, and round to the nearest even. Show all the steps, and write your answer in both the 16-bit floating point format and in decimal. (4)
2. Draw neatly the data path diagram for the MIPS load instruction. Use a pencil and ruler. (4)
3. For the code below: (1+2+2)

```
lw $t0, 0($s1)
add $t1, $s1, $a2
sub $t0, $t0, $s2
sw $t1, 0($s1)
addi $s1, $s1, -4
```

1b

- a. Identify all the data dependencies in the code given below and identify which dependencies will cause data hazards without forwarding hardware.
  - b. Assuming there is no special hardware that is added for forwarding, add “nop” instructions to the code to avoid the data hazards.
  - c. Assume that the hardware supports forwarding and stalling. Show from which pipeline register the data is taken from and where it is forwarded. How many cycles will it take to execute this code (no need for nops)?
4. Using a table calculate 16 divided by 5. You should show the contents of each register on each step. Assume both inputs are unsigned 5-bit integers. (3)
  5. Briefly describe the floating-point load and store instructions. (2)
  6. What is the need of a biased representation for the exponent in IEEE-754 format? (2)



National Institute of Technology  
Tiruchirappalli, Tamil Nadu – 620 015

Principles of Programming Languages – Cycle Test II Date: 31.10.2022

Duration: 1 Hour

Time: 03:00 – 04:00 PM

Total Marks: 20

1. For the following program:

(2 M + 1 M + 6 M + 1 M)

(i) Draw the basic Activation Record Instance

(ii) Write the order in which the function calls are made

(iii) Draw the complete Activation Record Instance [Hint: Mark the current locations of EP and SP as well]

(iv) Write the final output of the program

```
int div(int j, int k)
{
    int w = j / k;
    return w;
}
int sub(int g, int h, int i)
{
    int x = div(g, h);
    return x;
}
```

```
int add(int d, int e, int f)
{
    int z = sub(d, e, f);
    return d; 5
}
void main()
{
    int a = 5, b = 6, c = 8, x;
    x = add(a, b, c);
    printf("%d", x);
}
```

2. Draw the descriptor table of multi-dimensional array.

(2 M)

3. What is the output of the following statement in C-Program?

(1 M)

printf();

(a) Prints Nothing      (b) NULL

(c) ""

(d) Error

4. What is the size of the following two datatypes? (Consider, int = 2 Bytes; char = 1 Byte; float = 4 Bytes) (2 M)

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

- (a) 7 Bytes, 2 Bytes (b) 4 Bytes, 7 Bytes (c) 7 Bytes, 4 Bytes (d) None of the above

5. If the memory address to which a pointer ( $P_1$ ) is pointing to has been deallocated, then the pointer ( $P_1$ ) will be called as \_\_\_\_\_ (1 M)

- (a) NULL Pointer (b) Dangling Pointer (c) Missing Pointer (d) Empty Pointer

6. What is the output of the following statement? (Consider, list[0] is at address 1000 and the size of int is 2 Bytes) (2 M)

```
int list[5] = {1, 2, 3, 4, 5};  
int *ptr = list;  
printf("%d, ", *(ptr+2)); 3  
*ptr++;  
printf("%d", *ptr);
```

- (a) 3, 4 (b) 2, 4 (c) 2, 3 (d) 3, 2

7. What is the final value of p1, if the functional parameters are evaluated from R→L? (2 M)

```
void sub(out int a, out int b)  
{  
    a = 17;  
    b = 35;  
}  
int p1 = 5;  
int p2 = 10;  
f.sub(out p1, out p1);
```

- (a) 5 (b) 35 (c) 17 (d) None of the above

----- END -----

in derived class.

(a) Visible

(b) Hidden

(c) Accessible

- d) Write the names of the two types of synchronization that are required when different tasks share data.

(1 M + 1 M + 3 M)

5. What will be the output of the following code?

[Hint: Do step-by-step derivation for question c]

a) (CAR 'A)

b) (CDR '((A B) C D))

c) (CADDAR '((A B (C) D) E))

~~(A B)~~ (C D)  
~~(A B)~~ (C Y)

----- END -----

}; *virtual void dud() { . . . }*

2. For the following program:

(2 M + 1 M + 9 M)

- Write the basic Activation Record Instance
- Write the order in which the function calls are made
- 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

3. a) 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 + 1 M + 1 M + 1 M)

- Value of "x" in b2 is alone copied to "x" in b1
- Both "x" and "y" values of b2 will be copied to b1
- Throws error



National Institute of Technology  
Tiruchirappalli, Tamil Nadu – 620 015

CSPC31: Principles of Programming Languages – FA

Date: 07.12.2022

Duration: 3 Hours

Time: 09:30 AM – 12:30 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. a) Using the following grammar, derive the leftmost derivation for the following sentence: **(3 M + 10 M)**

$$A = (B * C) + A$$

$\begin{aligned} <\text{assign}> &\rightarrow <\text{id}> = <\text{expr}> \\ <\text{id}> &\rightarrow A \mid B \mid C \\ <\text{expr}> &\rightarrow <\text{expr}> + <\text{expr}> \quad | \quad <\text{expr}> * <\text{expr}> \quad | \quad ( <\text{expr}> ) \quad | \quad <\text{id}> \end{aligned}$

b) Draw the inheritance diagram and complete Class Inheritance Record (with vtable) for the following program.

```
class Add
{
public:
    int w, x, y;
    virtual void add() { ... }
    virtual void sub() { ... }
};

class Sub
{
public:
    int z;
    virtual void sub() { ... }
    virtual void sum() { ... }
};

class Div : public Add, public Sub
{
public:
    int u;
    virtual void add() { ... }
    virtual void sub() { ... }
};
```

1 | Page

Dr. R. Bala Krishnan, Asst. Prof., Dept of CSE, NIT, Tiruchirappalli – 620 015

- (d) None of the above
- b) In C++ program, a throw keyword without any value/variable\_name can \_\_\_\_\_  
(a) Occur only inside a handler      (b) Occur anywhere inside a program  
(c) Occur only inside a try loop      (d) None of the above
- c) Any object that is created inside a try loop \_\_\_\_\_  
(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

d) The class at point A and point B are called as \_\_\_\_\_ respectively.

```
class base {———— Point A
{
    ...
    class derived {———— Point B
    {
        ...
    }
}
```

- (a) Nested and Nesting Class      (b) Nesting and Nested Class  
(c) Virtual Class and Nesting Class      (d) Nesting and Virtual Class

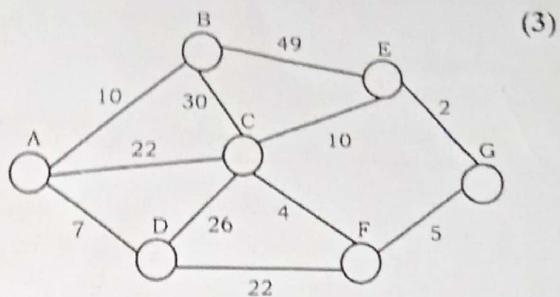
4. a) At which point and in what order, the destructor will be called in the following C++ program? **(2 M + 1 M + 1 M + 1 M)**

