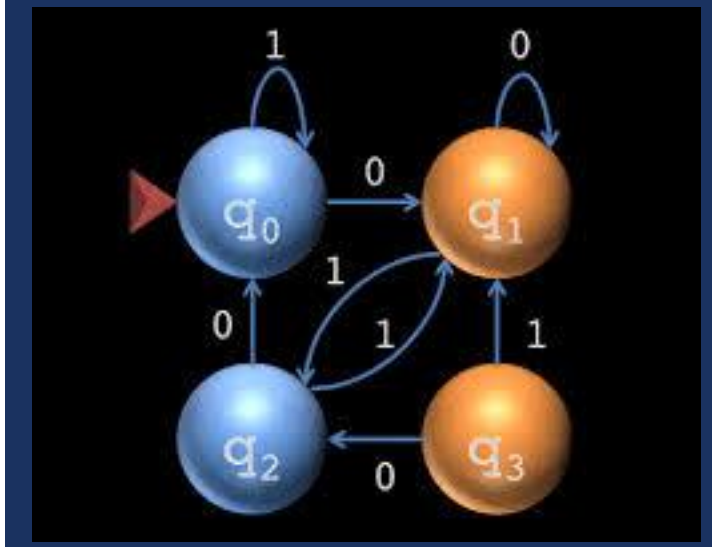
AUTOMATA WITH OUTPUTS

TRANSDUCERS



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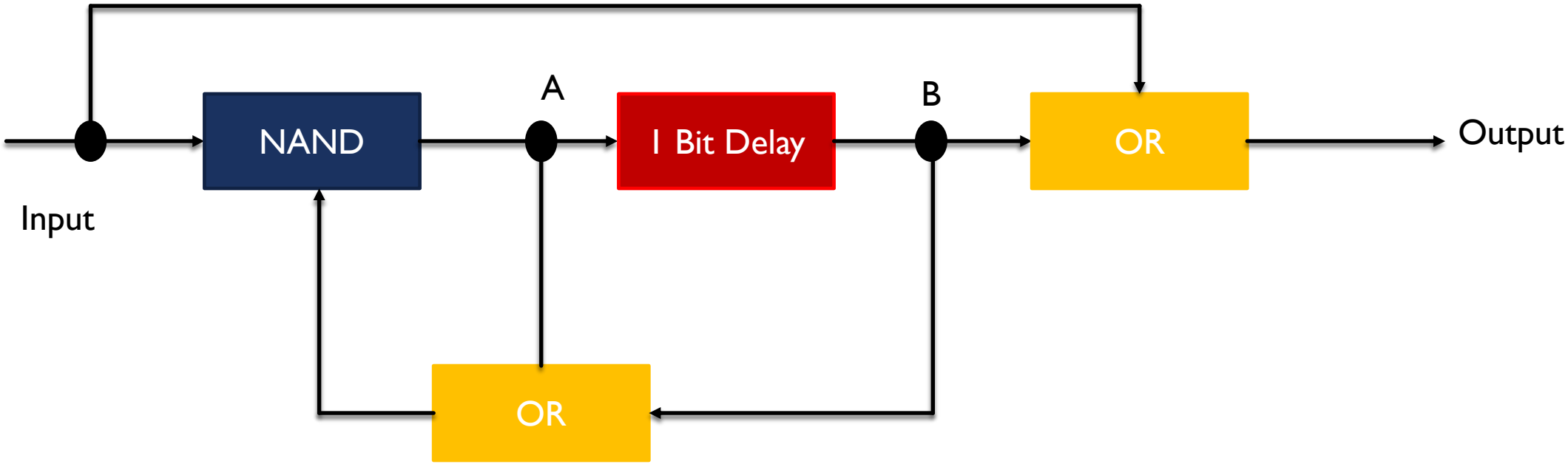
TRANSDUCER



A **transducer** is a device or system that converts one form of input into another form of output. In the context of **automata theory and formal languages**, a **transducer** is typically a type of **finite automaton** that produces **output** along with processing **input**.

ANALYSIS

- In this transducer we can clearly found that some piece of information has already been given to us.
- Known as Parameters we known
- Also we need to find some of the parameters which we need to find consider as Unknown Parameters
- Before we start for input we know a clock 555 timer which can generate 0 and 1 as pulse train.
- For each 0 and 1 input the logical gates will generate some output which we can fill in the table to make Mealy or Moore Machine depending on our requirement.
- There are two nodes A and B from where we can change the states.

