

Program: B.Sc. in CSE

CT-1 (Section - C [Set B])

Spring - 2025

4th year 1st Semester

Course Code: CSE 401 Course Title: Mathematics for Computer Science

Credit: 3

Time: 20 Minutes.

Full Mark: 10

1. The **Tower of Hanoi** is a classic mathematical puzzle that involves moving a set of disks from one peg to another, following specific rules. [5]
-“The minimum number of moves to solve the Double Tower of Hanoi (DTOH) problem with n disks is always twice the number of moves required to solve the Single Tower of Hanoi (TOH) problem with the same number of disks” – do you agree? Please justify your answer with the necessary derivations. Then, find the minimum number of moves necessary to solve the DTOH problem with 15 disks.
2. The **Lines in the Plane** problem explores the maximum number of regions into which a plane can be divided by drawing n straight lines.
 - I. Find the maximum number of regions that can be obtained from n number of intersecting **ZigZag** lines in a plane.

CT-1 (Section - C [Set A])

Spring - 2025

4th year 1st Se

Course Code: CSE 401

Course Title: Mathematics for Computer Science

Credit: 3

Time: 20 Minutes.

Full Mark:

1. The **Tower of Hanoi** is a classic mathematical puzzle that involves moving a set of disks from one peg to another, following specific rules.
 - I. Write the **recurrence** for the minimum number of moves required to solve the Triple Tower of Hanoi (TTOH) problem. Derive the **closed form expression** for the recurrence. Then, find the minimum number of moves necessary to solve the TTOH problem with 12 disks.
2. I. The Lines in the Plane problem explores the maximum number of regions into which a plane can be divided by drawing n straight lines.
 - I. Find the maximum number of regions that can be obtained from n number of intersecting **W-Object** lines in a plane.

CT-1 (Section - B [Set A])	Spring - 2025	4th year 1st Sem
Course Code: CSE 401	Course Title: Mathematics for Computer Science	Credit: 3
Time: 20 minutes.		Full Mark: 1
1. The Tower of Hanoi is a classic mathematical puzzle that involves moving a set of disks from one peg to another, following specific rules.		
I. Write the recurrence for the minimum number of moves required to solve the Triple Tower of Hanoi (TTOH) problem. Derive the closed form expression for the recurrence. Then, find the minimum number of moves necessary to solve the TTOH problem with 12 disks.		
2. I. The Lines in the Plane problem explores the maximum number of regions into which a plane can be divided by drawing n straight lines.		
I. Find the maximum number of regions that can be obtained from n number of intersecting ZigZag lines in a plane.		

Program: B.Sc. in CSE		
CT-1 (Section - B [Set B])	Spring - 2025	4th year 1st Sem
Course Code: CSE 401	Course Title: Mathematics for Computer Science	Credit: 3
Time: 1.00 Hour.		Full Mark
1. The Tower of Hanoi is a classic mathematical puzzle that involves moving a set of disks from one peg to another, following specific rules.		
-“The minimum number of moves to solve the Double Tower of Hanoi (DTOH) problem with n disks is always twice the number of moves required to solve the Single Tower of Hanoi (TOH) problem with the same number of disks” – do you agree? Please justify your answer with the necessary derivations. Then, find the minimum number of moves necessary to solve the DTOH problem with 15 disks.		
2. The Lines in the Plane problem explores the maximum number of regions into which a plane can be divided by drawing n straight lines.		
I. Derive the recursive definition of the function to calculate the maximum number of regions created when n lines intersect in a plane.		

CT-2 (Set - B)	Spring- 2025	4th year 1st Se
Course Code: CSE 401	Course Title: Mathematics for Computer Science	Credit: 3
Time: 30 minutes.		Full Mark:
<p>1. The Josephus Problem is a theoretical puzzle involving people standing in a circle and being eliminated in a fixed pattern until only one person remains.</p> <p>I. Find the smallest three values of N such that the person standing at the N/3-rd position survives.</p> <p>2. Two fair 7-sided dice are rolled. Each die has faces numbered from 1 to 7. Let X be the sum of the two numbers rolled. What is the probability that the sum X is a prime number?</p>		

Program: B.Sc. III CSE		
CT-2 (Set - A)	Spring- 2025	4th year 1st Se
Course Code: CSE 401	Course Title: Mathematics for Computer Science	Credit: 3
Time: 30 minutes.		Full Mark:
<p>1. The Josephus Problem is a theoretical puzzle involving people standing in a circle and being eliminated in a fixed pattern until only one person remains.</p> <p>I. Find the smallest three values of N such that the person standing at the 25-th position survives.</p> <p>2. Two fair 7-sided dice are rolled. Each die has faces numbered from 1 to 7. Let X be the sum of the two numbers rolled. What is the probability that the sum X is a power of 2?</p>		

CT-2 (Set - A)	Spring- 2025	4th year 1st Se
Course Code: CSE 401	Course Title: Mathematics for Computer Science	Credit: 3
Time: 30 minutes.		Full Mark: 1
<p>1. The Josephus Problem is a theoretical puzzle involving people standing in a circle and being eliminated in a fixed pattern until only one person remains.</p> <p>I. Find the smallest three values of N such that the person standing at the 25-th position survives.</p> <p>2. Two fair 7-sided dice are rolled. Each die has faces numbered from 1 to 7. Let X be the sum of the two numbers rolled. What is the probability that the sum X is a power of 2?</p>		

CT-2 (Set - B)

Spring- 2025

4th year 1st Sem

Course Code: CSE 401

Course Title: Mathematics for Computer Science

Credit: 3

Time: 30 minutes.