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

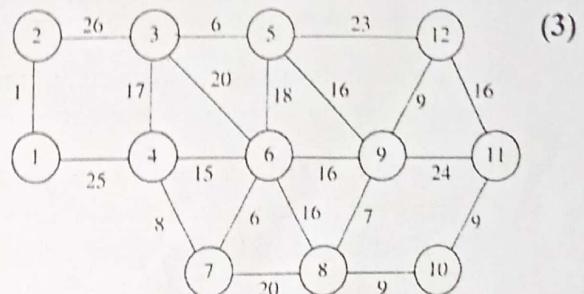
b) Headless Horn clause in Prolog is called as \_\_\_\_\_ statement

c) If the base class members are declared as "private" and the derived class is derived using the access modifier "public", then the class members of base class will become \_\_\_\_\_

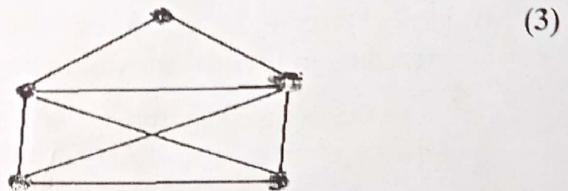
- d) Suppose that you want to provide water connection to a set of houses. The houses are not at equal distances. Given a connected graph where the vertices and edges denote these houses and the possible connections between them respectively. How can you connect these houses for providing water in minimum cost without looking for reliability of connection? What is the cost?



4. a) Suppose the graph represents a network of pipelines for transporting oil, what is the maximum flow possible through the network between vertices 3 and 10?



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



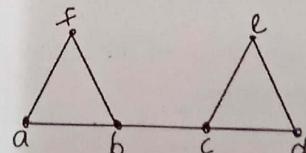
- c) Check whether the given graph is planar or not by performing elementary reduction.



5. a) There are 6 gifts labeled 1,2,3,4,5, and 6 under the Christmas tree, and 5 children receiving them. Alice, Bob, Charles, Danielle, and Edward. Can the gifts be distributed to each person so that each one of them gets a gift they'll like? Solve the problem by constructing the graph. Give any possible solutions.

CHILDREN	GIFTS
ALICE	G1, G3
BOB	G2, G4, G5, G6
CHARLES	G2, G5
DOT	G1, G2, G3
EDWARD	G2

- b) From the graph, find Maximal Independent sets, and Minimal Dominating sets. Derive your answer by showing required steps.





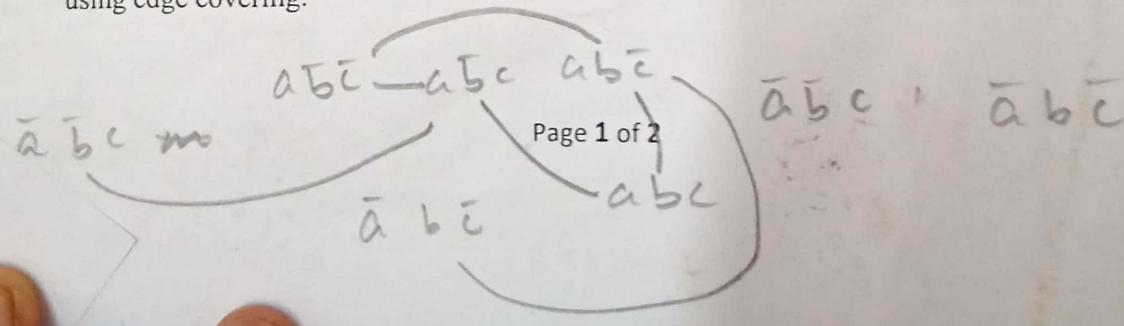
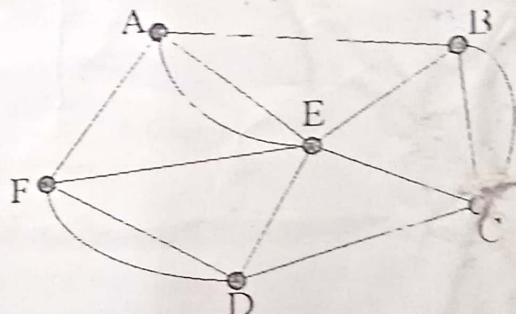
End Semester Examination  
CSPE32 - Combinatorics and Graph Theory

Course/Department : B.Tech./CSE  
Semester/Section : III B  
Date and Time : 13-12-2022 & 09.30 AM - 12.30 PM

Batch : 2021-2025  
Session : July/2022  
Marks : 40

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

1. a) In how many ways can Sunil distribute 17 sweets among his five children in such a way that the eldest gets only two or three of them? (2)
- b) In how many ways can three w's, three u's, and three v's be arranged so that no consecutive triples of the same letter appear? (2)
- c) Five people are assigned to analyze the quality and taste of chips made by two companies. There are 24 sample packets of each type. In how many ways can these 48 sample packets be distributed so that each person gets at least 2 packets of one particular type and at least 3 of the other type? Solve the problem using generating function. (2)
- d) Using Ferrer's graph, show that the number of partitions of an integer  $n$  into summands not exceeding  $m$  is equal to the number of partitions of  $n$  into at most  $m$  summands. (2)
2. a) Prove that a simple graph,  $G$ , with  $n$  ( $\geq 3$ ) vertices is Hamiltonian, if  $d(v) \geq n/2$  for every vertex  $v$  of  $G$ . (3)
- b) Prove that a connected planar graph with  $n$  vertices and  $e$  edges has  $e - n + 2$  regions. (3)
- c) Prove that for a given spanning tree  $T$ , a chord  $c_i$  that determines a fundamental circuit  $\Gamma$  occurs in every fundamental cut-set associated with the branches in  $\Gamma$  and in no other. (3)
3. a) Identify whether Euler path or circuit exist in the following graph. If so, trace one such path/ circuit. Also, provide a suitable matrix representation of this graph. (2)
- b) Construct edge induced ( $S_1$ ) and vertex induced ( $S_2$ ) subgraphs from the graph  $G$  given in Question 3 c. Edge set,  $E(S_1) = \{(A,B), (C,E), (A,D), (C,D), (C,F), (A,C)\}$  and vertex set,  $V(S_2) = \{A, C, E, F\}$ . Perform ring sum operation on  $S_1$  and  $S_2$  to obtain  $S_3$ . Fuse vertices  $E$  and  $G$  of graph  $G$ . Show the resultant subgraphs. (2)
- c) Perform minimization of the switching function  $a'b'c + a'bc' + ab'c' + ab'c + abc' + abc$  using edge covering. (2)





