Lab 1A - Sequence Generator

Implementation LAB 1A

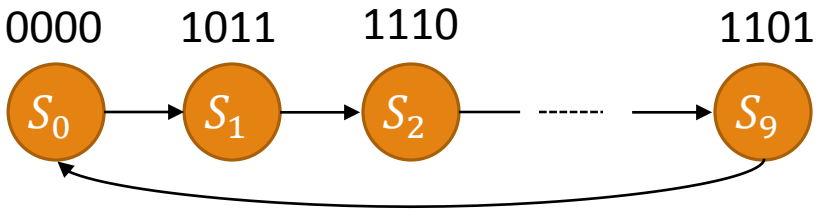
Deliverables:

1. **Sequence generator:**

- Design and implement a sequence generator to generate a sequence which has a minimum of 10 different states: 0, 11, 14, 5, 4, 15, 12, 9, 2,13, 0, 11, ...
- Ensure that all invalid stages of the machine clear it (set it too state zero.)
- Make sure you have zero in your sequence.

Sequence generator

The sequence : 0, 11, 14, 5, 4, 15, 12, 9, 2,13, 0, 11, …



Design the circuit using D flip-flop and MUX.

PS	D MSB	C	B	A LSB	NS	QD	QC	QB	QA
0	0	0	0	0	**11**	**1**	**0**	**1**	**1**
1	0	0	0	1		0	0	0	0
2	0	0	1	0	**13**	**1**	**1**	**0**	**1**
3	0	0	1	1		0	0	0	0
4	0	1	0	0	**15**	**1**	**1**	**1**	**1**
5	0	1	0	1	**4**	**0**	**1**	**0**	**0**
6	0	1	1	0		0	0	0	0
7	0	1	1	1		0	0	0	0
8	1	0	0	0		0	0	0	0
9	1	0	0	1	**2**	**0**	**0**	**1**	**0**
10	1	0	1	0		0	0	0	0
11	1	0	1	1	**14**	**1**	**1**	**1**	**0**
12	1	1	0	0	**9**	**1**	**0**	**0**	**1**
13	1	1	0	1	**0**	**0**	**0**	**0**	**0**
14	1	1	1	0	**5**	**0**	**1**	**0**	**1**
15	1	1	1	1	**12**	**1**	**1**	**0**	**0**

MUX Design

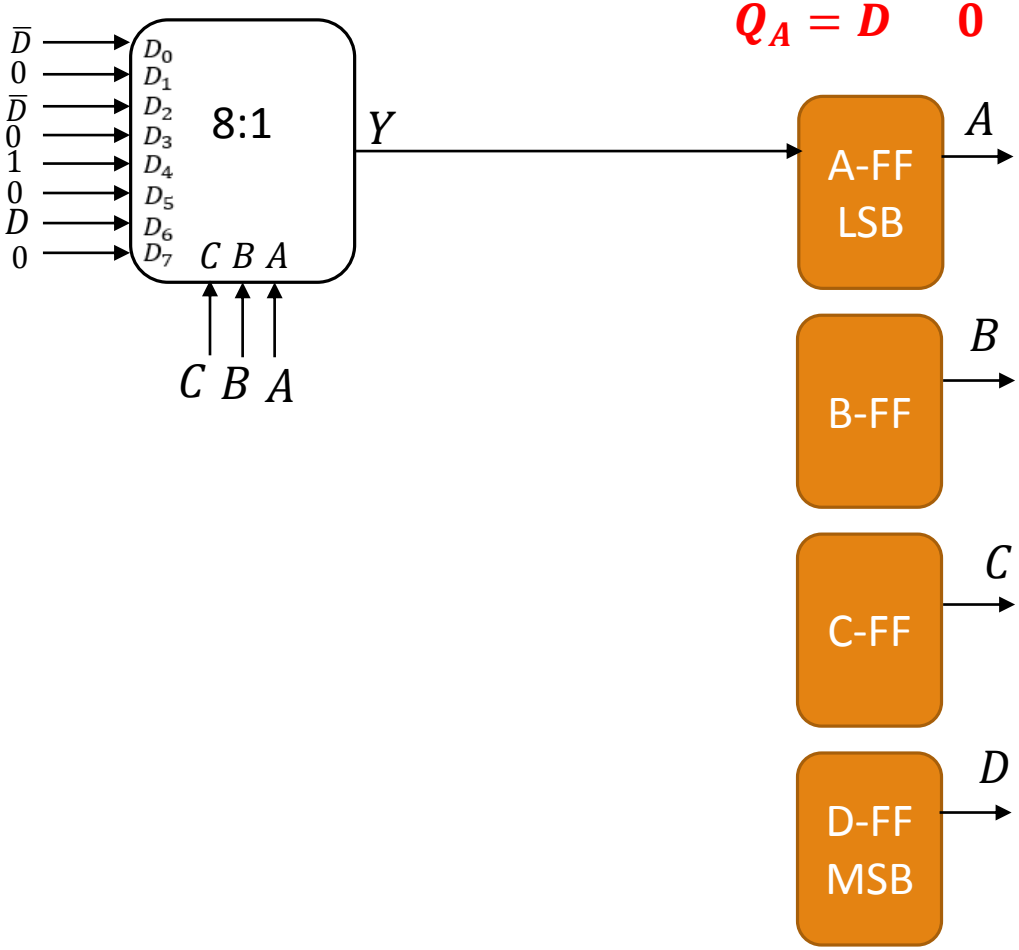
PS	D MSB	C	B	A LSB	NS	QD	QC	QB	QA
0	0	0	0	0	11	1	0	1	1
1	0	0	0	1		0	0	0	0
2	0	0	1	0	13	1	1	0	1
3	0	0	1	1		0	0	0	0
4	0	1	0	0	15	1	1	1	1
5	0	1	0	1	4	0	1	0	0
6	0	1	1	0		0	0	0	0
7	0	1	1	1		0	0	0	0
8	1	0	0	0		0	0	0	0
9	1	0	0	1	2	0	0	1	0
10	1	0	1	0		0	0	0	0
11	1	0	1	1	14	1	1	1	0
12	1	1	0	0	9	1	0	0	1
13	1	1	0	1	0	0	0	0	0
14	1	1	1	0	5	0	1	0	1
15	1	1	1	1	12	1	1	0	0

