18. (a) Find the generating function of the following recurrence relation: (7 marks) (10) CO4 BL4

$a_r - 7a_{r-1} + 12a_{r-2} = 0; a_0 = 5, a_1 = 7$

(b) Using truth tables, check if the following proposition is a tautology, contradiction or contingency. (3 marks)

$(p \vee q) \wedge (\sim p \wedge \sim q)$

19. Find the DNF(Disjunctive Normal Form) of the following propositions: (10) CO2 BL5

(a) $p \vee \{\sim p \rightarrow (q \vee (q \rightarrow \sim r))\}$

(b) $\sim\{\sim(p \leftrightarrow q) \wedge r\}$

All the laws used must be clearly mentioned.

20. Find the Disjunctive Normal Form of the following propositions: (10) CO3 BL4

(a) $p \rightarrow \{(p \rightarrow q) \wedge \sim(\sim q \vee \sim p)\}$ (5 marks)

(b) $\{p \wedge \sim(q \wedge r)\} \vee (p \rightarrow q)$ (5 marks)

All the laws must be clearly mentioned.

21. (a) (5 marks) (10) CO1 BL2
Find the conjunctive normal form of the following proposition:

$\{(q \vee (p \wedge r)\} \wedge \sim\{(p \vee r) \wedge q\}$

(b) Show that a bipartite graph cannot have a triangle as its subgraph (3 marks)

(c) Can we have a simple graph with the degree sequence (3,3,1,1,1)? (2 marks)

Sl. No.:023/CSE/BTech/150/Set 2

JIS UNIVERSITY

Roll Number

JIS University

End Semester Examinations - Odd 2023

YMT3001 - Discrete Structures

Time: 2 Hrs **Maximum Marks: 50**

Instructions to the candidate:

Figures to the right indicate full marks.
Draw neat sketches and diagram wherever is necessary.
Candidates are required to give their answers in their own words as far as practicable.

Part A
Answer any Ten (10x1=10 Marks)

1. Choose the correct statement: (1) CO1 BL1
The graph with the degree sequence (3,2,1,1)

(a) is simple

(b) is self-complementary

(c) is always planar

(d) does not exist.

2. Question: Let * be a binary operation on the set of all real numbers defined by a*b=a. Then (1) CO1 BL1
a)* is commutative but not associative
b) * is associative but not commutative
c) * is commutative and associative
d) none of the above.

3. Let G be a planar graph. If G has 16 edges and 12 vertices, then the number of bounded regions in the planar diagram of G is (1) CO2 BL2
(a) 5

(b) 4

(c) 6

(d) None

4. Let * be a binary operation on the set of all real numbers defined by a*b=a+b+2. Then (1) CO1 BL1
a) -2 is the identity element
b) 2 is the identity element
c) -3 is the identity element
d) 3 is the identity element

5. If a graph G has 20 vertices each of degree 4, then the number of edges of G is (1) CO1 BL1

(a) 40

(b) 45

(c) 50

(d) None

6. The proposition $p \vee \sim p$ (1) CO1 BL1
(a) is a tautology

(b) is a contradiction

(c) is a contingency

(d) none of the above

7. Consider the set Q of all rational numbers with a binary operation * defined as a*b=ab .Then which one is false (1) CO1 BL1
(a) * is always closed

(b) the identity element exists.

(c) Q forms a group with *

(d) both (b) and (c)

8. The compound proposition $s=(q \vee p) \wedge (\sim p \vee \sim q)$: (1) CO1 BL3
(a) has exactly 2 outputs as false

(b) is a contradiction

(c) has exactly 3 outputs as false

(d) none of the above

9. Choose the correct statement: (1) CO1 BL1
The graph with the degree sequence (4,3,2,1,1)

(a) is simple

(b) is self-complementary

(c) is always planar

(d) does not exist.

