** *In The Name OF God* **

Latex : 621-624

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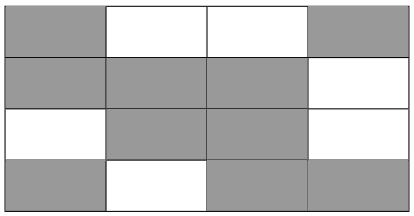
Now take a sequence 1001. Let us construct the sequence to t_3 using wrap around and null stufng technique.

Wrap Around:

t_0	1	0	0	1
t_1	1	1	1	0
t_2	0	1	1	0
t_3	1	0	1	1

The cells representation are given below

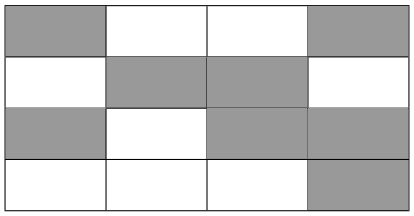


Null Stuffed:

In null stuffed two '0' are added at both sides of the original string.

t_0	0	1	0	0	1	0
t_1	0	0	1	1	0	0
t_2	0	1	0	1	1	0
t_3	0	0	0	0	1	0

The cells representation are given below



Example 14.5 : Find the update of a one-dimensional CA rules for 212.

Solution:

The binary equivalent of 212 is 11010100. The rules are

Decimal	7	6	5	4	3	2	1	0
Binary	111	110	101	100	011	010	001	000
212	1	1	0	1	0	1	0	0

14.3.2 Applications of Cellular Automata

Cellular automata is not only used in Computer Science field, it also has different applications in other fields.

In the Field of Computer Science

- Cryptography
- Detecting fault tolerance in digital circuit
- Simulation of complex system

Beyond the Field of Computer Science

- Simulation of gas behavior
- Simulation of forest fire propagation
- Simulation of bone erosion.

Cellular automata are used to identify fault in some digital circuits.
Let consider an OR gate
Its truth table is

X	Y	O/P
0	0	0
0	1	1
1	0	1
1	1	1

It may happen that the input Y is faulty. It takes ' 1 ' for any input applied to it. Thus the output that we get will always be ' 1 '. This is called 'Struck at 1 '. Similarly the problem 'Struck at 0 ' can occur for a digital circuit.

Rule 192 : Binary of 192 is 11000000

The rule is

	7	6	5	4	3	2	1	0
	111	110	101	100	011	010	001	000
192	1	1	0	0	0	0	0	0

Let the initial sequence is 1111 .
By null stuffing at both sides the sequence become 011110 .
So

t_0	0	1	1	1	1	0
t_0	0	0	1	1	1	0

Let it t_0 the bits are labeled as $S_0, S_1, S_2 \ldots\ldots S_5$.
State $\mathbf{S}_1$ in t_1 depends on $\mathbf{S}_0, \mathbf{S}_1$ and $\mathbf{S}_2$ of $\mathbf{t}_0$.
The bit pattern is 011 , so the value of $\mathbf{S}_1$ in $\mathbf{t}_1$ is 0 (according to rule 192). By the same way all the other bits are placed. By the same way the patterns for t_2 and t_3 are generated.

t_2	0	0	0	1	1	0
t_3	0	0	0	0	1	0

Let a digital circuit has four inputs.
To identify the ' Struck at 0 ' problem all bits are taken as ' 1 ' and patterns are generated for next (n-1) steps, where n is the number of input line. If the LSB is other than ' 1 ' in t_{n-1} step then we can say that the circuit is faulty.

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