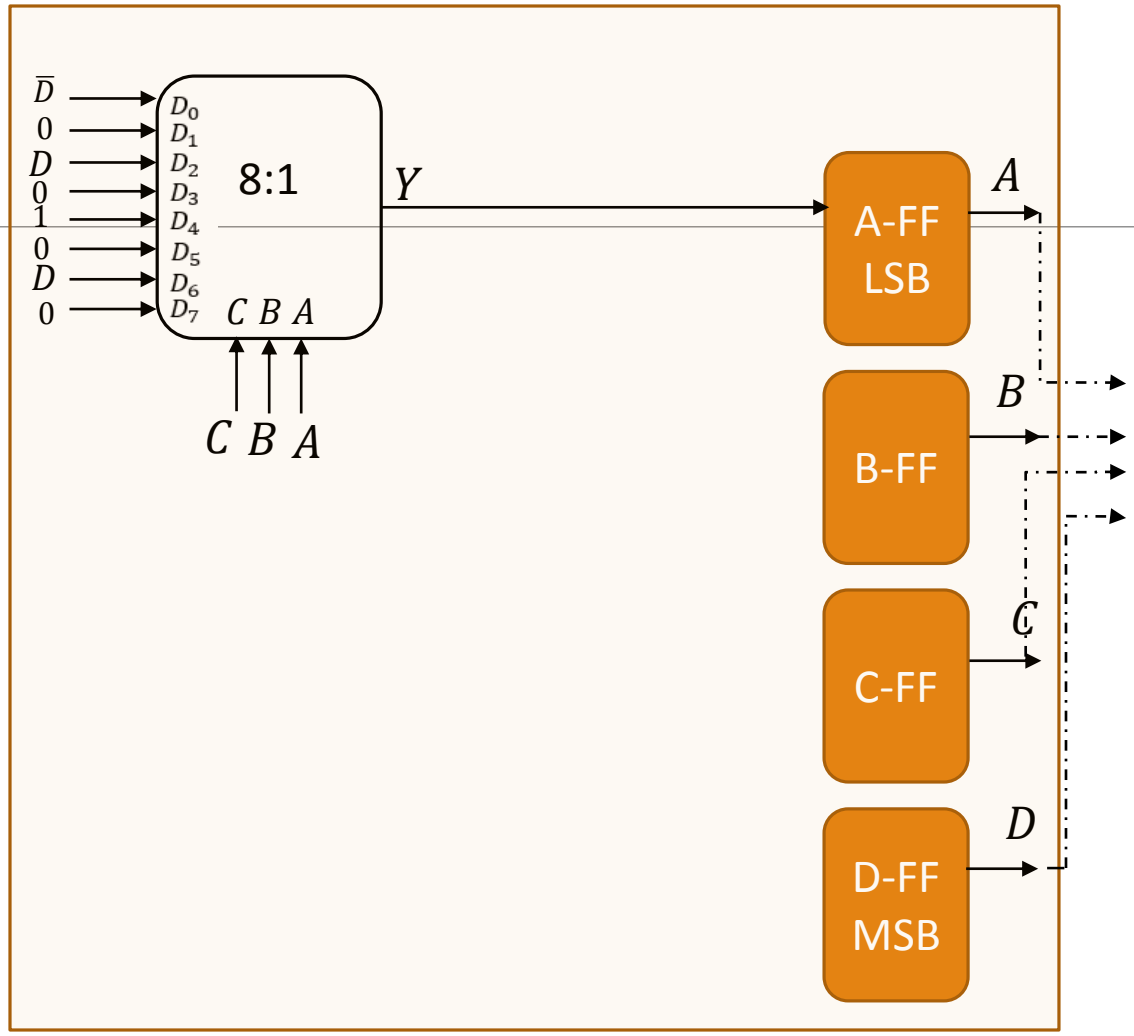
- 4 D- Flip Flops
- Use Mux to derive the input of each flip flops.
- Use **CBA** as the select for MUX