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

Programme: B.TECH

Date: 08.12.2022

Final Assessment

Duration: 3 Hours

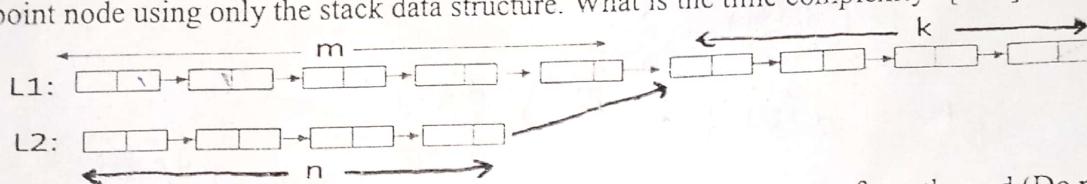
Session: JULY/2022

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]

61 0123  
109



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

Programme: B.TECH

Date: 08.12.2022

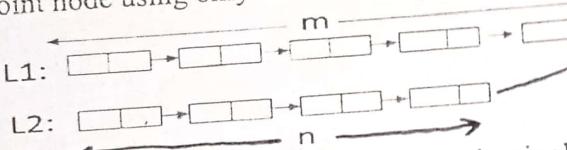
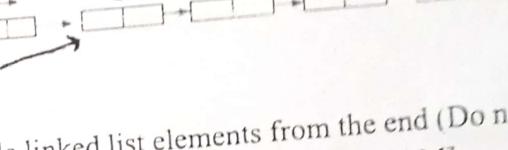
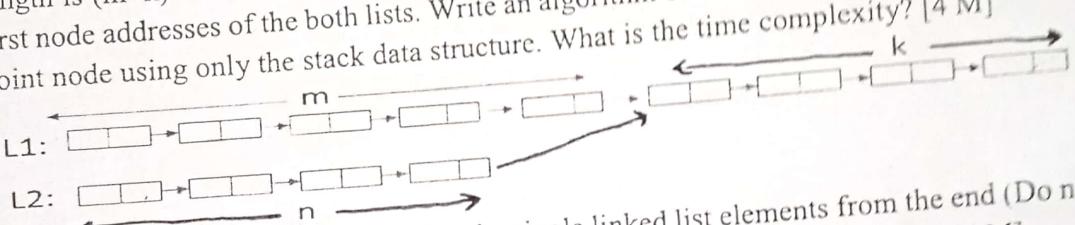
Final Assessment

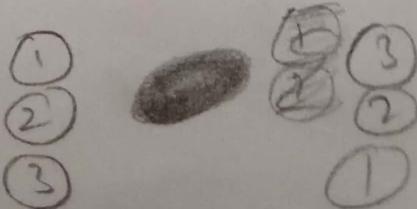
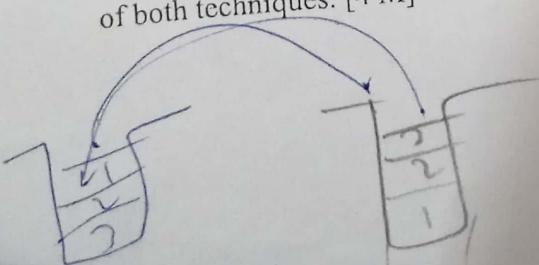
Duration: 3 Hours

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]
- L1:   
L2:   

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]  
Red-Black tree elements: 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: 20.09.2022

Cycle Test-1

Duration: 1 Hour

Session: JULY/2022

Total Marks: 20

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  $a = 5, b = 2, c = 10$ . [3 M]

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

2. Discuss advantages and disadvantages of arrays and linked lists [2 M]

3. Write *Enqueue ()* and *Dequeue ()* functions for a circular queue using arrays [3M]

4. Write *Push ()* and *Pop ()* functions for a stack using linked list. [3 M]

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

Ex: Input linked list is  $1 \rightarrow 5 \rightarrow 10 \rightarrow 12 \rightarrow 12 \rightarrow 15 \rightarrow 36 \rightarrow 36$

Output Linked list:  $1 \rightarrow 5 \rightarrow 10 \rightarrow 12 \rightarrow 15 \rightarrow 36$

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

Ex: Input Linked list:  $1 \rightarrow 5 \rightarrow 10 \rightarrow 12 \rightarrow 15 \rightarrow 36$

Output Linked list:  $5 \rightarrow 1 \rightarrow 12 \rightarrow 10 \rightarrow 36 \rightarrow 15$