10. The compound proposition $s=(q \vee p) \wedge (\sim p \wedge \sim q)$: (1) CO2 BL1
(a) has exactly 2 outputs as false

(b) is a contradiction

(c) has exactly 3 outputs as false

(d) is a tautology

11. The order of the recurrence relation $a_{r+2}-8a_{r+1}+10a_{r-2}=0$ is (1) CO2 BL3
(a) 2

(b) 3

(c) 4

(d) None

12. The operation $a*b=\sqrt{a^2+b^2}$ is (1) CO1 BL3
(a) commutative but not associative

(b) neither commutative nor associative

(c) both commutative and associative

(d) associative but not commutative

Part B
Answer any Two (2x5=10 Marks)

13. Using principle of mathematical induction show that (5) CO2 BL4
$$\frac{1}{1\times 2}+\frac{1}{2\times 3}+\frac{1}{3\times 4}+\ldots\ldots+\frac{1}{n\times(n+1)}=\frac{n}{n+1}$$
for all natural numbers n.

14. Prove that the set of all rational numbers other than -1 forms a commutative group with respect to * where * is defined by a*b=a+b+ab. (5) CO3 BL4

15. Solve the recurrence relation by characteristic root method: (5) CO3 BL5
$a_{r+2}-11a_{r+1}+18a_r=0; a_1=3, a_2=11$.

16. Is the cycle graph C_5 a self-complementary graph? If yes, then prove it. (5) CO4 BL2

Part C
Answer any Three (3x10=30 Marks)

17. (a) Define a planar graph. Verify Euler's formula for the complete graph K_4 and the complete bipartite graph $K_{2,3}$. (5 marks) (10) CO5 BL5

(b) Are the graphs K_5 and $K_{2,3}$ planar? If yes, then prove it.

UNIVERSITY

Roll Number | | | | | | | | | | | | |

JIS University

End Semester Examinations - Odd 2023

YMT3002 - Probability and Statistics

Time: 2 Hrs **Maximum Marks: 50**

Instructions to the candidate:

Figures to the right indicate full marks.
Draw neat sketches and diagram wherever is necessary.
Candidates are required to give their answers in their own words as far as practicable

Part A
Answer any Ten (10x1=10 Marks)

1. In a binomial distribution the probability of getting a success is 1/4. The standard deviation is 3. Then mean is. (1) CO2 BL2
   (a) 6
   (b) 8
   (c) 10
   (d) 12

2. In a binomial distribution, n=4, P(X=0)=16/81, then P(X=4) is (1) CO1 BL1
   (a)1/16
   (b) 1/81
   (c) 1/27
   (d) 1/8

3. If $b_{xy}=0.4, b_{yx}=0.8$, then r_{xy} is (1) CO1 BL1
   a)0.56
   b)0.65
   c)0.75
   d)None

4. If the correlation coefficient between X and Y is 0.85, covariance is 27 and variance of X is 36, then what is the variance of Y? (1) CO3 BL1

(a) 5.3

(b) 6.3

(c) 4.3

(d) None

5. If 3z-x=4 , where z is a standard normal variate, then (1) CO1 BL2
a) x is a normal variate with mean 4 and standard deviation 3
b) x is a normal variate with mean 3 and standard deviation 4
c)x is a normal variate with mean -4 and standard deviation 3
d)None of the above

6. The probability that a missile will strike a target is 70%. If 10 missiles are dropped, find mean. (1) CO2 BL2
a) 3,
b) 0.3,
c) 7
d) 0.7

7. A bag contains 5 brown and 4 white socks. A man pulls out two socks . The probability that these are of the same colour is (1) CO2 BL3
(a) 5/108

(b) 18/108

(c) 30/108

(d) None of the above

8. The probability of getting a correct answer is $\frac{x}{12}$. If the probability of not gettting a correct answer is $\frac{2}{3}$. (1) CO1 BL3

Then x is equal to

(a) 2

(b) 3

(c) 4

(d) None

Sl. No.:023/CSE/BTech/151/Set 2

9. There are 3 red balls, 4 green balls, and 5 black balls in a basket. The probability of not getting the red balls is (1) CO1 BL1
(a) 1/4
(b) 1/3
(c) 5/12
(d) None