Full Mark: 1

1. The Josephus Problem is a theoretical puzzle involving people standing in a circle and being eliminated in a fixed pattern until only one person remains.

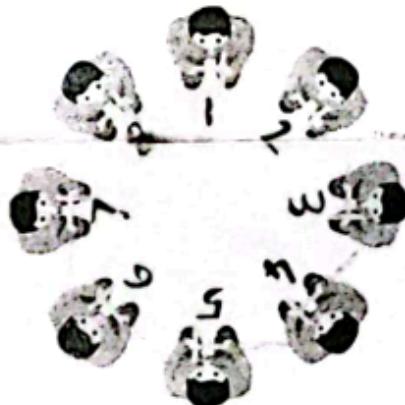
 - I. Find the smallest **three** values of N such that the person standing at the $N/3$ -rd position survives.
2. Two fair 7-sided dice are rolled. Each die has faces numbered from 1 to 7. Let X be the sum of the two numbers rolled. What is the probability that the sum X is a prime number?

Course Code: CSE 401 Course Title: Mathematics for Computer Science

Time: 1.00 Hour

There are Three Questions. Answer all of them. Part marks are shown in the margins.

- a. Demonstrate the steps for moving 4 disks from pole 1 to pole 3 in the Tower of Hanoi problem.
- b. Describe the derivation of the recursive formula for the solution to the Josephus problem.



A bookshelf has n shelves, each initially empty. On the first day, 1 book is placed on the first shelf. On the second day, 2 books are placed on the second shelf. On the third day, 3 books are placed on the third shelf, and so on. How many books will be on the bookshelf after n days? Deduce through mathematical derivation.

Two 5-sided dice are rolled. Discuss what is the probability that the sum of the numbers on the two dice is 4?

Mid Semester Examination, Fall 24**Program: B.Sc. in CSE****4th year 1st Semester**

Course Title: Mathematics For Computer Science
 Time: 1 hour. Credit Hour: 3.00

Course Code: CSE
 Full Marks: 20

There are Two Questions. Answer all of them. Part marks are shown in the margins.

QUESTION 1 [10 MARKS]

- a. Demonstrate the maximum number of regions that can be formed by n zig-zag lines. Calculate the maximum number of regions that can be obtained by ZZ_n where,

$$n = (\text{last digit of your ID}) + 1 \quad [\text{if last digit of your ID} < 9]$$

$$n = 3 \quad [\text{if last digit of your ID} = 9]$$

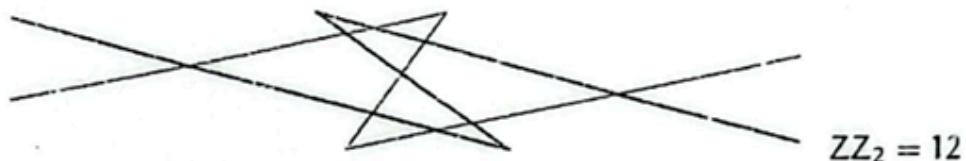


Figure 1. Regions Created by 2 Zig-Zags

- b. Prove $J(2^m + L) = 2L + 1$ for the Josephus Problem using the mathematical induction method where $n = 2^m + L$. Also, find $J(103)$ using the recurrence method.

QUESTION 2 [10 MARKS]

- i. Compare Googol and Googolplex. Then Generate the value of $A(2,1)$ by categorizing each step of Ackermann functions.
- Two fair 12-sided dice are rolled. Let X be the sum of the numbers appearing on the two dice. Develop the probability that the sum is at most 6 ($X \leq 6$).

SPRING 23

1. a. Let $m = 2^9 5^{24} 11^7 17^{12}$ and $n = 2^3 7^{22} 11^{21} 13^1 17^9 19^2$, compute mn by using gcd and lcm. [3]

b. Let Φ be Euler's function, compute $\Phi(500)$. [4]

2. Let $A(m,n)$ be Ackermann recurrence function and m, n are nonnegative integers, calculate the value of $A(1, 1)$, $A(2, 1)$ and $A(3, 1)$ by using the formulas of Ackermann's recurrence function. [6]

3. Insert the keys 79, 69, 98, 72, 14, 50 into the hash table of size 13. Identify and resolve all collisions using double hashing where first hash-function is $h1(k) = k \bmod 13$ and second hash-function is $h2(k) = 1 + (k \bmod 11)$. [7]

Mid-Semester Examination

Fall-2023

4th year 1st

Course Code:CSE401 Course Title: Mathematics for Computer Science

Credit:

Time: 1.00 Hour.

Full Ma

There are Three Questions. Answer all of them. Part marks are shown in the margins.

~~1.~~ a. Determine Greatest Common Divisor (GCD) of 3289 and 2415 using [5] Euclid's Algorithm.

~~b~~ Let ϕ be Euler's function, prove that $k^{\phi(n)} \equiv 1 \pmod{n}$, where n and k are [5] relatively prime numbers.

~~2.~~ Let $A(m,n)$ be Ackermann recurrence function and m, n are nonnegative [2*3=6] integers, identify the value of $A(1, 2)$, $A(2, 2)$ and $A(3, 2)$ by using the formulas of Ackermann's recurrence function.

~~3.~~ Suppose, there are 3 pegs A, B and C. Now, you want to move n disk from [4] the first peg A to the second peg B in a way that

- a. must move one disk at a time;
- b. larger disk cannot be on top of any smaller disks at any time, and
- c. do it in as few moves as possible
- d. Direct move from A to B is disallowed; the move is possible via peg C only.

Here, $n = (\text{Last 2 digits of your id}) \% 2 + 6$

Note that, % refers to the mod operation.

Compute the total number of moves using Tower of Hanoi recursion method.