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# S.E. (Computer Engineering/Computer Science & Design Engg/Artificial Intelligence & Data Science Engg.) (Insem)

# DISCRETE MATHEMATICS

## (2019 Pattern) (Semester - III) (210241)

***Time : 1 Hour]*** ***[Max. Marks : 30***

***Instructions to the candidates:***

1) ***Answer Q1 or Q2, Q3 or Q4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data, if necessary.***

***Q1)*** a) Let A ={1, 2, 3} and B = {1, 2, 3, 4, 5}. Find **[5]**

i) P(A U B)

ii) P(A $\cap$ B)

iii) A – B

b) By using mathematical induction prove that

$S_n = 1 + 3 + ... + (2n-1) = n^2$; for all integers $n \geq 1$ **[5]**

c) Let P : I will study hard and Q: I will get admission in IIT.

Statement: If I study hard then I will get admission in IIT.

Write the Converse, Inverse & Contrapositive of the above statement. **[5]**

OR

***Q2)*** a) Suppose 100 Computer Engineering students studies at least one of the following language C, C++ and Python. It is given that 65 students studies C language, 45 studies C++ language and 42 studies Python language. 20 students studies C and C++ language, 25 student studies C and Python language, 15 students studies C++ and Python language. Find students studying : **[5]**

i) Only C and C++ language, not Python language

ii) Only C and Python language, not C++ language

***P.T.O.***

b) Use mathematical induction to prove **[5]**

$S_n = 2 + 4 + 6 + 8 + ... + 2n = n(n + 1)$ for all positive integer $n$.

c) What is Logical Equivalence? Show that $\sim(q \rightarrow p) \vee (p \wedge q) \equiv q$ **[5]**

***Q3)*** a) Let A = ( 0, 2, 4, 6, 8, 10 } and Relation aRb defined on set A as

aRb = {(a,b) | (a–b) % 2 == 0 ; $\forall$a,b $\in$ A}.

Find aRb is Equivalence Relation or not? **[5]**

b) Write the relation pairs and Draw the Hasse Diagram for the Relation defined on set 'X' as aRb = {(a, b) | a divides b ; $\forall$a,b $\in$ X };

where X = { 10, 20, 30, 40, 50, 60, 80, 100 }. **[5]**

c) If f(x) = 2x + 5 and g(x) = 5x + 2 find **[5]**

i) fog (5)

ii) fog (2) + gof(2)

OR

***Q4)*** a) If X = {10,20,30,40,50} & Relation on set 'X' is represented as

aRb = { (a, b) | a divides b; $\forall$a,b $\in$ X }. Find a relation aRb is Partial Order Relation or not? **[5]**

b) Let A = { 1, 2, 4, 8, 16, 24, 32, 48 }. A relation on set 'A' is defined as aRb = { (a, b) || a divides b; $\forall$a,b $\in$ A}. **[5]**

i) Write Relation aRb

ii) Write any two Chain of aRb on set 'A'

iii) Write any two Anti Chain of aRb on set 'A'

c) If $f(x) = 16x^2 + 12$. Find Inverse of $f(x)$. Is the inverse of $f(x)$ is function? Justify. **[5]**

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## S.E. (Artificial Intelligence & Data Science/Computer Engineering) (Insem.)

## FUNDAMENTALS OF DATA STRUCTURES

## (2019 Pattern) (Semester - III) (210242)

***Time : 1 Hour]*** ***[Max. Marks : 30***

***Instructions to the candidates:***

1) ***Attempt questions Q1 or Q2, Q3 or Q4.***
2) ***Draw neat & labelled diagrams wherever necessary.***
3) ***Assume suitable data if necessary.***
4) ***Figures to the right indicate full marks.***

***Q1)*** a) What is time complexity? Why asymptotic notations are important? Find time complexity of following code using step count method. **[6]**

```
int x = 0;
for (i = 0; i <N; i++)
{
    for (j = N; j > i; j--)
    {
    x = x + i + j;
    }
}
```

b) Write pseudocode to find factorial of a number. Draw the flowchart for the same. **[5]**

c) Explain what is Linear and non-linear data structure with example. **[4]**

OR

***Q2)*** a) Write short note on : **[6]**

ADT

Divide and conquer method.

b) What is meant by time and space complexity? Explain the asymptotic notations used for time complexity? **[5]**

***P.T.O.***

c) Explain what is static and dynamic data structure with example. **[4]**

***Q3)*** a) What is Row Major and Column Major Representation? Explain with example. Write the formula to find any element A[i][j] in row major and column major representations of A. **[6]**

b) What is meant by sparse Matrix? Write an algorithm to perform addition of two sparse matrices. **[5]**

c) Explain with example how single variable polynomial can be represented using 1-D array? What is advantage and disadvantage of this representation? **[4]**

OR

***Q4)*** a) What is the difference between simple and fast transpose of sparse matrix? Write an algorithm to find simple transpose of sparse matrix. **[6]**

b) Write an algorithm to find addition of two single variable polynomials using array. Polynomial term consists of coefficient and exponent and both are stored as an element in array. Assume terms are arranged in descending order of exponent. State time complexity of the same. **[5]**

c) Draw and explain following terms : **[4]**

2D Array

3D Array

**Total No. of Questions : 4]**

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# S.E. (Computer Engg./Artificial Intelligence & Data Science/Computer Science &Design Engg.) (In Sem.)
# OBJECT ORIENTED PROGRAMMING
# (2019 Pattern) (Semester - III) (210243)