10. A box contains 6 nails and 10 nuts. Half of the nails and half of the nuts are rusted. If one item is chosen at random, the probability that it is rusted or is a nail is: (1) CO1 BL1
(a) 3/16

(b) 5/16

(c) 11/16

(d) 14/16

11. A dice is thrown 20 times. If getting a number >4 is a success, find the mean of the number of success (1) CO1 BL2
(a) 6.66

(b) 4.44

(c) 7.77

(d) None

12. The covariance between X and Y is 15, variance of X is 4, and variance of Y is 49, then the correlation coefficient is (1) CO4 BL2
(a) 0.75

(b) 0.25

(c) 0.5

(d) None

Part B

Answer any Two (2x5=10 Marks)

13. If 4X–5Y+33 = 0 is the regression equation of Y on X, and 20X-9Y–107 = 0 is the regression equation of X on Y, calculate the value of correlation coefficient r_{xy} . (5) CO4 BL2

Is it possible for the line 4X–5Y+33 = 0 to be the regression equation of X on Y, and 20X-9Y–107 = 0 to be the regression equation of Y on X? Why/ Why not?

14. Calculate Spearman's Rank correlation for the following data: (5) CO1 BL1

X	56	18	89	23	62	32	45	26

JIS University, ESE, Odd 2023 12/14/2023 1:25:53 PM

Y	45	23	57	62	14	20	30	41

15. The probability density function of a random variable X is given as follows: (5) CO2 BL3

$$f(x)=\begin{cases} ax^2(b-x); 0<x<1 \\ 0; elsewhere \end{cases}$$

Find the values of a and b if the mean of X is 600. Hence calculate P(X<0.5).

16. Let X be a random variable with the following probability density function (5) CO4 BL5

$$f(x)=\begin{cases} cx^2; 1\le x\le 2 \\ cx; 2<x<3 \\ 0; elsewhere \end{cases}$$

Find the constant c, P(X>2) and $P\left(\frac{1}{2}<X<\frac{3}{2}\right)$.

Part C

Answer any Three (3x10=30 Marks)

17. Calculate the correlation coefficient and the regression line of y on x and regression line of x on y from the following data. (10) CO1 BL1

X	25	30	34	38	42	48
Y	22	20	25	28	32	36

18. (a) The contents of 3 urns are as follows: (10) CO3 BL3
Urn I: 7 white, 3 black balls

Urn II : 4 white, 6 black balls and

Urn III : 2 white, 8 black balls.

The probability of choosing Urn I, Urn II, and Urn III are respectively 0.20, 0.60 and 0.20 respectively. An urn is chosen at random and two balls are drawn at random. If both the balls are white, find the probability that it is from Urn III. (5 marks)

(b) Bag I contains 4 red and 3 black balls. Bag II contains 5 red and 4 black
balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II.
The ball so drawn is found to be red in color. Find the probability that the transferred ball
is black. (5 marks)

19. The probability density function of a random variable X is given as follows: (10) CO4 BL2
$f(x)=kx^2(3-x)$ for $0<x<3$.

(a) Find the value of k (2 marks)

(b) Find the mean of X (2 marks)

(c) Find P(X>2) (2 marks)

(d) If s denotes the standard deviation of X and m denotes the mean of X, find the value of m+2s. (4 marks)

20. Find the two degree curve that best fits the following data: (10) CO2 BL2

X	35	45	52	72	38	42
Y	58	28	37	43	50	39

21. (10) CO3 BL4

(a) The sum of mean and variance of a binomial distribution is 1.8. If the number of observations is 5, find the values of p and q. Hence, find the distribution. (4 marks)

(b)The sum of the mean and variance of a binomial distribution is 4. Moreover, the product of the mean and variance of a binomial stribution is 128. Find the values of p,q and n. Hence, find the stribution. (6 marks)

JIS UNIVERSITY

Roll Number													

JIS University

End Semester Examinations - Odd 2023

YCS3001 - Digital Circuits and Logic Design

Time: 2 Hrs **Maximum Marks: 50**

Instructions to the candidate:

Figures to the right indicate full marks.
Draw neat sketches and diagram wherever is necessary.
Candidates are required to give their answers in their own words as far as practicable

Part A
Answer any Ten (10x1=10 Marks)

1. Identify the logic gate as universal gate (1) CO2 BL2

a) AND
b) NAND
c) OR
d) NOT

2. Convert $(775)_8 = (?)_{16}$ (1) CO1 BL2
a) $(1FA)_{16}$
b) $(1FD)_{16}$
c) $(5EF)_{16}$
d) None of these

3. Solve the 1's complement of 1101 (1) CO1 BL3
a) 0100
b) 1100
c) 0010
d) 0011

4. Convert $(24)_8 = (?)_2$ (1) CO1 BL2
a) $(110100)_2$
b) $(010101)_2$
c) $(010100)_2$
d) None of these

5. Solve the 2's complement of 011 (1) CO1 BL3
a) 001
b) 101
c) 011
d) 111

6. Convert $(ABC)_{16} = (?)_2$ (1) CO1 BL2
a) 101010111100
b) 111010111100
c) 101010111101

d) None of these

7. Solve : A+AB = ? (1) CO2 BL3
a) 0
b) 1
c) A
d) AB

8. Calculate the result of binary addition of two binary numbers 001+101 = ? (1) CO1 BL4
a) 010
b) 100
c) 110
d) None of these

9. Convert binary number 1100 to gray code : (1) CO1 BL2
a) 1101
b) 1110
c) 1011
d) 1010

10. Another name of Asynchronous counter is (1) CO4 BL1
a) Serial counter
b) Parallel counter
c) Parallel / Serial counter
d) None of these

11. Choose the example of combinational logic circuit (1) CO3 BL3
a) Multiplexer
b) Latch
c) Flip Flop
d) Counter

12. The input value of A= 1 and B=1 for NOR gate, the output Y will be expressed as (1) CO2 BL2
a) 0
b) 1
c) 10
d) A

Part B
Answer any Two (2x5=10 Marks)

13. Analyze and simplify the following expression using k-map method : $Y= \sum_m (0,1,4,5,6,8,9,12,13,14)$ (5) CO5 BL4

14. Analyze and simplify the following expression using k-map method : $Y= \prod (0,2,8,10)$ (5) CO5 BL4

15. Design 4-to-1 Multiplexer circuit with proper truth table and block diagram. (5) CO3 BL5

Sl. No.:O23/CSE/BTech/134/Set 1

16. Design D flip flop circuit and explain with proper truth table. (5) CO4 BL5

Part C
Answer any Three (3x10=30 Marks)

17. Answer all (10)

a) Demonstrate the function Y= AB by implementing it, using (i) NOR gate only (ii) NAND gate only (5) CO3 BL3

b) Explain full adder circuit with suitable diagram and truth table. (5) CO3 BL5

18. Answer All (10)

a) Write down the De-Morgan's law in Boolean algebra and prove it with truth table. (5) CO2 BL1

b) Design the logical expression below using Basic Gates : $Y=(\overline{A} + \overline{B} + C) . (B + \overline{C}) . (C + A)$ (5) CO2 BL3

19. Answer All (10)

a) Explain S-R flip flop circuit with proper truth table. (5) CO4 BL5

b) Design 3-to-8 Decoder circuit with proper truth table and block diagram (5) CO3 BL5

20. Answer All (10)

a) Describe Exclusive-OR gate with the help of logic symbol, logical expression and truth table. (5) CO2 BL2

b) Implement the following function using a multiplexer and explain with truth table.
$F (A,B,C) = \sum (1,3,5,6)$ (5) CO3 BL6

21. Explain the logic diagram of a 4-bit binary synchronous counter using J K flip-flops that trigger on the negative - edge transition. Also make the truth table and output waveforms. (10) CO4 BL6

JIS UNIVERSITY

Roll Number												

JIS University

End Semester Examinations - Odd 2023

YCS3002 - Data Structures and Algorithms

Time: 2 Hrs **Maximum Marks: 50**

Instructions to the candidate:

Figures to the right indicate full marks.
Draw neat sketches and diagram wherever is necessary.
Candidates are required to give their answers in their own words as far as practicable

Part A
Answer any Ten (10x1=10 Marks)

1. Which data structure is used for implementing recursion? (1) CO5 BL1
a) Queue
b) Array
c) Stack
d) Tree

2. When a pop() operation is called on an empty queue, what is the condition called? (1) CO1 BL1
a) Overflow
b) Underflow
c) Syntax Error
d) Garbage Value

3. The prefix form of A-B/ (C * D ^ E) is? (1) CO1 BL1
a) -A/B*C^DE
b) -A/BC*^DE
c) -ABCD*^DE
d) -/*^ACBDE

4. What is an AVL tree? (1) CO1 BL1
a) a tree which is unbalanced and is a height balanced tree
b) a tree which is balanced and is a height balanced tree
c) a tree with atmost 3 children
d) a tree with three children

5. What is a dequeue? (1) CO1 BL1
a) A queue implemented with both singly and doubly linked lists
b) A queue with insert/delete defined for front side of the queue
c) A queue with insert/delete defined for both front and rear ends of the queue
d) A queue implemented with a doubly linked list

6. Which of the following is a Divide and Conquer algorithm? (1) CO1 BL1
a) Bubble Sort
b) Selection Sort
c) Heap Sort

d) Merge Sort

7. What is the time complexity of the binary search algorithm? (1) CO1 BL1
a) O(n)
b) O(1)
c) O(log2n)
d) O(n^2)

8. Which of the following statements is true about AVL Trees? (1) CO1 BL1
a) The difference between the heights of left and right nodes cannot be more than 1.
b) The height of an AVL Tree always remains of the order of O(logn)
c) AVL Trees are a type of self-balancing Binary Search Trees.
d) All of the above.

9. Which of the following algorithms are used to find the shortest path from a source node to all other nodes in a weighted graph? (1) CO1 BL1
a) BFS.
b) Djikstra's Algorithm.
c) Prims Algorithm.
d) Kruskal's Algorithm.

10. The time complexity used for inserting a node in a priority queue on the basis of key is: (1) CO1 BL1
a) O(n)
b) O(n2)
c) O(nlogn)
d) O(logn)

11. How many children does a binary tree have? (1) CO1 BL1
a) 2
b) any number of children
c) 0 or 1 or 2
d) 0 or 1

12. A graph having an edge from each vertex to every other vertex is called a _____ (1) CO1 BL1
a) Tightly Connected
b) Strongly Connected
c) Weakly Connected
d) Loosely Connected

Part B
Answer any Two (2x5=10 Marks)

13. Define ADT (Abstract Data Type) (5) CO2 BL1
Mention the features of ADT.

What are benefits of ADT?

14. Write the algorithm to push and pop an element from a stack using array. (5) CO2 BL5
What is linked list.

15. What is meant by pivot node? (5) CO2 BL2
Define leaf?

What is a balance factor in AVL trees?

What is meant by binary search tree?

16. What are the postfix and prefix forms of the expression? (5) CO2 BL2
A+B*(C-D)/(P-R)

How do you test for an empty queue?

Define circular queue

Part C
Answer any Three (3x10=30 Marks)

17. Define non-linear data structure (10) CO2 BL2
What is a minimum spanning tree?What is the use of Kruskal's and prim's algorithm?

What are the two traversal strategies used in traversing a graph and tree?

What is a undirected graph?

18. Write down an algorithm for Insertion sort with example. (10) CO4 BL4
Explain the time complexities of Insertion sort, Selection sort.

Define Insertion sort.

19. What are the difference between Linear search and Binary search. (10) CO3 BL3
Write an algorithm for linear Search with example.

Write time complexity of linear search.

20. write down the examples of linear data structure. (10) CO3 BL3
Difference between Stack and Queue.

Write down the algorithms for inserting and deleting an element from queue.

