

## Lab 1 Question 8 (Post lab)

### 8.1 Sensor Detector

Truth table

	W 3	X 2	Y 1	Z 0	F(W, X, Y, Z)
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	0
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	1
7	0	1	1	1	1
8	1	0	0	0	0
9	1	0	0	1	1
10	1	0	1	0	1
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	1
15	1	1	1	1	1

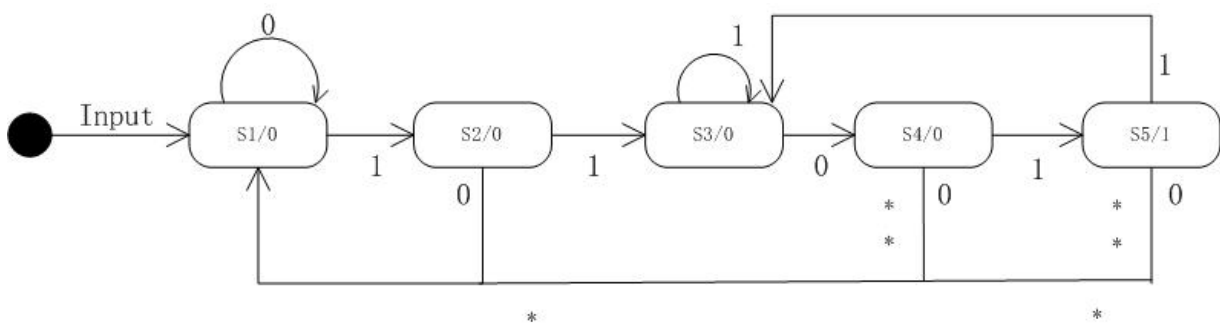
K-Map

	W'		W		
Y'	0	0	0	0	Z'
	1	1	1	1	Z
Y	1	1	1	1	Z'
	0	1	1	1	Z'
	X'	X	X'	X	

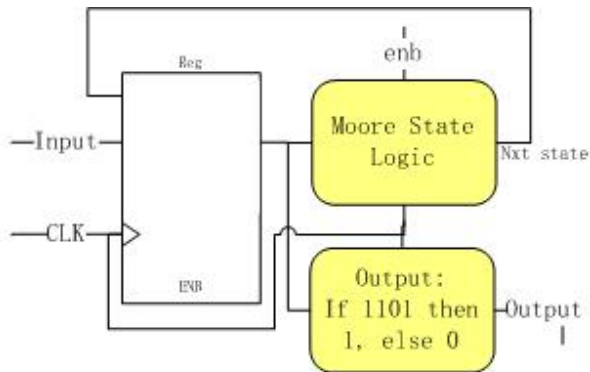
Sum of product form:  $Z + X \& Y + W \& Y$

### 8.2 "1101" detector

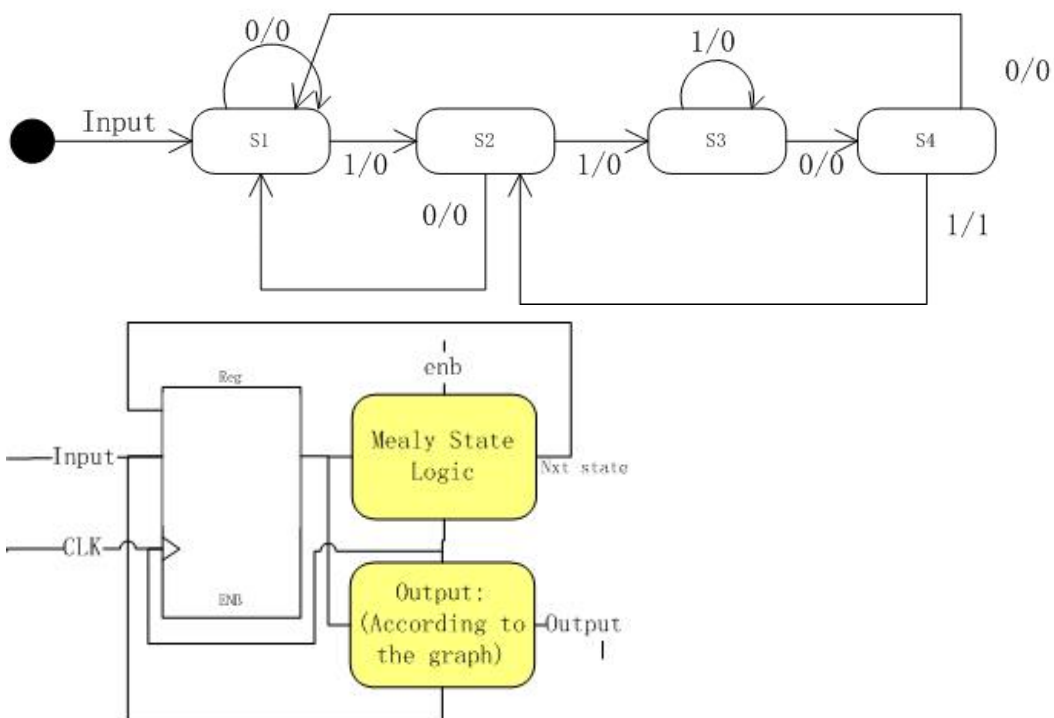
Moore machine:



Jing, Jiangshan  
mg86



Mealy machine:



Mealy machine's output at every state will be depend on input. Thus, it has one fewer state.

### 8.3 Hardware Building Blocks

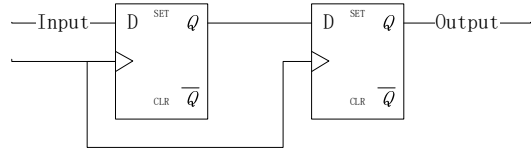
#### 8.3.1 Synchronizer

#### 8.3.2 Most Significant Bit first Serial to Parallel Shift Register

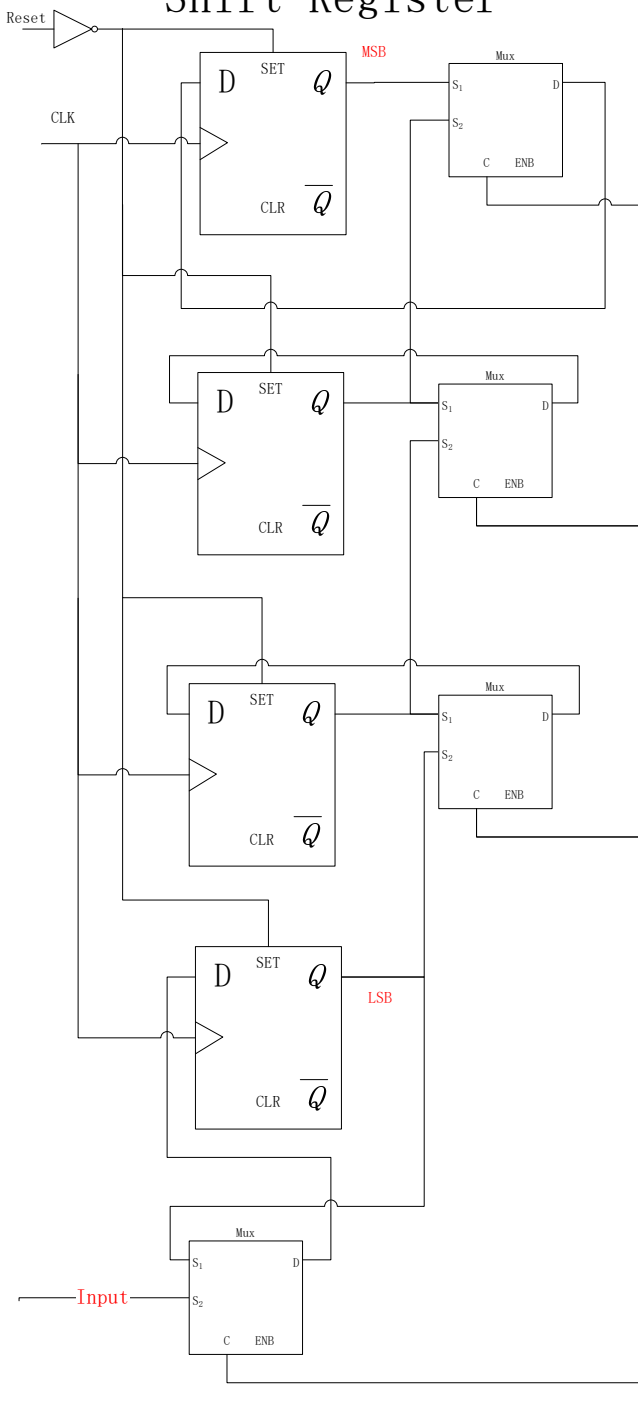
#### 8.3.3 Most Significant Bit first Parallel to Serial Shift Register