7. 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")
    }
}
```

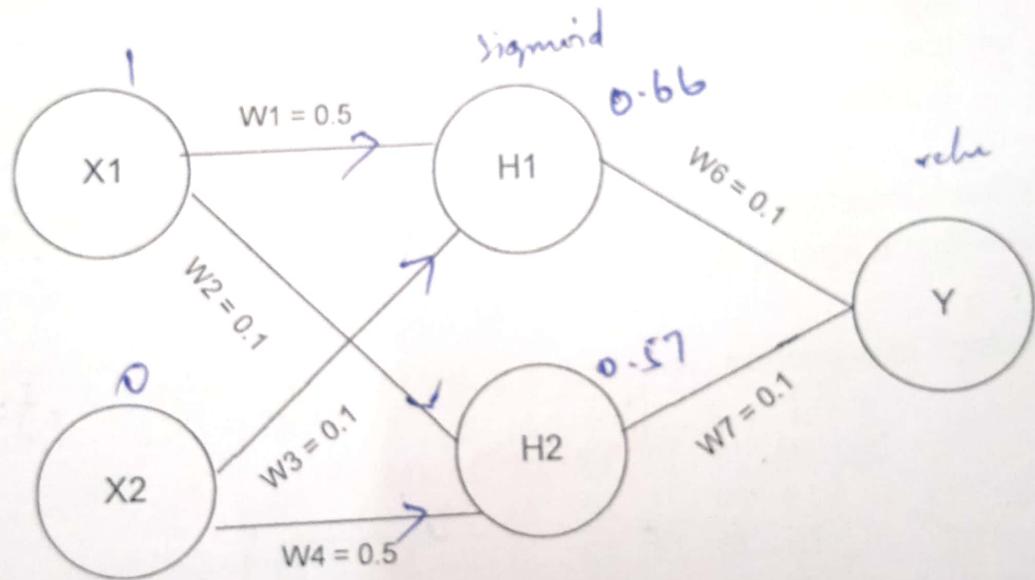
$\log_2 n$

$i \leq$        $0 \rightarrow$

1      1  
2      4  
3      6

$k = \log_2 n$

3. a) What is parameter and hyper parameter? When are they used? (2)
- b) What is the need for optimization in the neural networks? (2)
- c) Consider the neural network 'N' (given below) with the weights assigned to it and 0.2 as bias for all neurons. Compute the output for input values (1,0). Suppose you use the mean square error formula for calculating loss function, sigmoid activation function at hidden units and ReLu activation at output unit.
- Find the outputs in the hidden and output units.
  - What is the loss for the training case? (Note : Target value is 1)
  - What is the derivative of loss with respect to weights associated with the hidden layer?
  - Calculate the new weight values for W6 and W7.  $\alpha = 0.5$  (4)

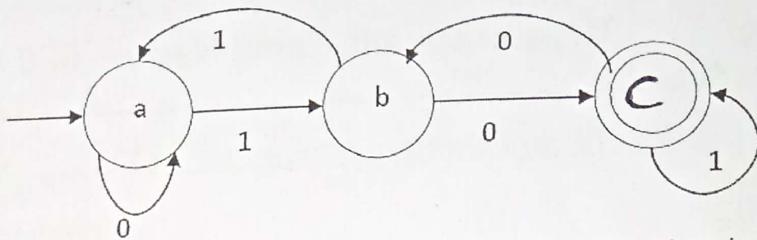


N



3. (i) State whether the following diagram is NFA or DFA.

(1 M + 2 M)



- (ii) Which of the following sentences are generated by the automaton given in 3 (i)?

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

4. (i) For the statement,  $123.55*2^e+10$  derive the leftmost derivation and corresponding parse tree using the following grammar.

(5 M + 3 M)

digit  $\rightarrow$  0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

digits  $\rightarrow$  digits digit

| digit \*

| digit

optionalFraction  $\rightarrow$  . digits \* digits

optionalExponent  $\rightarrow$  e ^+ digits

| e ^- digits

number  $\rightarrow$  digits optionalFraction optionalExponent

- (ii) Is the grammar given in 4 (i) left recursive? If yes, write the name of the left recursion and also rewrite the particular rule without left recursion.

5. (i) What is the output of lexical analyzer called?

(1 M + 3 M)

- (ii) What outputs are generated by lexical analyzer while parsing the following two statements?

*[Hint: Consider d, e, f and g are all integer datatypes; \_ represents Space character]*

(a) int\_d\_=e\_+f\_\*\_\_\_\_g\_; // Assignment Operation

(b) printf\_(“HelloHowAreYou”)\_; //Print Statement

----- END -----



National Institute of Technology  
Tiruchirappalli, Tamil Nadu – 620 015

CSPC31: Principles of Programming Languages – CTI

Date: 19.09.2022

Time: 04:00 – 05:00 PM

Duration: 1 Hour

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. Using the following grammar and table, check whether the string id + (id) will be accepted or not: (4 M)

1.  $E \rightarrow E + T$
2.  $E \rightarrow T$
3.  $T \rightarrow (E)$
4.  $T \rightarrow id$

State	Action					Goto	
	id	+	(	)	\$	E	T
0	S4		S3			1	2
1		S5			Accept		
2	R2	R2	R2	R2	R2		
3	S4		S3			6	2
4	R4	R4	R4	R4	R4		
5	S4		S3				8
6		S5		S7			
7	R3	R3	R3	R3	R3		
8	R1	R1	R1	R1	R1		

2. What operation does the operator +.x do? (1 M)  
(a) Addition Operation only  
(c) Addition followed by Multiplication  
(b) Multiplication Operation only  
(d) Multiplication followed by Addition



## Department of Computer Science and Engineering

### Cycle Test - 1

#### CSPE 72 – DEEP LEARNING TECHNIQUES

Date: 19.09.2022

Time : 2.30 – 3.30 pm

Max. Mark: 20

1. a) What is softmax used for? Explain with an example. (1)

$$16 + 4 - 3 + 1$$

- b) What will be the output image in the following

- Image of size 16x16 and kernel of size 3x3 are convoluted in a CNN with stride = 1, padding = 2
- Image of size 16x16x3 and kernel of size 3x3x3 are convoluted in a CNN with stride= 2, padding = 2
- Image of size 16x16 and kernel of size 3x3x4 are convoluted in a CNN with stride = 2, padding = 2 (3)

- c) What is regularization? Why it is required in neural network? Explain different types of regularization used in DNN. (3)

2. a) Perform max pooling for the given image values with Stride = 3 (1)

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
19	20	21	22	23	24	25	26	27
10	11	12	13	14	15	16	17	18
1	2	3	4	5	6	7	8	9
7	8	9	4	5	6	1	2	3
16	17	18	13	14	15	10	11	12
25	26	27	22	23	24	10	11	12

boosting  
bagging

- b) Which loss function(s) are most suitable for classification problems in deep learning? (2)  
Explain it.

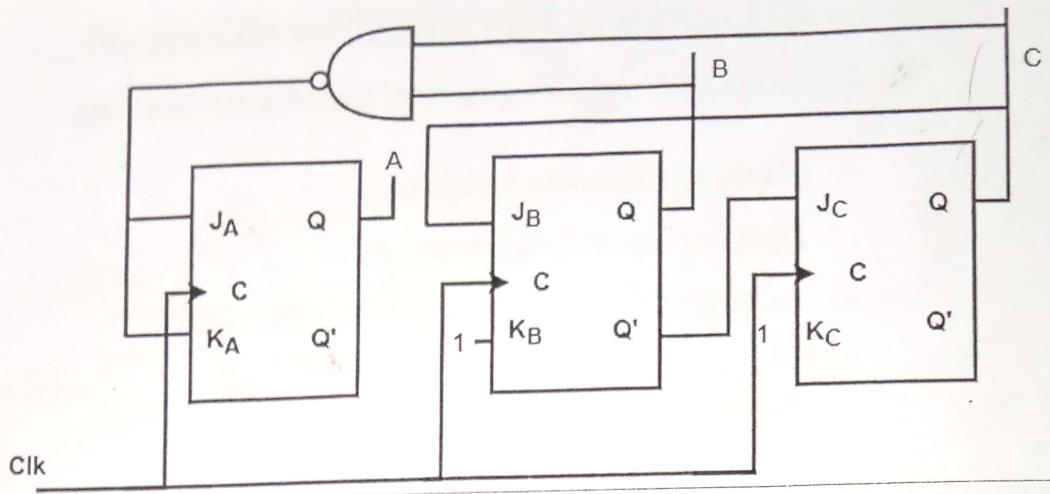
- c) Construct an CNN architecture with the following (2)

A color image of size 256x256 is given as an input to the model. The following sequence of operations are performed:

- 1<sup>st</sup> convolution operation performed with two filters of size 5x5 each and padding ?
- 2<sup>nd</sup> convolution operation performed with a filter of size 3x3 with padding and stride = 2
- Max pooling with stride = 4
- Flatten layer
- Softmax of 25

Q2  
128 x 128  
/ P

(P.T.O.)



4. a) Write a short note on the real-time application of the following terminologies.

i) Flip-flops ii) Multiplexer iii) Encoders iv) Counters (4)

b) Design a circuit for voting system for a class to select class representative.

There are 12 students in the class amongst which 2 students are standing for the election. Explain the steps, components needed for designing the system.

Draw necessary truth tables and circuit diagrams. (6)

5. a) Explain in detail about the conditional statements in verilog. (4)

b) What is the difference between always and assign statements. (2)

d) Registers x and y are declared as reg [2:0] x,y;. x and y have initial values of 1 and 2 respectively. Find the value of x and y after each of the following Verilog codes have been executed. (4)

(a)  $y = x \&\& y;$

$$x = y \& x; \quad \begin{matrix} 0 & 0 & 0 \\ 0 & 1 & 0 \end{matrix}$$

(c)  $x = (y) ? y : x;$

$$y = (x) ? x : y; \quad \begin{matrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{matrix}$$

(b)  $x <= (y) ? y : x;$