21. Write an algorithm for Tower of Hanoi. (10) CO4 BL3
Write an algorithm for BFS.

What is BFS and DFS?

JIS UNIVERSITY

Roll Number | | | | | | | | | | | | |

JIS University

End Semester Examinations - Odd 2023

YCS3003 - Object Oriented Programming

Time: 2 Hrs **Maximum Marks: 50**

Instructions to the candidate:

Figures to the right indicate full marks.
Draw neat sketches and diagram wherever is necessary.
Candidates are required to give their answers in their own words as far as practicable

Part A
Answer any Ten (10x1=10 Marks)

1. C++ uses which approach? (1) CO1 BL1
a) right-left
b) Top-down
c) left-right
d) bottom-up

2. Identify the correct extension of the user-defined header file in C++. (1) CO1 BL1
a) .cpp
b) .hg
c) .h
d) .hf

3. Which of the following statement is correct with respect to the use of friend keyword inside a class? (1) CO1 BL1
a) A private data member can be declared as a friend.
b) A class may be declared as a friend.
c) An object may be declared as a friend.
d) We can use friend keyword as a class name.

4. What is C++? (1) CO1 BL1
a) C++ is an object oriented programming language
b) C++ is a procedural programming language
c) C++ supports both procedural and object oriented programming language
d) C++ is a functional programming language

5. Which of the following data type is supported in C++ but not in C? (1) CO1 BL1
a) bool
b) int
c) double
d) float

6. Which header file is required to use file I/O operations? (1) CO1 BL1
a) ifstream
b) ostream
c) fstream

d) iostream

7. By default, what a program does when it detects an exception? (1) CO1 BL1
a) Continue running
b) Results in the termination of the program
c) Calls other functions of the program
d) Removes the exception and tells the programmer about an exception

8. Which of the following is not a type of Constructor in C++? (1) CO1 BL1
a) Default constructor
b) Parameterized constructor
c) Copy constructor
d) Friend constructor

9. Inheritance allow in C++ Program? (1) CO1 BL1
a) Class Re-usability
b) Creating a hierarchy of classes
c) Extendibility
d) All of the above

10. How Exception handling is implemented in the C++ program? (1) CO1 BL1
a) Using Exception keyword
b) Using try-catch block
c) Using Exception block
d) Using Error handling schedules

11. _____ underlines the feature of Polymorphism in a class. (1) CO1 BL1
a) Virtual Function
b) Inline function
c) Enclosing class
d) Nested class

12. When the inheritance is private, the private methods in base class are _____ in the derived class (in C++). (1) CO1 BL1
a) Inaccessible
b) Accessible
c) Protected
d) Public

Part B
Answer any Two (2x5=10 Marks)

13. In C++,a variable can be declared anywhere in the scope.What is the significance of this feature? (5) CO1 BL1

14. How is polymorphism achieved at compile time and run time? (5) CO4 BL1

15. Can we pass class objects as function arguments? Explain with the help of an example. (5) CO1 BL1

16. When do we use multiple catch handlers? (5) CO4 BL1

Part C
Answer any Three (3x10=30 Marks)

17. Let us design a class bank Account. A bank account has an account number. The bank gives each account a different, unique number. Each instance of this class maintains one account with an owner, an account number and current balance. Normally, the account numbers start with some +ve integer and keep on increasing as the new accounts are created. We need a way to assign a new account number to each instance as it is created. A new account can be created by giving the owner's name and an initial amount. Nobody should be able to manipulate instance variables directly. Methods must be provided to access (i) name of the owner (ii) account number (iii) current balance, and (iv) deposit money in the account. (10) CO3 BL1

18. 1. To write a C++ program to implement the friend function concept. (10) CO3 BL1

19. Write a Program to implement the exception handling with rethrowing in exception. (10) CO3 BL1

20. We know that a private member of a base class is not inheritable.Is it anyway possible for the objects of a derived class to access the private members of the base class?If yes,how ? (10) CO2 BL1

21. Write a Program to implement the exception handling with try and catch statements. (10) CO4 BL1