KNOWN PARAMETERS

- Input clock that generates 0 and 1.
- Node A and Node B for the combinations of [00, 01, 10, 11] which will be helpful for states, and consider as old states [q0, q1, q2, q3].
- Working of AND and OR logical gates
- 1 bit delay, means what ever the signal is at node A will be send to B in the next clock cycle.

UNKNOWN PARAMETERS

- Also we know the relationships as follows;
- New value of B will be old value of A due to DELAY means NEW B = OLD A
- NEW A = (input) NAND (old A OR old B)
- Output = (input) OR (old B)

STATES

- Now learn how we makes the states:
- We assume that A=0 and B=0, consider it as q0,
- When A =0 and B = 1, consider it as q1
- When A=1 and B = 0, consider it as q2,
- And When A =1 and B = 1, consider it as q3

States	Node A	Node B
Q0	0	0
Q1	0	1
Q2	1	0
Q3	1	1

- We are interesting to find out what will be the next state so for that the input 0 and input 1.
- We will input the clock pulse for each state and find the new states values

STRATEGY TO SOLVE

- Now we need to use the three formulas which we have extracted from the transducer.
- NEW B = OLD A
- NEW A = (input) NAND (old A OR old B)
- Output = (input) OR (old B)
- We use above three formulas and the values of old A and old B using this table to find the new values.
- By doing this we can get the values of output and next state switching.
- So we need to calculate individually for each state with input 0 once then with input 1.

Input	States	Value of old A	Value of old B
0	Qo	0	1
1	Qo	0	1
0	Q1	0	1
1	Q1	0	1
0	Q2	1	0
1	Q2	1	0
0	Q3	1	1
1	Q3	1	1

AT STATE QO, WHEN A = 0 AND B = 0 AND INPUT = 0

new B = old A = 0

new A = (input) NAND (old A OR old B)

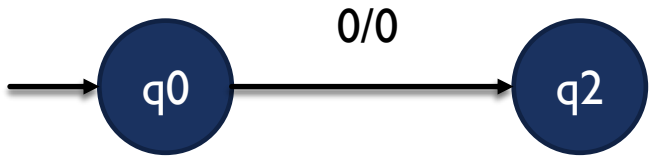
= (0) NAND (0 OR 0)

= 0 NAND 0

= 1

output = 0 OR0 = 0

The new state is q2 (since new A = 1, new B = 0).



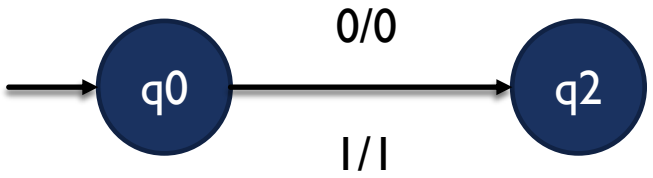
AT STATE QO, WHEN A = 0 AND B = 0 AND INPUT = 1

new B = old A = 0

new A = 1 NAND (0 OR 0) = 1

output = 1 OR0 = 1

The new state is q2 (since the new A = 1 and the new B = 0).



AT STATE Q1, WHEN A = 0 AND B = 1 AND INPUT = 0

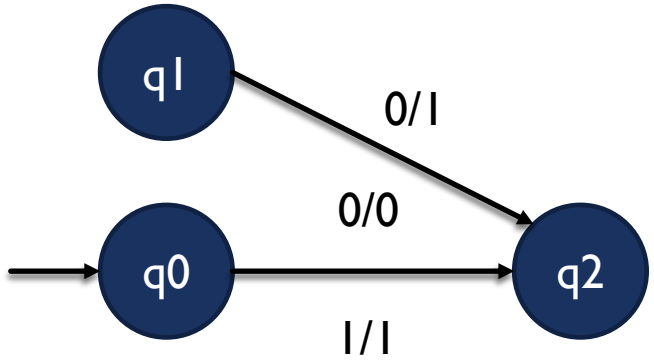
If we are in q1, and we receive the input 0:

new B = old A = 0

new A = 0 NAND (0 OR 1) = 1

output = 0 OR 1 = 1

The new state is q2.