$y <= (x) ? x : y;$

(iv)  $x <= x << 1;$

$x[0] <= x[2];$

$$\begin{matrix} 0 & 1 & 1 \\ 0 & 1 & 1 \end{matrix}$$

$$\begin{matrix} 1 & 1 & 1 \\ 0 & 1 & 0 \end{matrix}$$

\*\*\*Best Wishes\*\*\*



National Institute of Technology, Tiruchirappalli  
Department of Computer Science and Engineering

Digital System Design

End Semester Examination

Course/ Branch  
Duration

: B.Tech/ CSE  
: 3 Hours

Course Code : CSPC33  
Max Marks : 50

Answer All Questions

1. a) Design a combinational circuit with 4-bit input and 2-bit output. The first output bit is set to 1 if the one's complement value of the input is greater than 5. The second output bit is set to 1, if the XOR value of all the input bits is 1. (5)  
b) Solve the following functions using K-map.
  - i)  $F = \sum m(0, 1, 2, 3, 4, 6, 8, 10, 12, 14, 16, 17, 18, 19, 20, 22, 24, 26, 28, 29, 30, 31)$
  - ii)  $G = \prod M(0, 1, 2, 9, 10, 14, 15) + d(5, 6, 13)$
2. a) Implement the following Boolean expression using multiplexer considering B as the input variable. (5)  
$$F(A, B, C, D) = \sum m(0, 1, 3, 4, 8, 9, 15)$$

(b) Consider you are working in a company where a customer approach you with a problem. He owns a machinery company where he asks your help find faults in machine. A machine is attached with n number of sensors (say temperature sensor, low oil sensor, etc.). All the sensors are connected to LEDs, in which, particular LED will be ON when there is some abnormality (e.g. less oil in machine) in particular sensor. But due to increase in the number of sensors, he can't have one LED for each sensor and would like to reduce the number of LEDs. Given this problem, how will you solve this issue and what solution will you give to the customer? Explain in detail. (5)
3. a) Design a JK counter which counts the following sequence. (5)  
0, 5, 6, 9, 4, 11, 7, 3, 12, 10, 8, 0, 5 ...  
b) Analyze the following synchronous sequential circuit. Derive the equations, draw necessary tables and state diagram. (5)

**op(31:26)**

28-26	0(000)	1(001)	2(010)	3(011)	4(100)	5(101)	6(110)	7(111)
31-29								
0(000)	R-format	Blitz/gaz	jmp	jump & link	branch eq	branch ne	blez	bgtz
1(001)	add immediate	add u	add less than imm.	set less than imm. unsigned	andf	or	xori	load word immediate
2(010)	TLB	F1Pt						
3(011)								
4(100)	load byte	load half	lw1	load word	load byte unsigned	load half unsigned	lwR	
5(101)	store byte	store half	sw1	store word			swR	
6(110)	load linked word	lw1						
7(111)	store cond. word	sw1						

**op(31:26)=010000 (TLB), rs(25:21)**

23-21	0(000)	1(001)	2(010)	3(011)	4(100)	5(101)	6(110)	7(111)
25-24								
0(00)	mfc0		cfc0		mtc0		ctc0	
1(01)								
2(10)								
3(11)								

**op(31:26)=000000 (R-format), funct(5:0)**

2-0 5-3	0(000)	1(001)	2(010)	3(011)	4(100)	5(101)	6(110)	7(111)
0(000)	shift left logical		shift right logical	sra	sllv		srlv	sray
1(001)	jump register	jalr			syscall	break		
2(010)	mfhi	mthi	mflo	mtlo				
3(011)	mult	multu	div	divu				
4(100)	add	addu	subtract	subu	and	or	xor	not or (nor)
5(101)			set l.t.	set l.t. unsigned				
6(110)								
7(111)								



National Institute of Technology, Tiruchirappalli  
Department of Computer Science and Engineering

Digital System Design

End Semester Examination

Course/ Branch

: B.Tech/ CSE

Course Code : CSPC33

Duration

: 3 Hours

Max Marks : 50

Answer All Questions

1. a) Design a combinational circuit with 4-bit input and 2-bit output. The first output bit is set to 1 if the one's complement value of the input is greater than 5. The second output bit is set to 1, if the XOR value of all the input bits is 1. (5)

b) Solve the following functions using K-map. (5)

i)  $F = \sum m (0, 1, 2, 3, 4, 6, 8, 10, 12, 14, 16, 17, 18, 19, 20, 22, 24, 26, 28, 29, 30, 31)$

ii)  $G = \prod M (0, 1, 2, 9, 10, 14, 15) + d (5, 6, 13)$

2. a) Implement the following Boolean expression using multiplexer considering B as the input variable. (5)

$$F(A, B, C, D) = \sum m (0, 1, 3, 4, 8, 9, 15)$$

b) Consider you are working in a company where a customer approach you with a problem. He owns a machinery company where he asks your help find faults in machine. A machine is attached with n number of sensors (say temperature sensor, low oil sensor, etc.). All the sensors are connected to LEDs, in which, particular LED will be ON when there is some abnormality (e.g. less oil in machine) in particular sensor. But due to increase in the number of sensors, he can't have one LED for each sensor and would like to reduce the number of LEDs. Given this problem, how will you solve this issue and what solution will you give to the customer? Explain in detail. (5)

3. a) Design a JK counter which counts the following sequence. (5)

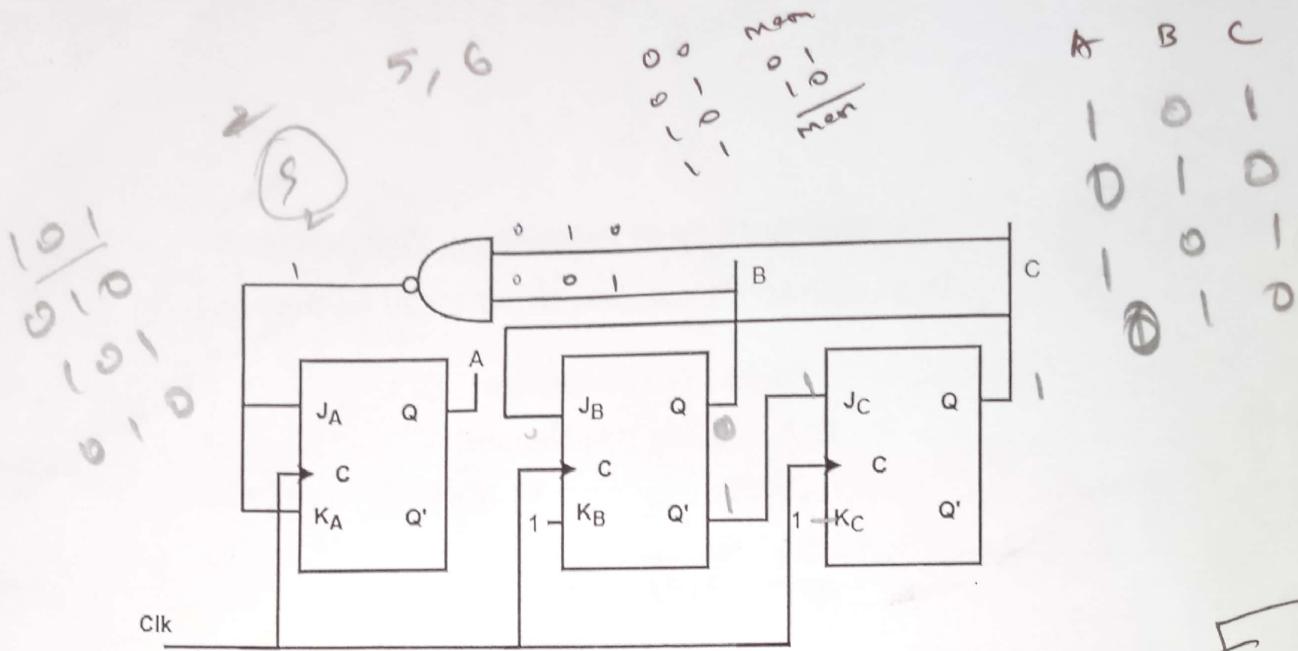
0, 5, 6, 9, 4, 11, 7, 3, 12, 10, 8, 0, 5 ...

- b) Analyze the following synchronous sequential circuit. Derive the equations, draw necessary tables and state diagram. (5)

$$J' B' (C \oplus 0) + J' B C (C \oplus 0)$$

$$+ J B (C \oplus 0) + J B' (C \oplus 0)$$

$$= (C \oplus 0)(A \oplus B) + (A \oplus B)(C \oplus 0)$$



A	B	C
1	0	1
0	1	0
1	0	0

4. a) Write a short note on the real-time application of the following terminologies.

i) Flip-flops ii) Multiplexer iii) Encoders iv) Counters (4)

b) Design a circuit for voting system for a class to select class representative.

There are 12 students in the class amongst which 2 students are standing for the election. Explain the steps, components needed for designing the system.

Draw necessary truth tables and circuit diagrams. (6)

5. a) Explain in detail about the conditional statements in verilog. (4)

b) What is the difference between always and assign statements. (2)

