National University of Computer and Emerging Sciences

Lahore Campus

Simulation and Modeling (CS 4056)

Quiz

Date: November 18 2025

Course Instructor(s)

Dr. Mirza Mubasher Baig

Total Time (Hrs): 0.6

Total Marks: 20(2%)

Total Questions:

_____ _____ _____

Roll No Section Student Signature

CELLULAR AUTOMATA

1. Define **Cellular Automata (CA)** formally. Explain the terms: state, configuration, neighborhood, transition rule. *(4 Points)*

2. Describe 3 different types of boundaries used while simulating CA. (3 Points)

3. What are **Von Neumann** and **Moore neighborhoods**? Provide a diagram for both in a 2D CA. *(2 Points)*

4. Given the initial configuration (1D, 13 cells):
0 0 0 0 0 1 0 0 0 0 0 0 0
Simulate **two iterations** of **Rule 30** and **Rule 110**. Write configuration after each iteration [2 + 2 Points]

5. Game of Life [2 + 4 Points]

a. Write Conway's **Game of Life rules** formally, using mathematical expressions.
b. Consider the **5×5 grid** below representing alive (1) and dead (0) cells:
Iteration 0:
0 0 0 0 0
0 1 1 1 0
0 0 1 0 0
0 0 0 0 0
0 0 0 0 0
Simulate one iteration of Game of Life and show the final configuration

6. **Rule 110** is considered *Turing Complete*. What does this imply about computation using cellular automata? [1 Points]