SUMIT KUMAR YADAV **AVIJIT MANDAL**
18CS30042 **18CS30010**

EXPERIMENT-5
(Moore and Mealy Machines)

Theory:

Mealy Machine:

1. Mealy machines are finite state machines whose outputs depends on the present states and the inputs.
2. It can be defined as < Q,q,∑,Δ,δ,λ >.

where,

Q is a finite state of states
q is athe initial states
∑ is the input alphabet
Δ is he output alphabet
δ is transition function
λ is the output function

Moore Machine:

1. Moore machines are finite state mahines whose output only depends on the present state.
2. It can be defined as < Q,q,∑,Δ,δ,G >.

where,

Q is a finite state of states
q is athe initial states
∑ is the input alphabet
Δ is he output alphabet
δ is transition function
G is the output function

<u>Part 1:</u>
Mealy Mahine, residue mod 5 from MSB:

1. Input symbol, ∑={0,1}
2. Output symbol, Δ={000,001,010,011,100}

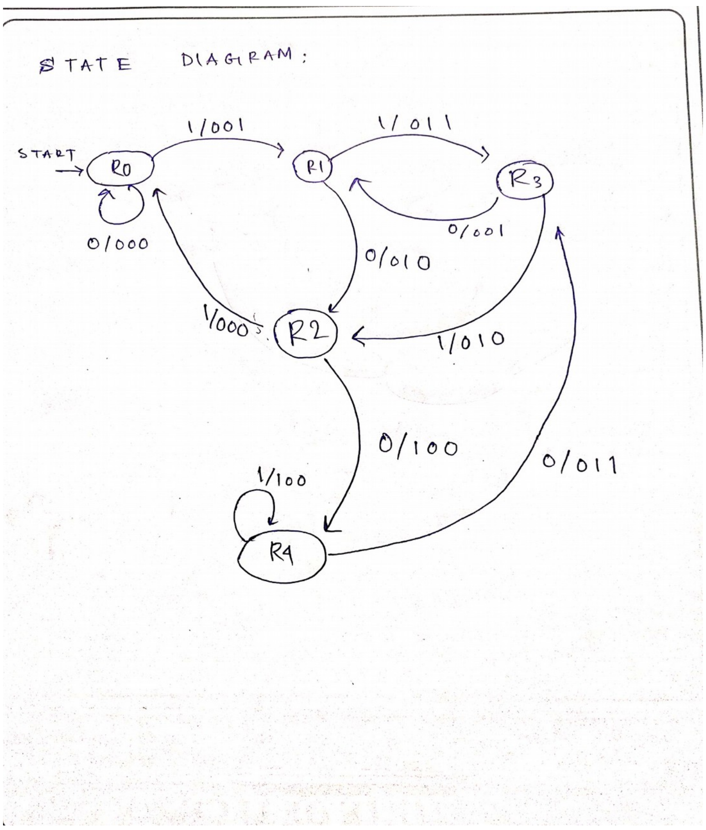
(a) State Transition:

INPUT	**0**		**1**	
PRESENT STATE	NEXT STATE	OUTPUT	NEXT STATE	OUTPUT
R0	R0	000	R1	001
R1	R2	010	R3	011
R2	R4	100	R0	000
R3	R1	001	R2	010
R4	R3	011	R4	100

Where,

RX =Remainder X

State Diagram:



(b) Report detailing design of the Mealy m/c residue mod 5 from MSB

- As we mentioned earlier that output obtained in the Mealy Machine depends on both the present states and inputs, that's why we first consider 5 different states as we have to make machine which residue mod 5 from most significant bit and then we draw the State transition table and obtained the output accordingly with respect to present state and inputs. So, on anaylsing the output that we obtained we find that their is 2 self loop first when input is 0 with present and next state having R0, we found output as 000 which means their is a self loop on state R0 when input is 0 and also their is a self loop at R4 when input is 1 and in this case we found output as 100.
- Considering all the present states, next states and the inputs we draw the state diagram shown above.
- Notation and Symbols: RX where X=0,1,2,3,4
  this indicates the remainder that we found while doing mod 5 operation and on each state transition we have written the input/output where state transition means arrowhead from present state to next state. On arrow we have written the input/output values while the States are written on the State itself as RX.

Part 2:

Mealy Machine, residue mod 5 from LSB:

1. Input symbol, ∑={0,1}
2. Output symbol, Δ={000,001,010,011,100}
3. Rest of the parts are almost same as Moore machine.

(a) State Transition:

INPUT	0		1	
PRESENT STATE	NEXT STATE	OUTPUT	NEXT STATE	OUTPUT
A0	B0	000	B1	001
A1	B1	001	B2	010
A2	B2	010	B3	011
A3	B3	011	B4	100

INPUT	0		1	
A4	B4	100	B0	000
B0	C0	000	C2	010
B1	C1	001	C3	011
B2	C2	010	C4	100
B3	C3	011	C0	000
B4	C4	100	C1	001
C0	D0	000	D4	100
C1	D1	001	D0	000
C2	D2	010	D1	001
C3	D3	011	D2	010
C4	D4	100	D3	011
D0	A0	000	A3	011
D1	A1	001	A4	100
D2	A2	010	A0	000
D3	A3	011	A1	001
D4	A4	100	A2	010