c) Registers x and y are declared as reg [2:0] x,y;. x and y have initial values of 1 and 2 respectively. Find the value of x and y after each of the following Verilog codes have been executed. (4)

(a)  $y = x \&& y;$   
 $x = y \& x;$

(c)  $x = (y) ? y : x;$   
 $y = (x) ? x : y;$

(b)  $x <= (y) ? y : x;$   
 $y <= (x) ? x : y;$

(iv)  $x <= x << 1;$        $x = 11$   
 $x[0] <= x[2];$        $y = 10$   
 $x$        $y$

\*\*\*Best Wishes\*\*\*

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI  
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING  
CYCLE TEST -I

Subject Code/ Name: CSPC34/ Computer Organization  
Marks: 20

Date: 21 / 09 / 2022  
Time: 11:00AM–12:00 PM

Answer all the Questions

1. List out and discuss briefly the eight great ideas invented by computer architects. (3)
2. Translate the following C code to MIPS. Assume that the variables f, g, h, i, and j are assigned to registers \$s0, \$s1, \$s2, \$s3, and \$s4, respectively. Assume that the base address of the arrays A and B are in registers \$s6 and \$s7, respectively. Assume that the elements of the arrays A and B are 4-byte words: (4)

while (f==g) A[f] = B[f] + h

3. For the register values shown above, what is the value of \$t2 for the following sequence of instructions? Assume \$t0 as holding the value 0xABCDFAA (2)

srl \$t2, \$t0, 4  
andi \$t2, \$t2, 0xEEEF

4. Consider two different implementations of the same instruction set architecture. The instructions can be divided into four classes according to their CPI (class A, B, C, and D). P1 with a clock rate of 3.5 GHz and CPIs of 1, 2, *<last digit of your roll\_no>*, and 3, and P2 with a clock rate of 3 GHz and CPIs of 1, *<second largest digit of your full roll\_no>*, 3, and 2.

Given a program with a dynamic instruction count of 1.0E6 instructions divided into classes as follows: 20% class A, 30% class B, 40% class C, and 10% class D, which implementation is faster? (4)

- i. What is the global CPI for each implementation?
- ii. Find the clock cycles required in both cases.

5. What are Pseudoinstructions? Why are they used? Give two examples. (2)

6. Provide the type, assembly language instruction, and binary representation of the instruction described by the MIPS fields: op=0x43, rs=4, rt = 3, constant = 0x55. Explain your answer. (2)

7. Distinguish between server computers and super computers. (2)

8. What are the different kinds of branch instructions in the MIPS ISA? (1)

PFB

$$\text{clock cycles} = \frac{\text{CPI} \times \text{IC}}{\text{Clock}}$$



**NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI**  
**TIRUCHIRAPPLALLI - 620 015, TAMIL NADU, INDIA**

Probability & Operations Research  
(MAIR 31)

Assessment - I  
(Computer Science Engineering)

Date—19/09/2022

**Answer all the questions (Full Marks - 25)**

1. Solve the following *linear programming problem* (LPP) [3+3]

$$\text{subject to } 2x_1 + 3x_2 \geq 6, \quad x_1 \leq 4, \quad x_2 \leq 7, \quad 4x_1 + 3x_2 \leq 18, \quad x_1, x_2 \geq 0.$$

a) Using graphical method, and

b) Using Big - M method. Verify both the solutions.

2. Solve the following LPP [6+3]

$$\begin{array}{lll} \text{Maximize } Z = 20x_1 + 10x_2 + 15x_3 \\ \text{subject to } 8x_1 + 6x_2 + 2x_3 \geq 60, \quad 5x_1 + x_2 + 6x_3 \geq 40 \quad 2x_1 + 6x_2 + 3x_3 \leq 30, \quad x_1, x_2, x_3 \geq 0. \end{array}$$

a) using Big - M method, and

b) Dual - simplex method.

3. Solve the following LPP using *simplex* method [5]

$$\begin{array}{lll} \text{Maximize } Z = 3x_1 + 2x_2 + 5x_3 \\ \text{subject to } x_1 + 2x_2 + x_3 \leq 43, \quad 3x_1 + 2x_3 \leq 46, \quad x_1 + 4x_2 \leq 42, \quad x_1, x_2, x_3 \geq 0. \end{array}$$

4. Solve [5]

$$\begin{array}{lll} \text{Maximize } Z = 3x_1 + 2x_2 - 5x_3 \\ \text{subject to } 2x_1 + x_2 - 5x_3 \leq 6, \quad x_1 + x_2 \leq 2, \quad x_1 - x_2 + 3x_3 = 0, \quad x_1, x_2, x_3 \geq 0. \end{array}$$

\*\*\*\*\*



Scanned with OKEN Scanner



NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI  
TAMIL NADU - 620 015, INDIA

Probability & Operations Research  
(MAIR 31)

End Semester Exam  
(Computer Science Engineering)

Date - 06/12/2022

- 2) A CEO has to assign four tasks ( $T_i, i = 1, 2, 3, 4$ ) to his four subordinates ( $S_i, i = 1, 2, 3, 4$ ). His estimates of the time each of his subordinate would take to perform each task is given in the matrix below. How should the tasks be allocated, one to each one, so to minimize the total man-hours? [3]

	$S_1$	$S_2$	$S_3$	$S_4$
$T_1$	18	26	17	11
$T_2$	13	23	14	16
$T_3$	38	19	18	15
$T_4$	19	26	24	10

- 3) The details of a project management work are given below: [3]

Activity	Immediate Predecessor	Duration (In weeks)		
		a	m	b
A	-	6	7	8
B	-	1	2	9
C	-	1	4	7
D	A	1	2	3
E	A, B	1	2	3
F	C	1	5	9
G	C	2	2	8
H	E, F	4	4	4
I	E, F	4	4	10
J	D, H	2	5	14
K	I, G	2	2	8

- i) Construct the project network with minimum number of nodes.  
ii) Find the expected duration and variance of each activity  
iii) Find the critical path and expected project completion time.  
iv) What is the probability of completing the project on or before 35 weeks?

- 4) Consider the following LPP

$$\text{Maximize } Z = 6X_1 + 8X_2$$

Subject to,

$$5X_1 + 10X_2 \leq 60$$

$$4X_1 + 4X_2 \leq 40$$

$$X_1 \text{ and } X_2 \geq 0.$$

- i) Solve the problem using simplex method,  
ii) Solve the problem if the right-hand side constants of the constraints are changed from 60 and 40 to 20 and 40 respectively.  
iii) Check whether the addition of the constraint  $6X_1 + 3X_2 \leq 48$  affects the optimality. If does, find the new optimum solution.



Probability & Operations Research  
(MAIR 31)

End Semester Exam  
(Computer Science Engineering)

Time: 3 hours

Answer all the questions

Maximum Marks: 30

[ $10 \times 2 = 20$ ]

