SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc.Mathematics - END SEMESTER EXAMINATIONS - NOV'2024
SEMESTER - V
**24UMAET5A01 - Mathematical Thinking in Computer Science**

Total Duration : 1 Hrs.30 Mins. Total Marks : 40

## Section B

Answer any **TEN** questions $(10 \times 2 = 20$ Marks)

1. What is meant by tensegrities?
2. For any integer $n \geq 0$, show that $8n = 0$.
3. You have 25 vouchers for hotel A and 20 vouchers for hotel B. What is the maximal number of vouchers for hotel C that you can use if you are not allowed to spend two consecutive nights in the same hotel (and if you have no other place to sleep).
4. Imagine we have only 5 and 7 coins. What is the maximum amount that cannot be paid?
5. A simple Tower of Hanoi puzzle consists of 3 pegs and 3 circular disks. What is the least number of moves that are required to move the disks to another empty peg?
6. Prove that for any natural number n: $2 + 2^2 + 2^3 + ... + 2n = 2n + 1 - 2$.
7. Show that the sum of any five consecutive integers is divisible by 5.
8. What is the maximum number of rooks that can be placed on an 8x8 chessboard without any two attacking each other?
9. What is the maximum number of two-digit integers that can be selected under the given constraint if the constraint is that no two selected integers share the same tens digit?
10. There are boys and girls in a class. Some of them study French, while others study German. Prove that there are a boy and a girl studying different languages.
11. Suppose we have 10 banks and we have 10$ in each of them. We would like to merge all accounts into one. For this each day we repeat the following operation. We arbitrarily pick two banks in which we still have money and move all money from one bank to another. How many days do we need to do it to move all money to one account?

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12. In a group of 27 students every girl knows four boys and every boy knows five girls. Find the number of boys in the group.

## Section C

Answer any **FOUR** questions $(4 \times 5 = 20$ Marks)

13. Write short notes on why proofs are needed? Also discuss the possibility to proof to cut a 3x3 tiles into two parts of the same shape and size by a line the goes along cell edges while the middle cell is missing.

14. What are magic Squares? Put numbers 1,2,3,4,5,6,7,8,9 (each should be used once) into 3 times 3 square to make the same sum in all rows, all columns and both diagonals.

15. State and prove the inequality between arithmetic and geometric mean.

16. Suppose there is a box with socks in the dark room. There are socks of five different colours: black, brown, blue, red and green. But we do not see the colour in the dark. How many socks do we have to take to guarantee that we have two socks of the same colour.

17. Each of 20 students in a group have solved three problems from the homework assignment, and each problem was solved by two students. How many problems were in the assignment?

18. Four chess players played a series of tournaments between each other. In each tournament the player that finishes in the first place receives \$4000 of prize money, the player that finishes in the second place receives \$2000 and the player that finishes in the third place receives \$1000. The player that finishes the last does not receive anything. After the series the total prizes won by each player are \$13000, \$10000, \$7000 and \$5000 respectively. How many tournaments have they played?

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