AT STATE Q1, WHEN A = 0 AND B = 1 AND INPUT = 1

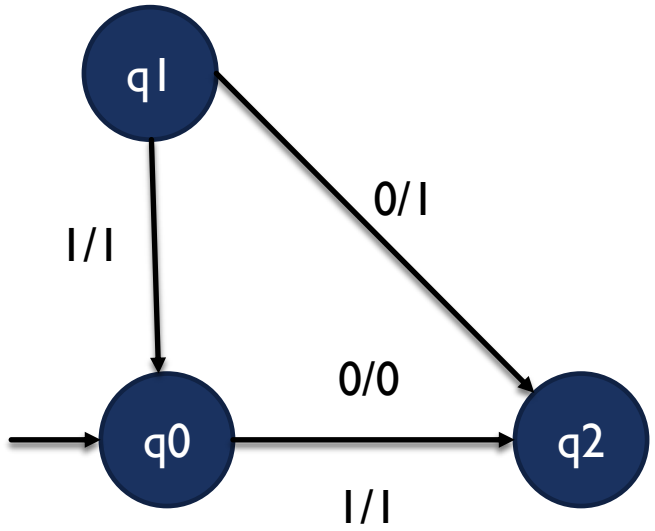
If we are in q1, and we receive the input 1:

new B = old A = 0

newA = 1 NAND (0 OR 1) = 0

output = 1 OR 1 = 1

The new state is qo.



AT STATE Q2, WHEN A = 1 AND B = 0 AND INPUT = 0

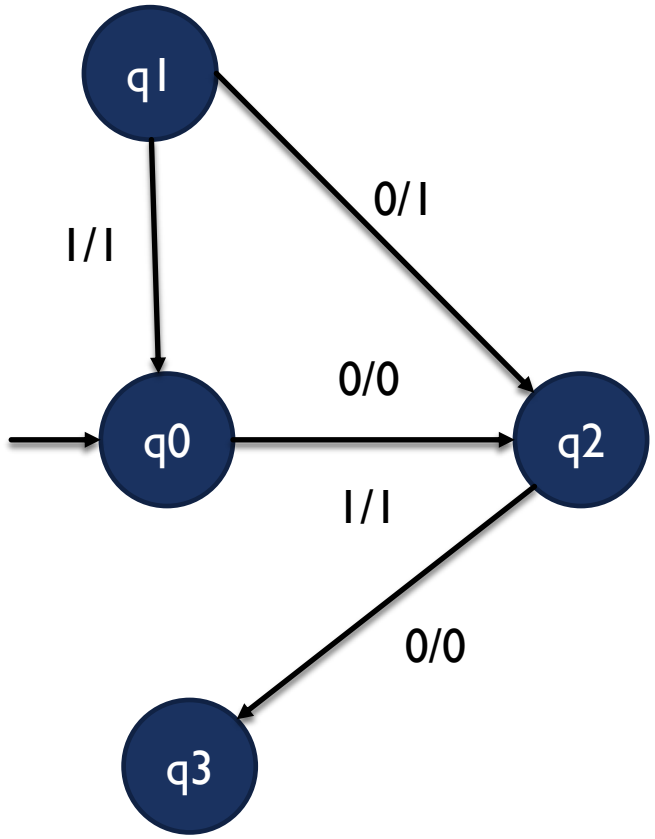
If we are in state q2 and we receive the input 0:

new B = old A = 1

new A = 0 NAND (1 OR0) = 1

output = 0OR0 = 0

The new state is q3 (since new A = 1, new B = 1).



