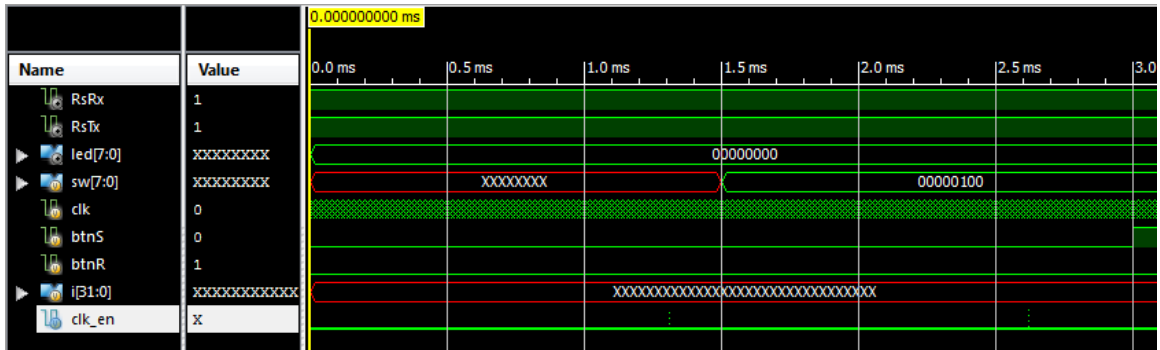


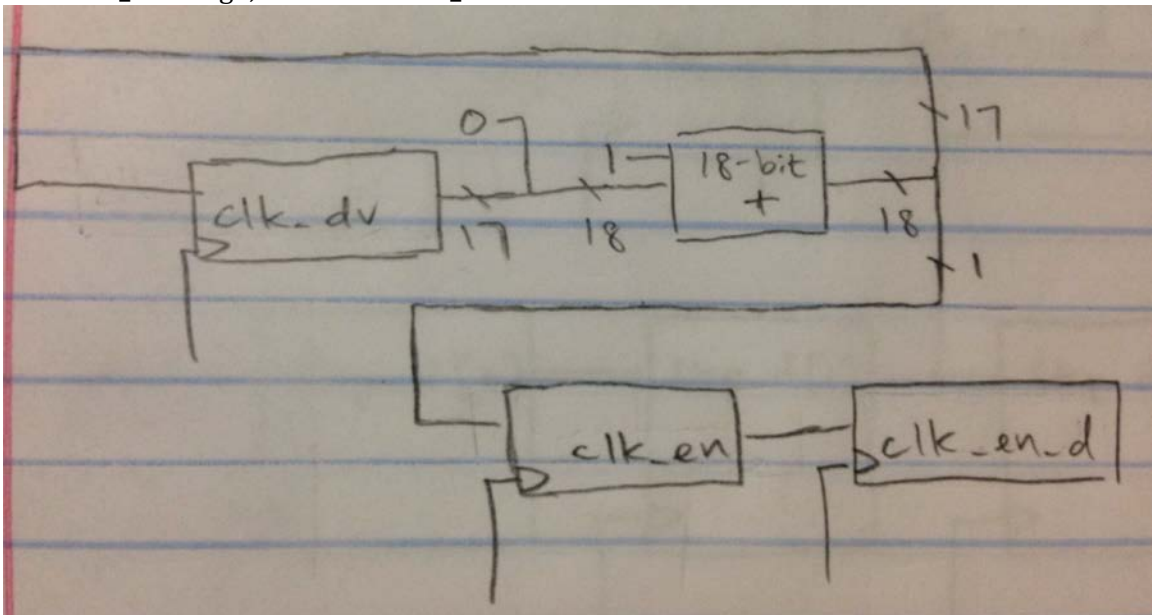
## Workshop 1

### Clock Enable

- The period of the clk\_en signal is 1.31072ms. Two occurrences of clk\_en's waveform are shown below:

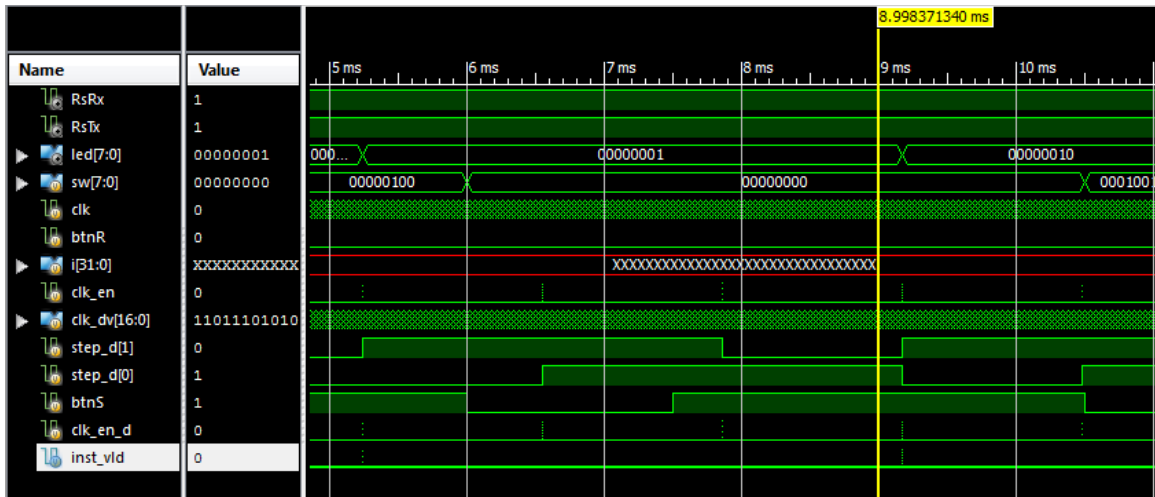


- When clk\_en is high, the value of clk\_dv is 000000000000000000.
- 

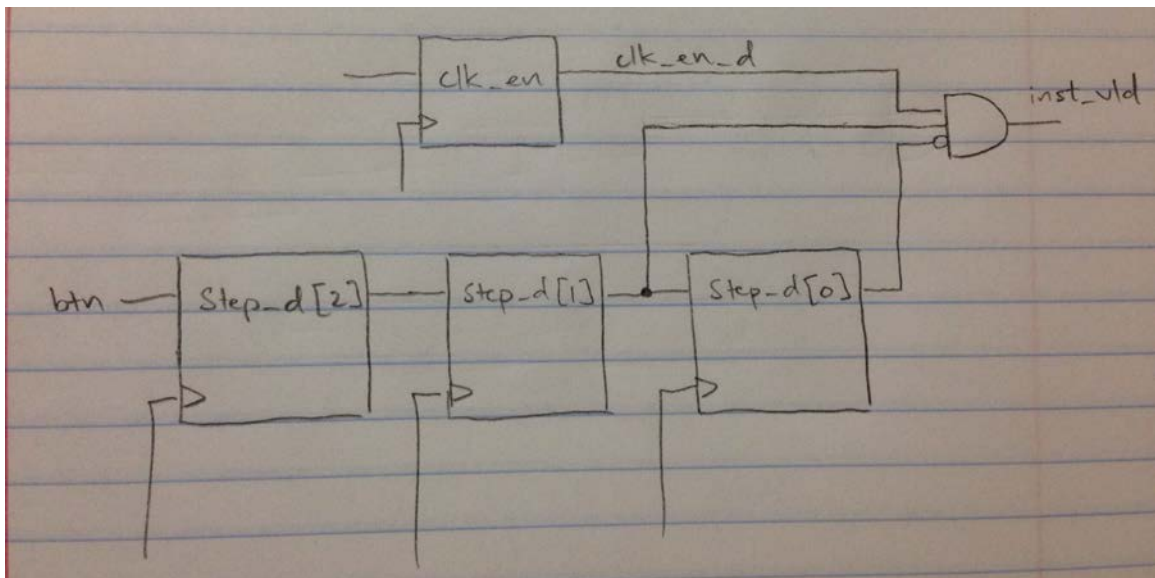


### Instruction Valid

- The first time that inst\_vld signal evaluates to 1 is at 5.243915ms.
- clk\_en\_d is the same waveform as clk\_en except that it is delayed by one clock cycle. Because there are three D flip-flops