CSE125 Lab3 Write-up

Cheng-Ruei Chiu, Yuehao Li

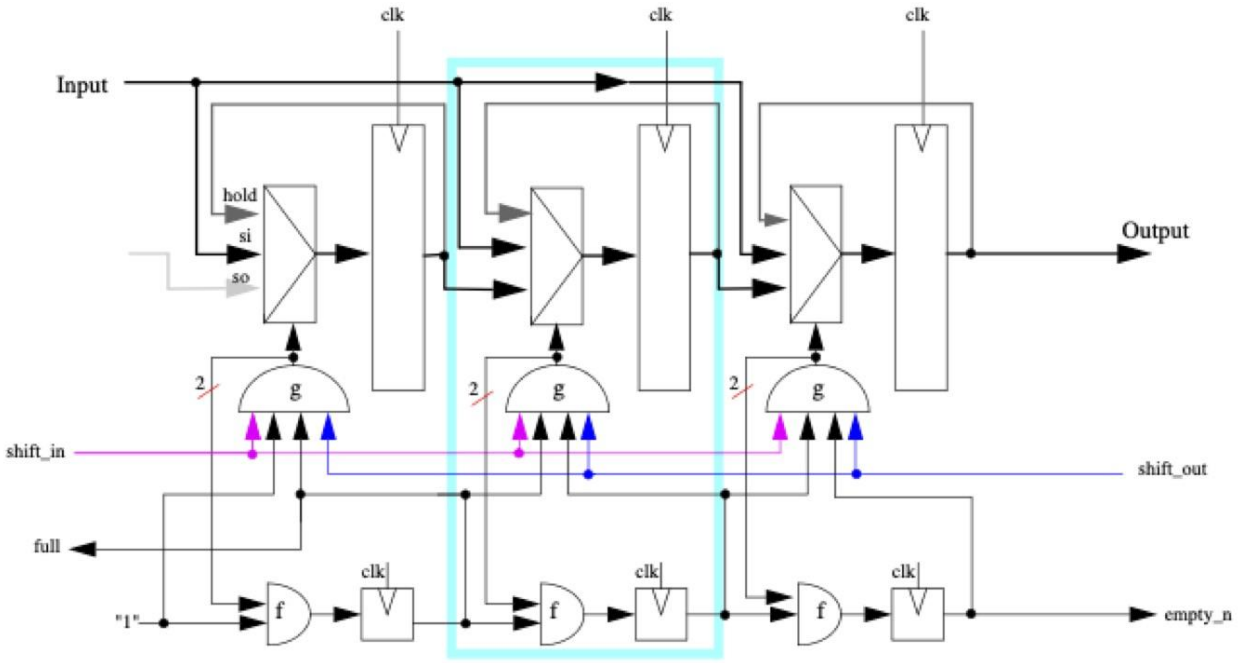

Figure 1: Register Based FIFO

Overview:

In this Lab, we are creating a fifo a register-based FIFO. To create a register-based FIFO, we need to create a module for each state and another top module to connect each state.

There will be 5 signals goes into each fifo state:

- Previous valid : There are data in the previous fifo state
- Valid: There are data in this fifo state
- Next valid: There are data in the next state
- Data_in: data from shift in
- Shift_in/Shift_out: shift in and shift out signal
- clk/ res: clock and reset signal

From all of the signals we have we can work with a few different cases:

1. No shift in or Shift out
   In this Case, both valid and data will be the same as before.

2. Both Shift in and Shift out
   We might have two cases here:
   - We are the last one and we are empty: we take in the data_in and valid will be 1

- This is one of the state in the middle: Take the data from previous state

3. Shift in but no Shift out
   We might have two cases here:
   - We are the last one and we are empty: we take in the data_in and valid will be 1
   - This is one of the state in the middle: Take the data from previous state

4. Shift out but no Shift in
   Every state will just take the valid and data from the previous state.

After we complete all of the cases for fifo state we just need to connect all of the states together with the given depth. And the data out of the FIFO will the the output of the first fifo state.

Resources and Fmax:

The resources usage of the parameter width 64 and Depth 8 is: LUT usage is 508 and FF usage is 520. The Worst Negative Slack is 14.417ns. Then Fmax is 0.17 GHz.

Resource	Utilization	Available	Utilization %
LUT	508	8000	6.35
FF	520	16000	3.25
IO	134	150	89.33
BUFG	1	32	3.13

Figure 2: Resources usage of FIFO

Setup		Hold		Pulse Width	
Worst Negative Slack (WNS):	14.417 ns	Worst Hold Slack (WHS):	0.012 ns	Worst Pulse Width Slack (WPWS):	9.500 ns
Total Negative Slack (TNS):	0.000 ns	Total Hold Slack (THS):	0.000 ns	Total Pulse Width Negative Slack (TPWS):	0.000 ns
Number of Failing Endpoints:	0	Number of Failing Endpoints:	0	Number of Failing Endpoints:	0
Total Number of Endpoints:	1032	Total Number of Endpoints:	1032	Total Number of Endpoints:	521

All user specified timing constraints are met.

Figure 3: timing report of FIFO

Evaluation:

In this part, we evaluate the FIFO with fixed parameter width of 32 and sweep the DEPTH of the FIFO from 4,8,16,64,256. And then we can get the graph of Fmax v.s. Depth and LUT v.s. Depth.