AT STATE Q2, WHEN A = 1 AND B = 0 AND INPUT = 1

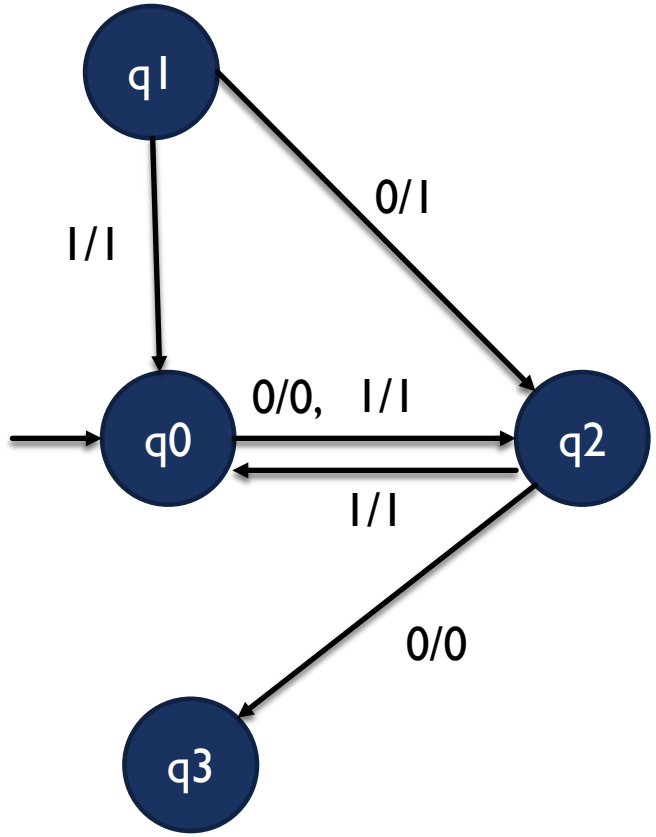
If we are in q2 and we receive the input 1:

newB = oldA = 1

new A = 1 NAND (1 OR 0) = 0

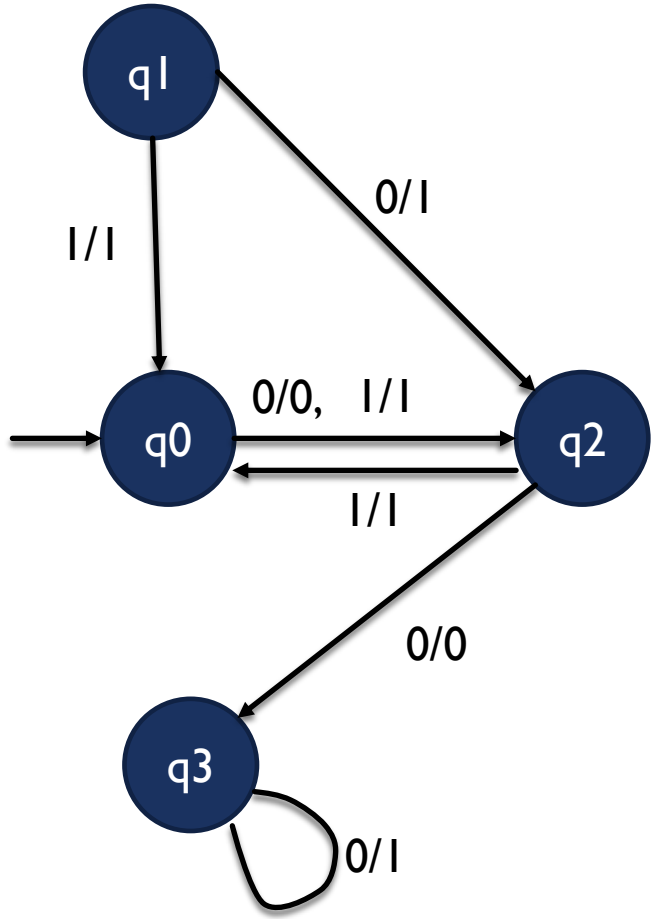
output = 1 OR0 = 1

The new state is q1 .



AT STATE Q3, WHEN A = 1 AND B = 1 AND INPUT = 0

- If we are in q3 and we receive the input 0:
- newB = oldA = 1
- new A = 0 NAND (1 OR 1) = 1
- output = 0 OR 1 = 1
- The new state is q3.



