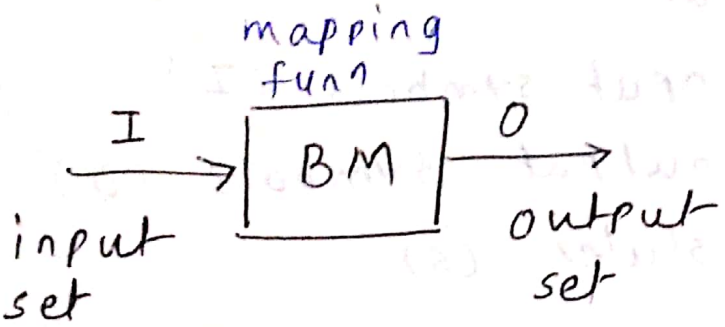
Basic machine



(1) most primitive machine

(2) concerned with I and O only

(3) behaves like a function that maps input set I to output set O

(4) It has only machine function (MAF)
No state function (STF) ✗

eg. Logic Gate OR

MAF $I \times S \to O$

$M = (I, O)$

$I = \{(0,0), (0,1), (1,0), (1,1)\}$
ie set of ordered pair of 0 or 1.

$O = \{1, 0\}$

I \ O	output
(0,0)	0
(0,1)	1
(1,0)	1
(1,1)	1

FSM
Finite state machine

Design FSM for testing divisibility by 3 for decimal numbers.

step1 : Defⁿ of Fsm

Fsm is a machine which consists of finite set of states (S) that alters on receiving the input set of symbols (I) to produce output set of symbols (O).

Fsm defines two functions.

① state function (STF) : $S \times I \rightarrow S$

② machine function (MAF) : $S \times I \rightarrow O$

step 2 : Logic

① input is a decimal number. so we define

$I = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

② The machine checks for divisibility by 3. $O = \{Y, N\}$

③ We define one initial/start state

q_s = initial/start state.

④ Whenever the number is divided by 3 there are 3 remainder possibilities.

