Mahindra University
Global Thinkers. Engaged Leaders.

Mahindra University Hyderabad
École Centrale School of Engineering
Minor - 1

Program: B. Tech Branch: CSE/ARI/CAM/CAB/ECM/ECE Year: I Semester:2
Subject:- Discrete Mathematical Structures (CS 1202)

Date: 10/03/2023 **Start Time: 10:00 AM**
Time Duration: 1 h 30 m **Max. Marks: 50**

Instructions:

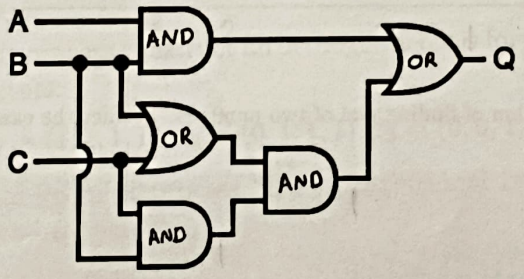
- Answer all the questions.
- All the sub-questions belonging to a big question should be answered together.

Q1: Formal Logic (10 M)

1. For what possible values of p, q and r can the following logical statement be True? (5)

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

2. In the logic circuit shown below A, B and C are switches each of which can either be closed (1) or open (0). What is the corresponding logical expression for the circuit? Find out for what values of A, B and C will there be current through Q. (5)



Q2: Mathematical Theory (10 M)

1. According to our conceptualization of a Mathematical Theory, what is a hypothesis? (2)

2. Using the following hypothesis, prove that the square root of any prime number is irrational. (8)

Hypothesis

If p is a prime number and q is any positive integer, then $p|q^2 \Rightarrow p|q$.

Q3: Big-O notation (10 M)

Mention only True/False:

1. $O(g(n)) = \{f(n) |$ for any $c > 0, n_0 > 0$ s.t. $f(n) \leq c.g(n) \forall n > n_0\}$ **True/False** (2)
2. $(n^2 + 8)(n + 1) \in O(n^4)$ **True/False**? (2)
3. $n^3 \in O(2^n)$ **True/False**? (2)
4. $\Omega(g(n)) = \{f(n) \mid \exists c > 0, n_0 > 0$ s.t. $f(n) \geq c.g(n) \forall n > n_o\}$ **True/False** (2)
5. Any computer program written in any langauge implementing bubble sort has a time function that grows qudratically. **True/False** (2)

Q4: Knaves and Knights (10 M)

Hypothesis

On an island there are only Knights and Knaves.

- **A Knight always speaks truth.**
- **A Knave always lies.**

You meet two people **A** and **B**; and **A** says: "If I am a knight, then **B** is knave; and if I am a knave, then **B** is a knight".

Can you decively conclude who is who based on this statement? Justify your answer.

Hint: Use truth tables.

Q5: Number Theory (10 M)

Recollect the Euclidean algorithm of finding gcd of two numbers. Predict the exact output of the following program.

```c
#include <stdio.h>

int gcd(int m, int n){
    //convention: m < n
    printf("m = %d, n = %d\n", m, n);
    if(n%m == 0){
        return m;
    }
    return gcd(n%m, m);
}

int main(){
    printf("%d\n", gcd(121,5321111));
}
```