1) Answer the following questions.

- a) The probability that machine A will be performing a usual function in 5 years' time is  $\frac{1}{4}$ , while the probability that machine B will still be operating usefully at the end of the same period is  $\frac{1}{3}$ . Find the probability in the following cases that in 5 years' time:
- Only machine B will be operating.
  - At least one of the machines will be operating.
- b) Given that  $P(A \cap \bar{B}) = \frac{1}{4}$  and  $P(A \cup B) = \frac{3}{4}$ , find (i)  $P(A)$ , (ii)  $P(B)$ .
- c) A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. All of them fire one shot each simultaneously at the target. What is the probability that
- 2 shots hit.
  - At least two shots hit?
- d) An underground mine has 5 pumps installed for pumping out storm water; the probability of any one of the pumps failing during the storm is  $\frac{1}{8}$ . What is the probability that
- at least 2 pumps will be working.
  - all the pumps will be working during a particular storm.
- e) If the density function of a continuous random variable  $X$  is given by
- $$f(x) = \begin{cases} 0, & x < 0 \\ ax, & 0 \leq x \leq 2 \\ a(4-x), & 2 \leq x \leq 4 \\ 0, & x > 4 \end{cases}$$
- Find the value of  $a$  and the cumulative distribution function of  $X$ .
  - Find  $P(X > 2.5)$ .
- f) A continuous random variable  $X$  has the probability distribution
- $$dF = a e^{-2|x|} dx, \quad -\infty < x < \infty.$$
- Find the value of  $a$ . Find the variance of the distribution.

The joint probability distribution function of  $(X, Y)$  is given by  $p(x, y) = K(3x + 5y)$ ,  $x = 1, 2, 3$ ;  $y = 0, 1, 2$ . Find the marginal distribution and conditional probability distribution of  $X$ ,  $P(X = x_i | Y = 2)$ ,  $P(X \leq 2 | Y \leq 1)$ .

The joint probability density function of the random variables  $X$  and  $Y$  is given by  $f(x, y) = K(xy + y^2)$ ,  $0 \leq x \leq 1$ ,  $0 \leq y \leq 2$ . Find  $P\left(X > \frac{1}{2}, Y > 1\right)$  and  $P(X + Y \leq 1)$ .

If  $X$  is normal  $(\mu, \sigma)$ , then prove that  $E(x) = \mu$  and  $Var(X) = \sigma^2$ .  
If  $X$  is normal  $(\mu, \sigma)$ , and  $\Phi(x)$  is the standard normal distribution, then prove that  $P(a \leq X \leq b) = \Phi\left(\frac{b-\mu}{\sigma}\right) - \Phi\left(\frac{a-\mu}{\sigma}\right)$ .

## Exercise 2

12.10.2020

1. Write a C-program that takes an input file and converts one form of comments in C-program to alternate comments form (that is, convert from “//” to “/\*” + “\*/” and from “/\*” + “\*/” to “//”)
  - Print the final output in a text file.
2. Write a C-program that contains two functions, both performing swap operation – One expects variable values as arguments and the other expects references to variables as arguments.
3. Write a C-program to perform the following:  
Step 1: Declare a 1-D integer array of size 5 and initialize it  
Step 2: Create an integer pointer variable and print the dereference value of it before assigning it to anything  
Step 3: Print the dereference value of the same pointer variable after assigning it to the 1-D array  
Step 4: Using pointer, print the third element of the array [*Hint: Use “ptr + index” method*]
4. Write a C-program to perform the following:  
Step 1: Declare a 1-D integer array of size 5 and initialize it  
Step 2: Create an integer reference variable and print the dereference value  
Step 3: Using pointer, print the third element of the array [*Hint: Use “ptr + index” method*]
5. Write a C-program to perform the following:  
Step 1: Declare a 1-D integer array of size 5 and initialize it  
Step 2: Create an integer pointer variable and assign it to the 1-D array  
Step 3: Create a character pointer variable and assign it to the 1-D array  
Step 4: Print the third element of 1-D array using both pointers

----- XXX -----



National Institute of Technology, Tiruchirappalli  
Department of Computer Science and Engineering

CSPC33 Digital System Design /Cycle Test 1

Course/ Branch/Sem : B.Tech/ CSE/III  
Duration : 1 Hour

Date : 20/09/2022  
Max Marks : 20

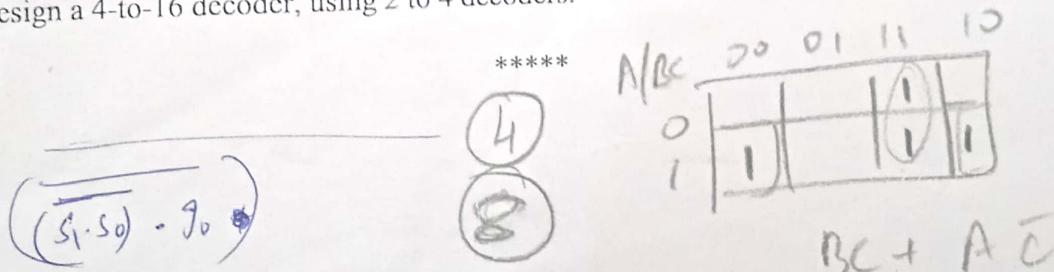
B - Section

Answer All Questions

1. Write down the boolean expression of a 4-to-1 multiplexer and design only using the NAND gates. (4)
2. Minimize the expression  $AB + AC + BC = AB + AC$ . Use Boolean rules. (3)
3. Implement  $F(A, B, C, D) = \sum m(0, 1, 5, 6, 8, 10, 12, 15)$  using 8 : 1 multiplexer. (2)
4. Design a combinational circuit whose input is a four-bit number and whose output is the 2's complement of the input number. Write down the truth table, simplify the boolean expression and draw the circuit diagram. (5)
5. Minimize the boolean function using K-map

$$F(A, B, C, D) = \sum m(1, 3, 4, 6, 8, 9, 11, 13, 15) + \sum d(0, 2, 14) \quad (3)$$

6. Design a 4-to-16 decoder, using 2 to 4 decoders. (3)



$$\overline{S_1} + \overline{S_0}$$

$$\overline{ABC}$$

$$AB + A\bar{C}$$

$$A\bar{B}\bar{C} + A$$



National Institute of Technology, Tiruchirappalli  
Department of Computer Science and Engineering

CYCLE TEST - 2

Digital System Design

Course/ Branch

: B.Tech/ CSE

Duration

: 1 Hour

Course Code : CSPC33

Max Marks : 20

Answer All Questions

1. Convert JK flipflop to T flipflop. Draw necessary truth tables excitation tables and diagrams. (3)
2. With diagrams and truth tables, explain NOR latch in detail. (3)
3. Differentiate latch and flip-flop.
4. Design a counter using JK-flipflop which counts the following sequence. (5)  
0, 7, 6, 2, 3, 4, 1, 5, 0, 7, ...
5. Design a 4-bit bi-directional shift register with direction control (C) bit. (Hint: If C=0, do left shift, else right shift) (5)
6. Differentiate Synchronous and asynchronous counters. (2)

\*\*\*\*\*