All see next page

### 2 Flip-Flop synchronizer

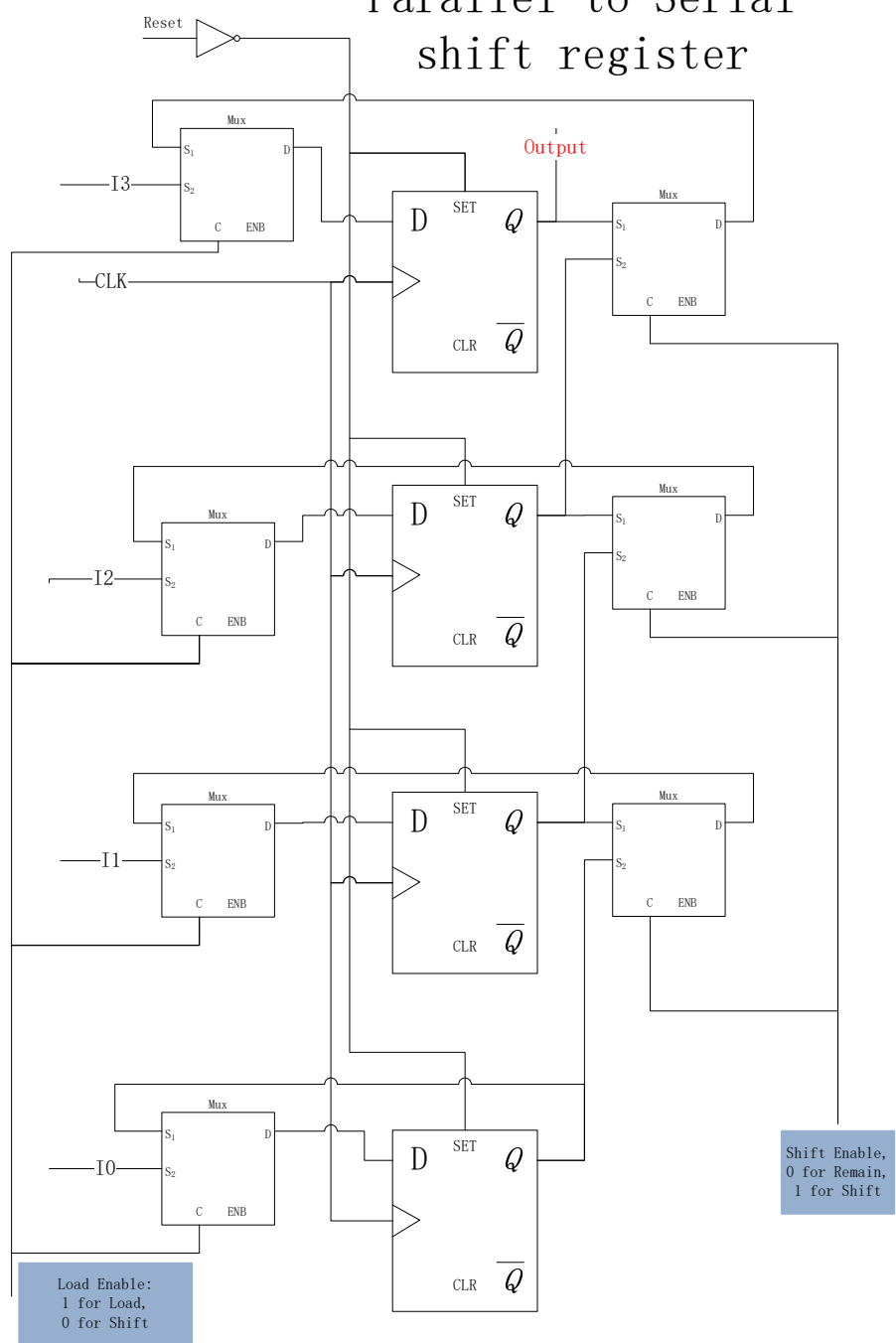


### Serial to Parallel Shift Register



Shift Enable:  
0 for remain  
1 for shift

### Parallel to Serial shift register



Load Enable:  
1 for Load,  
0 for Shift

Shift Enable,  
0 for Remain,  
1 for Shift