CBA / D	000	001	010	011	100	101	110	111
0	1	0	1	0	1	0	0	0
1	0	0	0	0	1	0	1	0
$Q_A = \bar{D}$	**0**	$\bar{D}$	**0**	**1**	**0**	D	**0**	

Circuit Diagram

CBA / D	000	001	010	011	100	101	110	111
0	1	0	1	0	1	0	0	0
1	0	0	0	0	1	0	1	0
$Q_A = \overline{D}$	$\overline{D}$	0	$\overline{D}$	0	1	0	D	0





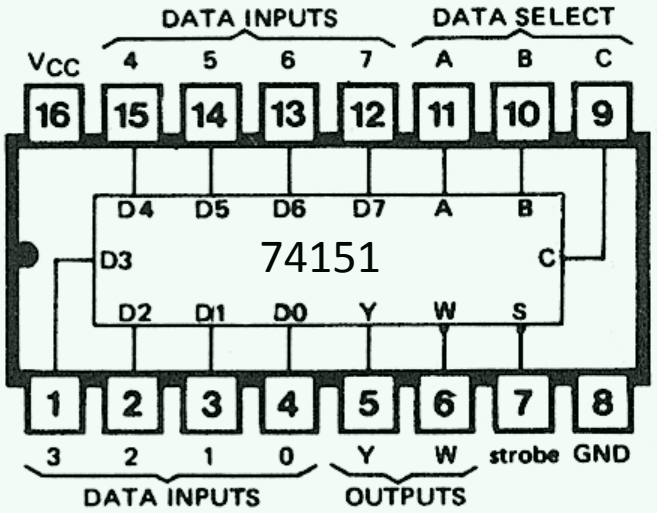
Sequence Generator

ICs

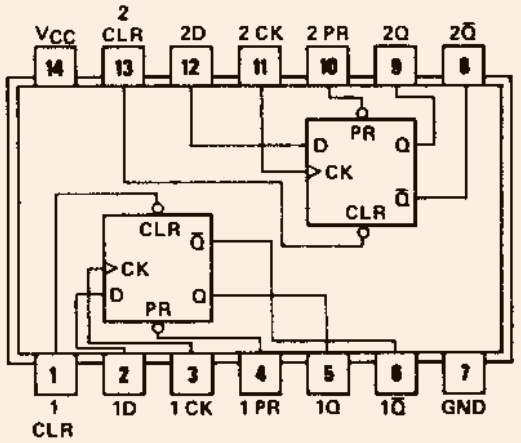
- 7474 Dual Positive Edge Triggered D-FF
  - Vcc to PR and CLR Pin
- 74151 8:1 Mux.
  - Gnd to Strobe Pin

Truth Table

Inputs				Outputs	
Select			Strobe		
C	B	A	S	Y	W
X	X	X	H	L	H
L	L	L	L	D0	$\overline{D0}$
L	L	H	L	D1	$\overline{D1}$
L	H	L	L	D2	$\overline{D2}$
L	H	H	L	D3	$\overline{D3}$
H	L	L	L	D4	$\overline{D4}$
H	L	H	L	D5	$\overline{D5}$
H	H	L	L	D6	$\overline{D6}$
H	H	H	L	D7	$\overline{D7}$



7474



FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{PRE}$	$\overline{CLR}$	CLK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H†	H†
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q}_0$