```
virtual void dud() { ... }  
};
```

(2M + 1M + 9M)

2. For the following program:

- Write the basic Activation Record Instance
- Write the order in which the function calls are made
- 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
```



3. a) 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** (2M + 1M + 1M + 1M)

(a) Value of "x" in b2 is alone copied to "x" in b1

A ○ X

(b) Both "x" and "y" values of b2 will be copied to b1

Throws error

B ○ Y

2 | Page

Dr. R. Bala Krishnan, Asst. Prof., Dept of CSE, NIT, Tiruchirappalli – 620 015

b<sub>1</sub>      b<sub>2</sub>  
x      XY

- (d) None of the above
- b) In C++ program, a throw keyword without any value/variable\_name can \_\_\_\_\_  
 (a) Occur only inside a handler      (b) Occur anywhere inside a program  
 (c) Occur only inside a try loop      (d) None of the above
- c) Any object that is created inside a try loop \_\_\_\_\_  
 (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
- d) The class at point A and point B are called as \_\_\_\_\_ respectively.

```
class base <---- Point A
{
  ...
  class derived <---- Point B
  {
    ...
  }
}
```

- (a) Nested and Nesting Class  
 (c) Virtual Class and Nesting Class

- (b)** Nesting and Nested Class  
 (d) Nesting and Virtual Class

4. a) At which point and in what order, the destructor will be called in the following C++ program? **(2 M + 1 M + 1 M + 1 M)**

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

- b) Headless Horn clause in Prolog is called as \_\_\_\_\_ statement

- c) If the base class members are declared as "private" and the derived class is derived using the access modifier "public", then the class members of base class will become \_\_\_\_\_

in derived class.

(a) Visible

(b) Hidden

(c) Accessible

- d) Write the names of the two types of synchronization that are required when different tasks share data.

5. What will be the output of the following code?

[Hint: Do step-by-step derivation for question c]

a) (CAR 'A) A

b) (CDR '((A B) C D)) C D

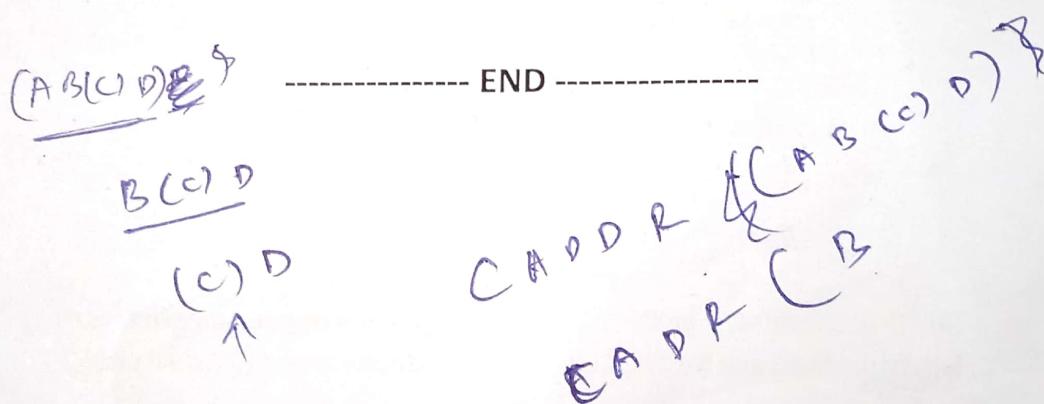
c) (CADDR '((A B (C) D) E)) C

(1 M + 1 M + 3 M)

Write  
C-pro  
/\* \*/

2. Wr  
ex:  
ar

3.





National Institute of Technology  
Tiruchirappalli, Tamil Nadu – 620 015

Date: 07.12.2022

CSPC31: Principles of Programming Languages – FA

Time: 09:30 AM – 12:30 PM

Duration: 3 Hours

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. a) Using the following grammar, derive the leftmost derivation for the following sentence:  
(3 M + 10 M)

$$A = (B * C) + A$$

$\langle \text{assign} \rangle \rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle$

$\langle \text{id} \rangle \rightarrow A \mid B \mid C$

$\langle \text{expr} \rangle \rightarrow \langle \text{expr} \rangle + \langle \text{expr} \rangle \mid \langle \text{expr} \rangle * \langle \text{expr} \rangle \mid (\langle \text{expr} \rangle) \mid \langle \text{id} \rangle$

b) Draw the inheritance diagram and complete Class Inheritance Record (with vtable) for the following program.

```
class Add
{
public:
    int w, x, y;
    virtual void add() { ... }
    virtual void sub() { ... }
};

class Sub
{
public:
    int z;
    virtual void sub() { ... }
    virtual void sum() { ... }
};

class Div : public Add, public Sub
{
public:
    int u;
    virtual void add() { ... }
    virtual void sub() { ... }
};
```