q_0 - 0 remainder

q_1 - 1 remainder

q_2 - 2 remainder

$S = \{q_s, q_0, q_1, q_2\}$

q_s ↙ initial state

q_0 ↘ final state with o/p Y

Step3 : Implementation - Transition tab

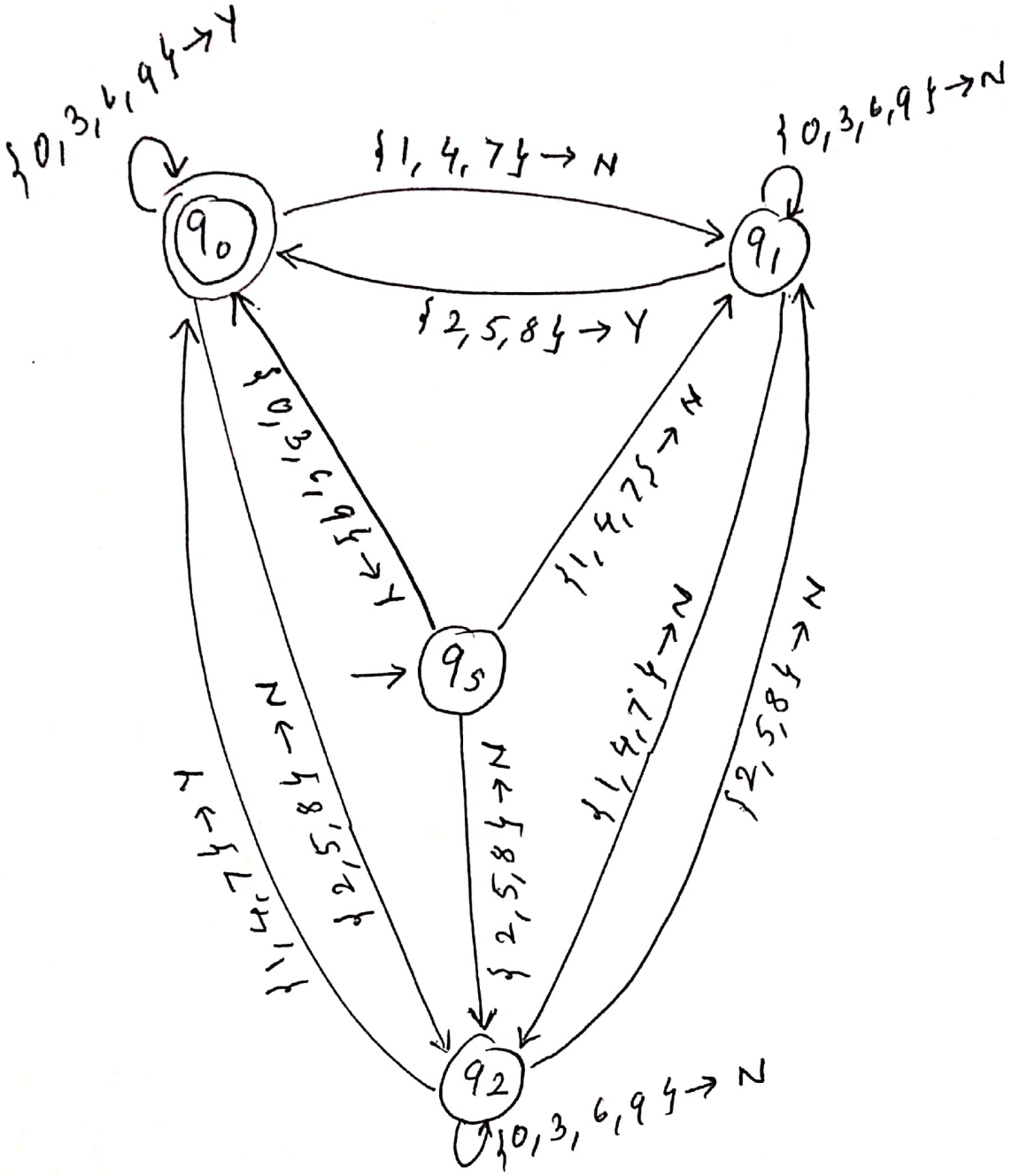
MAF : $S \times I \rightarrow O$

S \ I	{0,3,6,9}	{1,4,7}	{2,5,8}
q_s	Y	N	N
q_0	Y	N	N
q_1	N	N	Y
q_2	N	Y	N

STF $S \times I \rightarrow S$

S \ I	{0,3,6,9}	{1,4,7}	{2,5,8}
q_s	q_0	q_1	q_2
q_0	q_0	q_1	q_2
q_1	q_1	q_2	q_0
q_2	q_2	q_0	q_1

Transition diagram



step 5 :- FSM = { I, O, S }

where I = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 }

O = { Y, N }

S = { q_0 q_1 q_2 q_5 }

δ : as per transition table / diagram

Finite state machine (fsm)

Fsm consists of

set of input symbols (I)
set of output symbols (O)
set of states (S).

It defines two functions

$MAF = I \times S \rightarrow O$

$STF = I \times S \rightarrow S$

* Design fsm for binary numbers addition

Σ or $I = \{0, 1\}$

step 1 = fsm defn

step 2 = logic

	S_1 NC sum	S_2 C carry
$0+0=$	0	0
$0+1=$	1	0
$1+0=$	1	0
$1+1=$	0	1

① I or $\Sigma = \{0, 1\}$

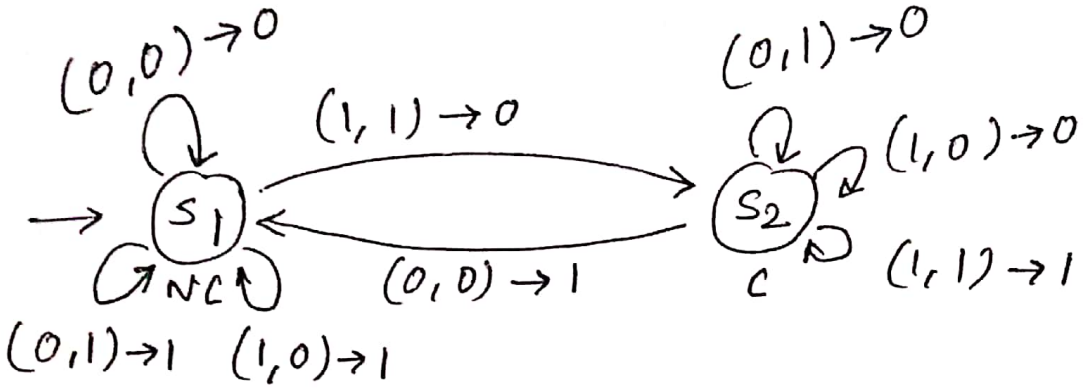
② $Q = \{S_1, S_2\}$

③ $O = \{0, 1\}$

④ initial state
$= S_1$ (No carry)

Step 3 - Design

Transition diagram



MAF

I \ O	NC S1	C S2
(0,0)	0	1
(0,1)	1	0
(1,0)	1	0
(1,1)	0	1

$I \times S \rightarrow O$

$\Sigma \times Q \rightarrow \Sigma$

STF

I \	NC S1	C S2
(0,0)	S1	S1
(0,1)	S1	S2
(1,0)	S1	S2
(1,1)	S2	S2

$I \times S \rightarrow S$

$\Sigma \times Q \rightarrow Q$