

Functional Verification of Binary Search Hardware Implementation

The following document displays selective testing performed using the bs_tb module covering common use cases as well as difficult edge cases.

The RAM has been initialized using the following .mif file:

Addr	+0	+1	+2	+3	+4	+5	+6	+7	ASCII
0	1	2	3	4	5	6	7	8
8	9	10	11	12	13	14	15	16
16	17	18	19	20	21	22	23	24
24	25	26	27	28	29	30	31	32

Figure 1: Visual display of contents of memory initialization file (mif).

Searching for a value that is not stored in the RAM.

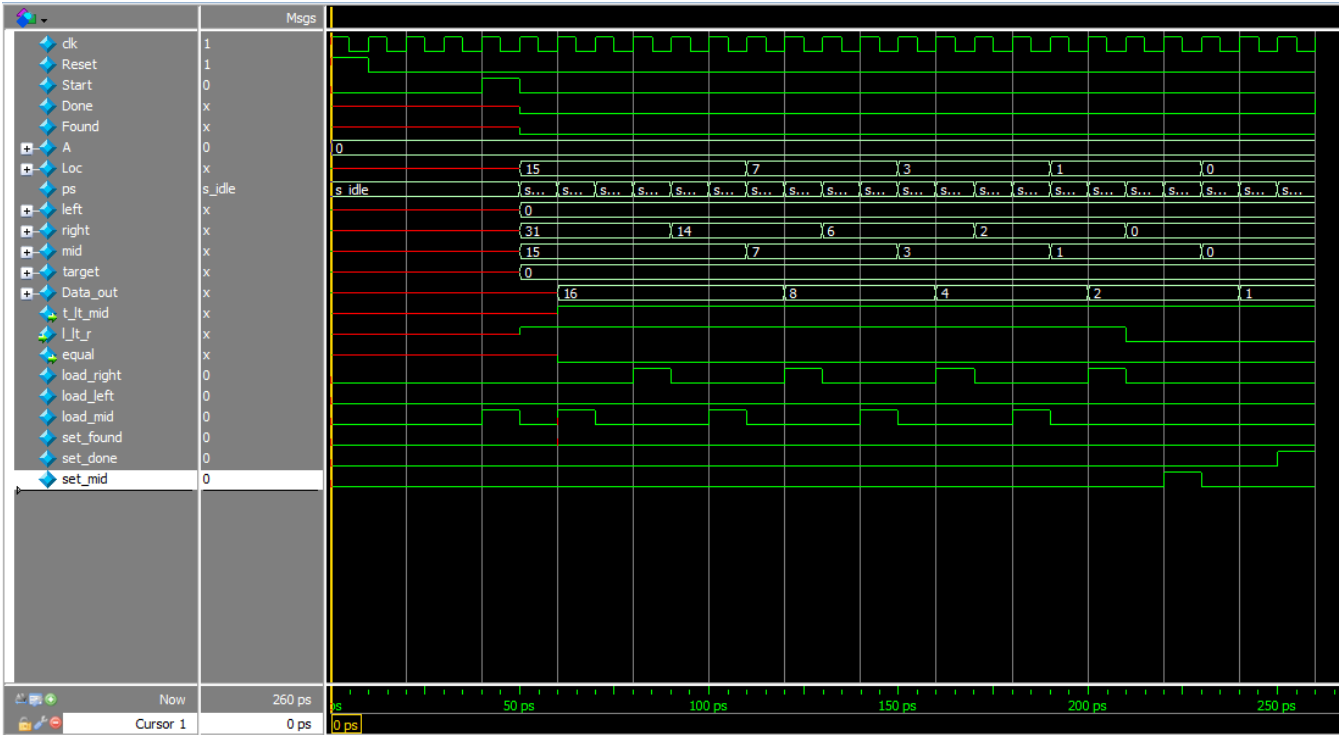


Figure 2: ModelSim waveform when searching for a value (0) not stored in RAM.

The design begins by initializing mid to the 15th index, the middle index given that this design assumes a 32 block memory. This value stored at the index is then compared to the target value and the mid index is adjusted. This repeats until mid and right are equal and it is clear the target value is not contained in memory at which point “Done” is asserted while “Found” is low.

Adam Friesz
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The following ModelSim printout is generated using SystemVerilog command statements for rapid, comprehensive verification when the value is both contained and not contained. The value of Location is considered invalid when the target value is not found.

```
# Target: 0 Found: NO Location: 4294967295
# Target: 1 Found: YES Location: 0
# Target: 2 Found: YES Location: 1
# Target: 3 Found: YES Location: 2
# Target: 4 Found: YES Location: 3
# Target: 5 Found: YES Location: 4
# Target: 6 Found: YES Location: 5
# Target: 7 Found: YES Location: 6
# Target: 8 Found: YES Location: 7
# Target: 9 Found: YES Location: 8
# Target: 10 Found: YES Location: 9
# Target: 11 Found: YES Location: 10
# Target: 12 Found: YES Location: 11
# Target: 13 Found: YES Location: 12
# Target: 14 Found: YES Location: 13
# Target: 15 Found: YES Location: 14
# Target: 16 Found: YES Location: 15
# Target: 17 Found: YES Location: 16
# Target: 18 Found: YES Location: 17
# Target: 19 Found: YES Location: 18
# Target: 20 Found: YES Location: 19
# Target: 21 Found: YES Location: 20
# Target: 22 Found: YES Location: 21
# Target: 23 Found: YES Location: 22
# Target: 24 Found: YES Location: 23
# Target: 25 Found: YES Location: 24
# Target: 26 Found: YES Location: 25
# Target: 27 Found: YES Location: 26
# Target: 28 Found: YES Location: 27
# Target: 29 Found: YES Location: 28
# Target: 30 Found: YES Location: 29
# Target: 31 Found: YES Location: 30
# Target: 32 Found: YES Location: 31
# Target: 33 Found: NO Location: 4294967295
# ** Note: $stop : ./bs_tb.sv(33)
# Time: 7500 ps Iteration: 2 Instance: /bs_tb
# Break in Module bs_tb at ./bs_tb.sv line 33
```

Figure 3: ModelSim terminal generated results from \$display statements in bs_tb.