in the form of step\_d[0], step\_d[1], and step\_d[2], and we only use step\_d[0] and step\_d[1] to determine the outcome of the inst\_vld signal, we need the delayed value of clk\_en, hence using clk\_en\_d.
- A waveform showing the relationship between clk\_en, step\_d[1], step\_d[0], btnS, clk\_en\_d, and inst\_vld is shown below:

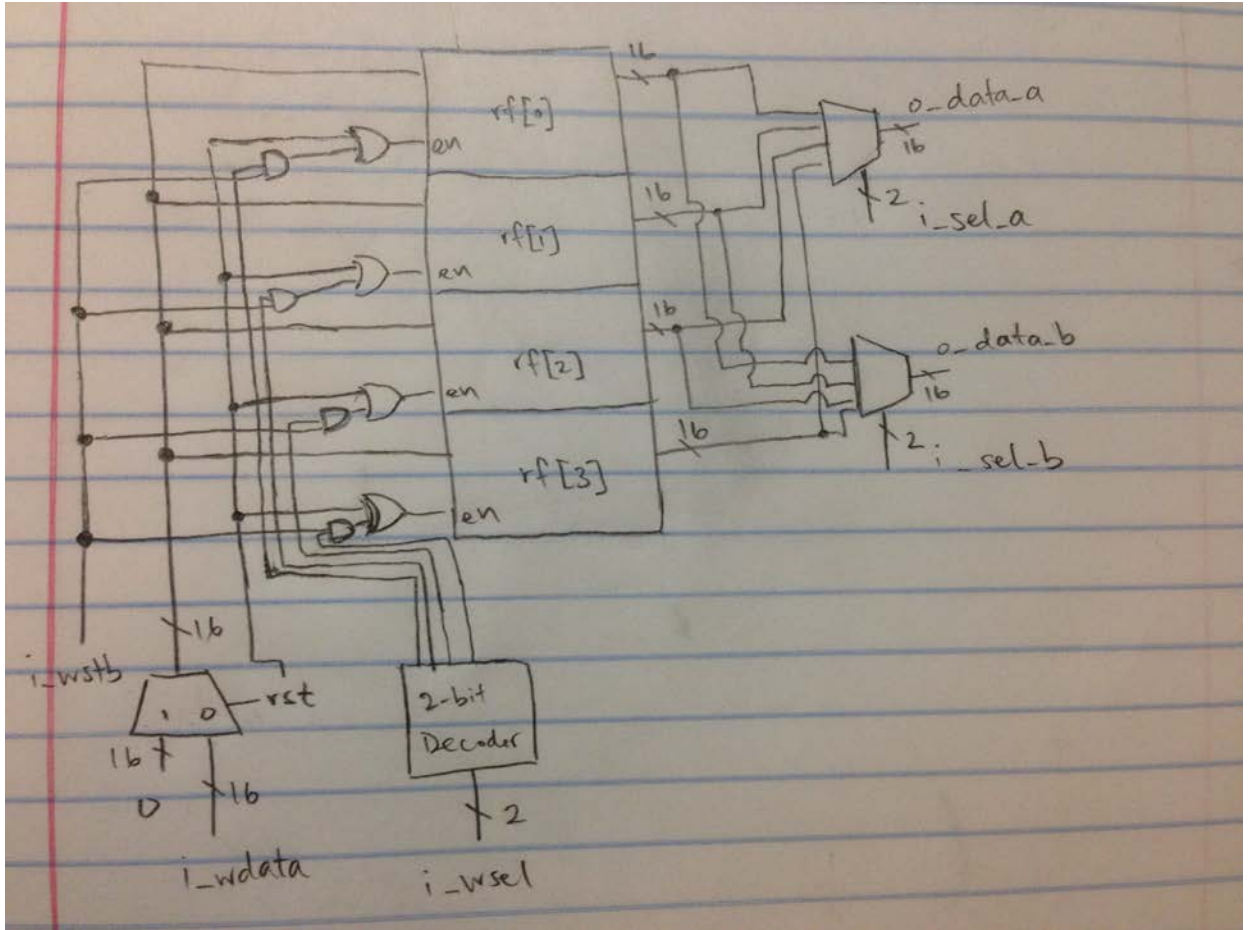


5.