AT STATE Q3, WHEN A = 1 AND B = 1 AND INPUT = 1

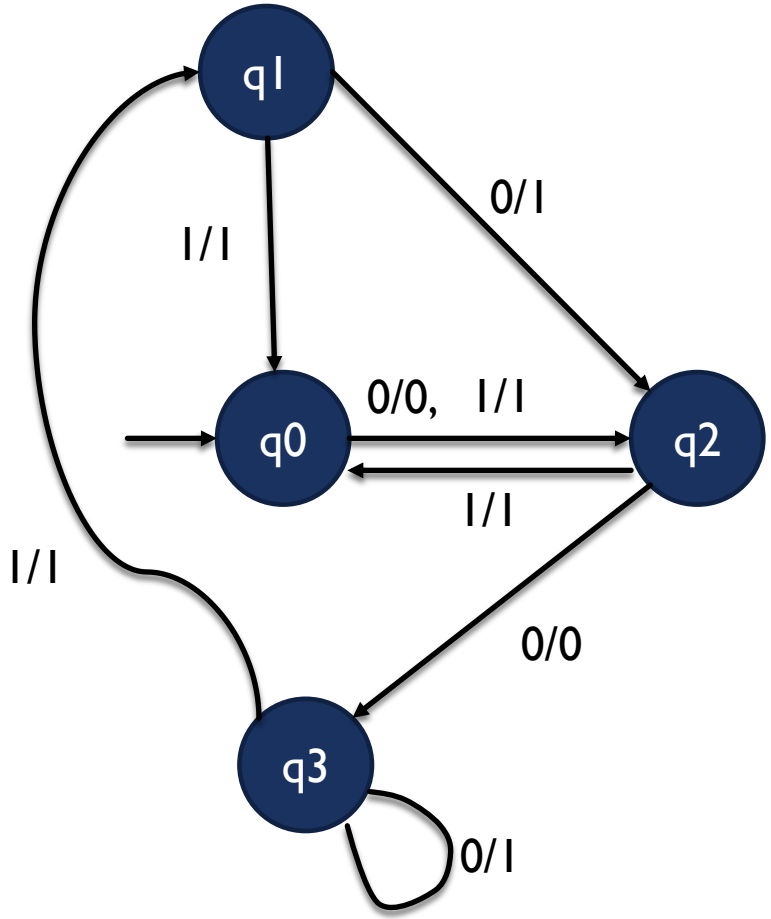
If we are in q3 and we receive the input 1:

new B = old A = 1

new A = 1 NAND (1 OR 1) = 0

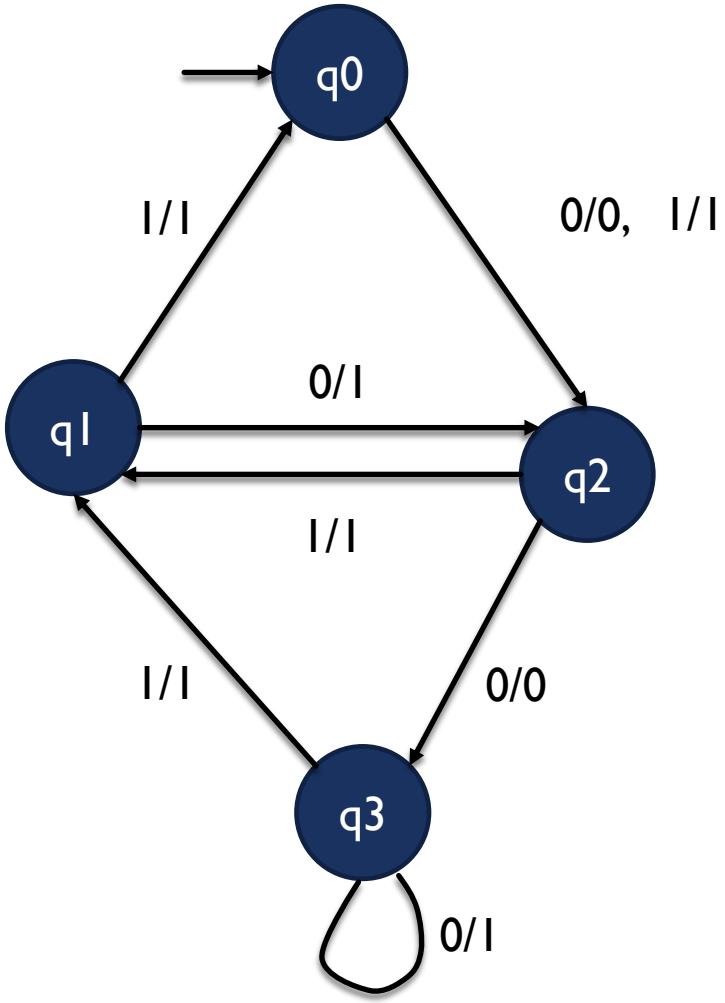
output = 1 OR 1 = 1

The new state is q1



FINAL TRANSITION TABLE

Old State	After Input 0		After Input 1	
	New State	Output	New State	Output
Q0	Q2	0	Q2	1
Q1	Q2	1	Q0	1
Q2	Q3	0	Q1	1
Q3	Q3	1	Q1	1



- If we input two O's no matter which state we started from, we will get to state q3.
- From there the input string 011011 will cause the output sequence 111011.