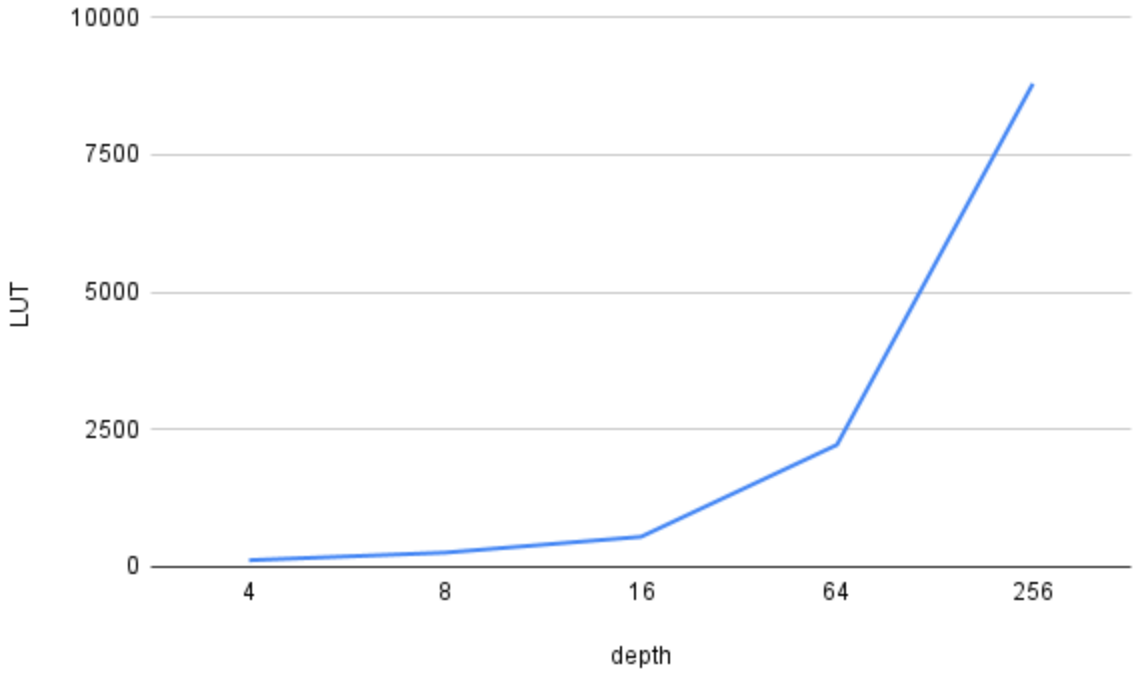

Figure 4 Depth V.S. LUT

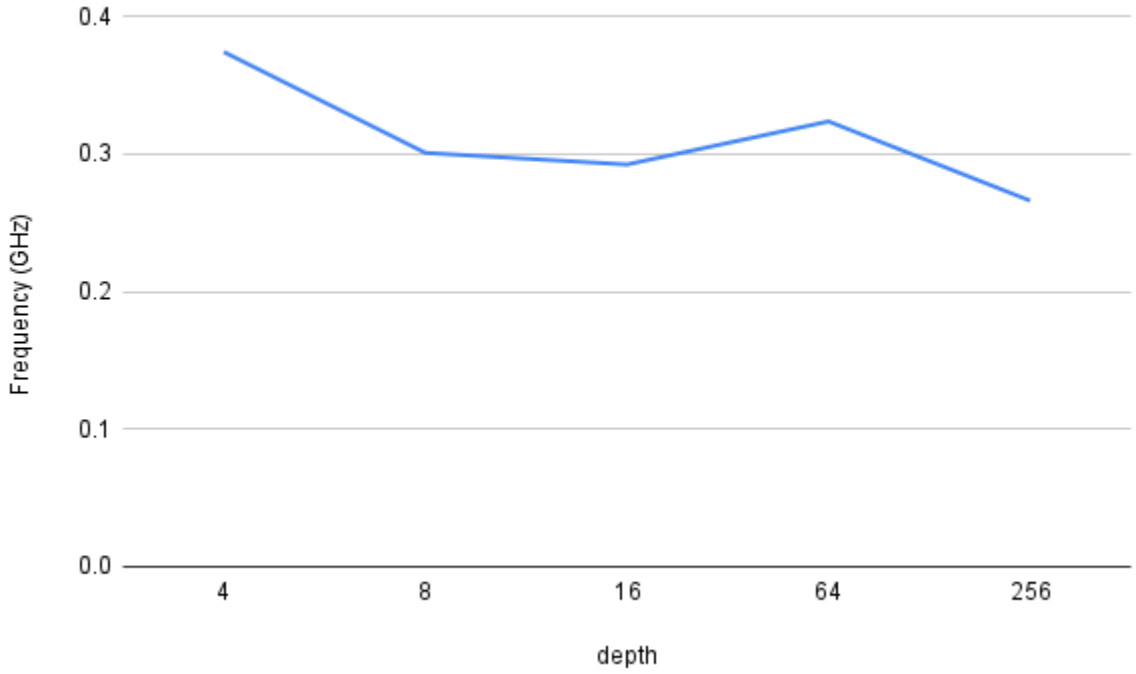

Figure 5: Depth V.S. Frequency