(b) Report detailing design of the Mealy m/c residue mod 5 from LSB

- As we mentioned earlier that output obtained in the Mealy Machine depends on both the present states and inputs, that’s why we first consider 4 Set of 5 different states as we have to make machine which residue mod 5 from Least significant bit and then we obtained the output accordingly with respect to present state and inputs. So, on anaylsing the output that we find that their is no self loop compare to Mealy machine mod 5 from MSB where we find 2 self loop.
- Notation and Symbols: PX where X=0,1,2,3,4 and P=A,B,C,D this indicates the remainder that we found while doing mod 5 operation .
- Here, we dividing the bit-position in four cases i.e, 4n, 4n+1, 4n+2, 4n+3 th position which represent the accumulated remainder that we get.
- Here, A:denotes we have read till (4n+3)th postion
  B:denotes we have read till (4n)th postion
  C:denotes we have read till (4n+1)th postion
  D:denotes we have read till (4n+2)th postion

Part 3:

Moore Machine, residue mod 5 from MSB:

1. Input symbol, $\Sigma=\{0,1\}$
2. Output symbol, $\Delta=\{000,001,010,011,100\}$

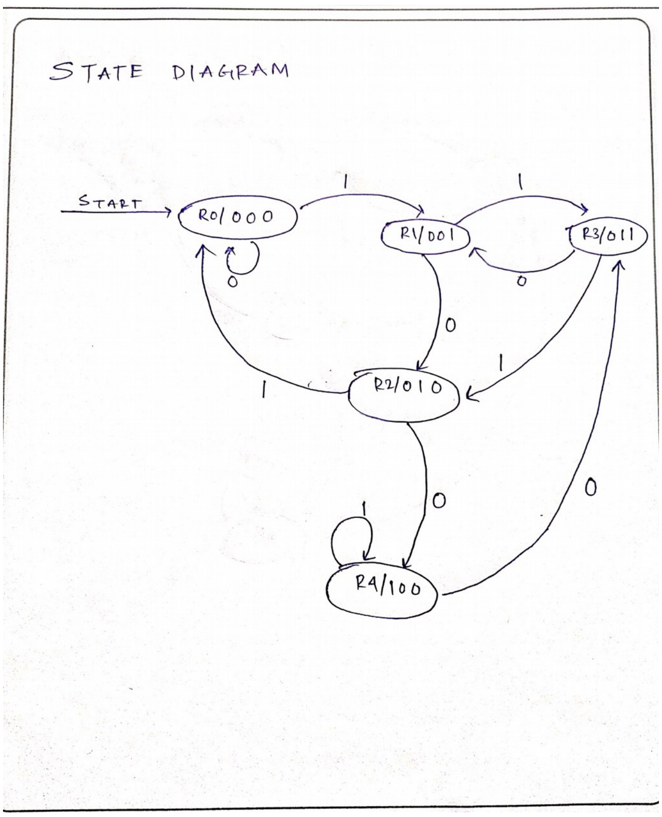
(a) State Transition:

PRESENT STATE	NEXT STATE		OUTPUT
	INPUT=0	INPUT=1	
R0	R0	R1	000
R1	R2	R3	001
R2	R4	R0	010
R3	R1	R2	011
R4	R3	R4	100

Where,

RX =Remainder X

State Diagram:



(b) Report detailing design of the Moore m/c residue mod 5 from MSB

- As we mentioned earlier that output obtained in the Moore Machine the output only depends on the present states, that's why we first consider 5 different states as we have to make machine which residue mod 5 from most significant bit and then we draw the State transition table and obtained the output accordingly with respect to present states. So, on anaylsing the output that we obtained, we find that when present state is R0 then we obtain output as 000 irrespective of inputs which holds for others also like when present state is R1,R2,R3,R4 we obtains output as 001,010,011,100.
- Considering all the present states, next states and the input we draw the state diagram shown above.
- Notation and Symbols: RX where X=0,1,2,3,4
  this indicates the remainder that we found while doing mod 5 operation and on each state transition we have written the input/output where state transition means arrowhead from present state to next state. On arrow we have written the input value while the States and output is written on the State itself as RX/output.

<u>Part 4:</u>

(a) Moore Machine, residue mod 5 from LSB:

1. Input symbol, ∑={0,1}
2. Output symbol, Δ={000,001,010,011,100}

PRESENT STATE	NEXT STATE		OUTPUT
	INPUT=0	INPUT=1	
A0	B0	B1	000
A1	B1	B2	001
A2	B2	B3	010
A3	B3	B4	011
A4	B4	B0	100
B0	C0	C2	000
B1	C1	C3	001
B2	C2	C4	010
B3	C3	C0	011
B4	C4	C1	100
C0	D0	D4	000

PRESENT STATE	NEXT STATE		OUTPUT
C1	D1	D0	001
C2	D2	D1	010
C3	D3	D2	011
C4	D4	D3	100
D0	A0	A3	000
D1	A1	A4	001
D2	A2	A0	010
D3	A3	A1	011
D4	A4	A2	100

(b) Report detailing design of the Moore m/c residue mod 5 from LSB

- As we mentioned earlier that output obtained in the Moore Machine the output only depends on the present states, that's why we first consider 4 different Sets of 5 different states as we have to make machine which residue mod 5 from least significant bit and then we draw the State transition table and obtained the output accordingly with respect to present states.
- a. First we are dividing the bit-position in four cases i.e,
  4n-th, (4n+1)-th, (4n+2)-th, (4n+3)-th position
  b. 1 on an 4n-th index bit adds 1 to the accumulated remainder.
  c. 1 on an (4n+1)-th index bit adds 2 to the accumulated remainder.
  d. 1 on an (4n+2)-th index bit adds 4 to the accumulated remainder.
  e. 1 on an (4n+3)-th index bit adds 3 to the accumulated remainder.
- Let's assume,
  A: denotes we have read till (4n+3)-th position
  B: denotes we have read till (4n)-th position
  C: denotes we have read till (4n+1)-th position
  D: denotes we have read till (4n+2)-th position
- Notation and Symbols: PX where X=0,1,2,3,4 and P=A,B,C,D this indicates the remainder that we found while doing mod 5 operation .