***Time : 1 Hour]*** ***[Max. Marks : 30***

***Instructions to the candidates :***

1) ***Attempt Q1 or Q2, Q3 or Q4.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat & labelled diagrams wherever necessary.***
4) ***Assume suitable data, if necessary.***

***Q1)*** a) What are advantages of object oriented programming over procedural oriented programming? **[4]**

b) What is polymorphism? How does it relate to function overloading? **[5]**

c) What a class "Student" with attributes like name, roll number & mark. Include member functions to set & display these attributes? **[6]**

OR

***Q2)*** a) State differences between abstraction and encapsulation. **[4]**

b) What are C++ access specifiers? Write down their significance. **[5]**

c) Write a class "Calculator" with methods for addition, subtraction, multiplication and division functions. Create a object to perform arithmetic operation. **[6]**

***Q3)*** a) Define Function overloading and Write a program for swapping two integer numbers, two float numbers and two characters using function overloading. **[5]**

b) What is the use of 'this' pointer? Explain with example. **[5]**

c) Explain public, private and protected inheritance. And give example of protected Inheritance with explanation. **[5]**

OR

***Q4)*** a) Define Function overriding in C++ and Write a program to demonstrate the same. **[5]**

b) What are types of inheritance. Explain them with syntax. **[5]**

c) Define function pointers? Give its Syntax of declaration, Referencing and Dereferencing. Write a program for it in C++. **[5]**

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**Total No. of Questions : 4]** **SEAT No. :**

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# S.E. (Computer Engineering/Computer Science & Design Engg./Artificial Intelligence & Data Science Engg.) (Insem.)

# COMPUTER GRAPHICS

## (2019 Pattern) (Semester - III) (210244)

***Time : 1 Hour]*** ***[Max. Marks : 30***

***Instructions to the candidates:***

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagram wherever necessary.***
4) ***Assume suitable data, if necessary.***

***Q1)*** a) Explain the following terms : **[5]**

i) Persistence
ii) Resolution
iii) Aspect ratio
iv) Pixel
v) Refresh Buffer

b) Discuss the significance of OpenGL Pipeline and OpenGL Libraries **[5]**

c) Derive the expression for Decision Parameter used in Bresenhams line drawing algorithm. **[5]**

OR

***Q2)*** a) Discuss any five applications of Computer Graphics **[5]**

b) Differentiate between Raster scan and Random scan **[5]**

c) Using DDA algorithm compute the pixels that would be turned on for line with end points (0, 0) to (4, 6). **[5]**

***Q3)*** a) Explain Winding number method to perform the inside out test for a given point with example. **[5]**

b) Comment on the advantages of using 8 connected method while using Seed Fill algorithm over 4 connected method with suitable example. **[5]**

c) Explain Weiler Atherton Polygon Clipping Algorithm. **[5]**

***P.T.O.***

OR

***Q4)*** a) Compare Flood fill and Boundary fill algorithm. **[5]**

b) Consider the Clip window with vertices a A(1,2), B(10, 2), C(10, 10), D(1, 10) and a line with end points as S(3, 1) and T(6, 4). Clip the line ST against the given window using Cohen Sutherland Algorithm. **[5]**

c) Discuss the limitations of Cohen Sutherland algorithm? Explain the significance of Region Codes. **[5]**

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Total No. of Questions : 4]

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## S.E. (Artificial Intelligence and Data Science) (Insem.)

## OPERATING SYSTEMS

## (2019 Pattern) (Semester - III) (217521)

*Time : 1 Hour]* *[Max. Marks : 30*

***Instructions to the candidates :***

1) ***Solve questions Q.1 or Q.2, Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

***Q1)*** a) Discuss different functions of operating system. **[6]**

b) Explain in detail Time sharing operating system with diagram. **[5]**

c) Define bash shell? Explain it. **[4]**

OR

***Q2)*** a) Explain in detail batch operating system. **[6]**

b) Discuss the system calls. **[5]**

c) Give the System Programs in operating system. **[4]**

***Q3)*** a) Explain the concept of Process Control Block with diagram. **[5]**

b) Discuss SJF process scheduling algorithms. **[6]**

c) Define Threads? Explain Threads Life Cycle. **[4]**

OR

***P.T.O.***

***Q4)*** a) Draw and Explain process state transition diagram. **[5]**

b) Consider following set of process with their CPU Burst time. Draw Gantt chart FCFS. Calculate average waiting time and average turnaround time. **[6]**

| Process | Arrival time | Burst time |
|---|---|---|
| $P_1$ | 0 | 4 |
| $P_2$ | 1 | 3 |
| $P_3$ | 2 | 1 |
| $P_4$ | 3 | 2 |
| $P_5$ | 4 | 5 |

b) Differentiate between Process & Threads. **[4]**

▽▽▽▽