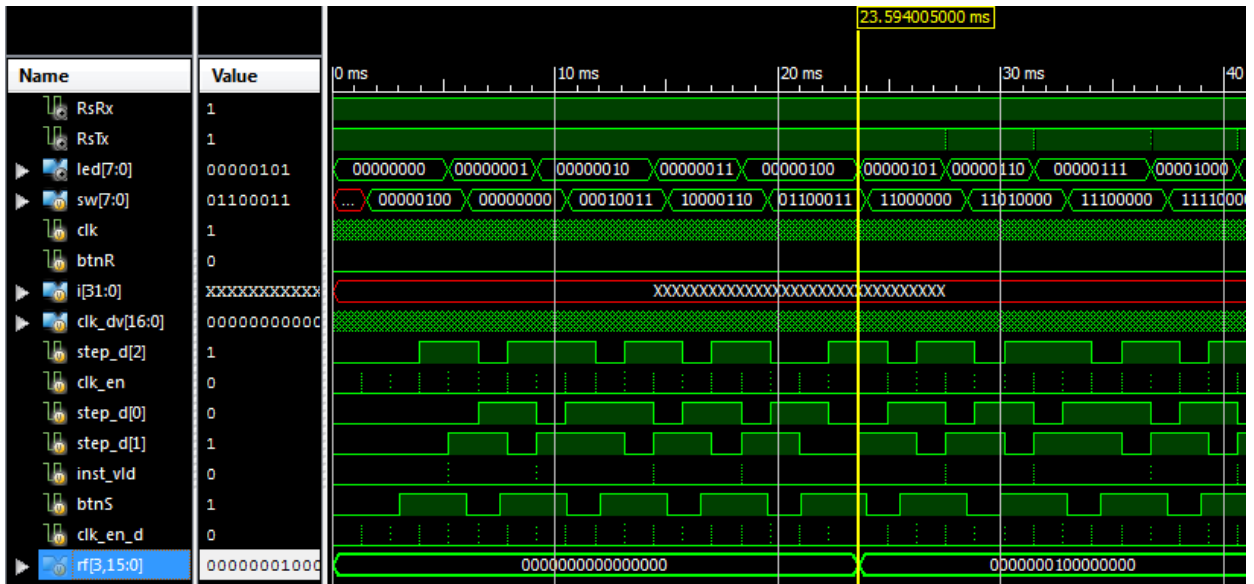


### Register File

2. The register is written into in sequential logic.
3. The register values are read out in combinatorial logic. To manually implement the readout logic, we would use registers and MUXs.



4.  
5.



## Workshop 2

1. Line 80 (shown below) creates a new nexys3 module name uut\_. This module is where tb.v sends instructions to, using the 8-bit sw register.

```
80     nexys3 uut_ (/*AUTOINST*/  
81                 // Outputs  
82                 .RsTx          (RsTx),  
83                 .led           (led[7:0]),  
84                 // Inputs  
85                 .RsRx          (RsRx),  
86                 .sw            (sw[7:0]),  
87                 .btnS          (btnS),  
88                 .btnR          (btnR),  
89                 .clk           (clk));  
90  
91     task tskRunInst;  
92         input [7:0] inst;  
93         begin  
94             $display ("%d ... Running instruction %08b", $stime, inst);  
95             sw = inst;  
96             #1500000 btnS = 1;  
97             #3000000 btnS = 0;  
98         end  
99     endtask //
```

2. tskRunPUSH, tskRunMULT, tskRunADD, and tskRunSEND, which all call tskRunInst, are called in this process.