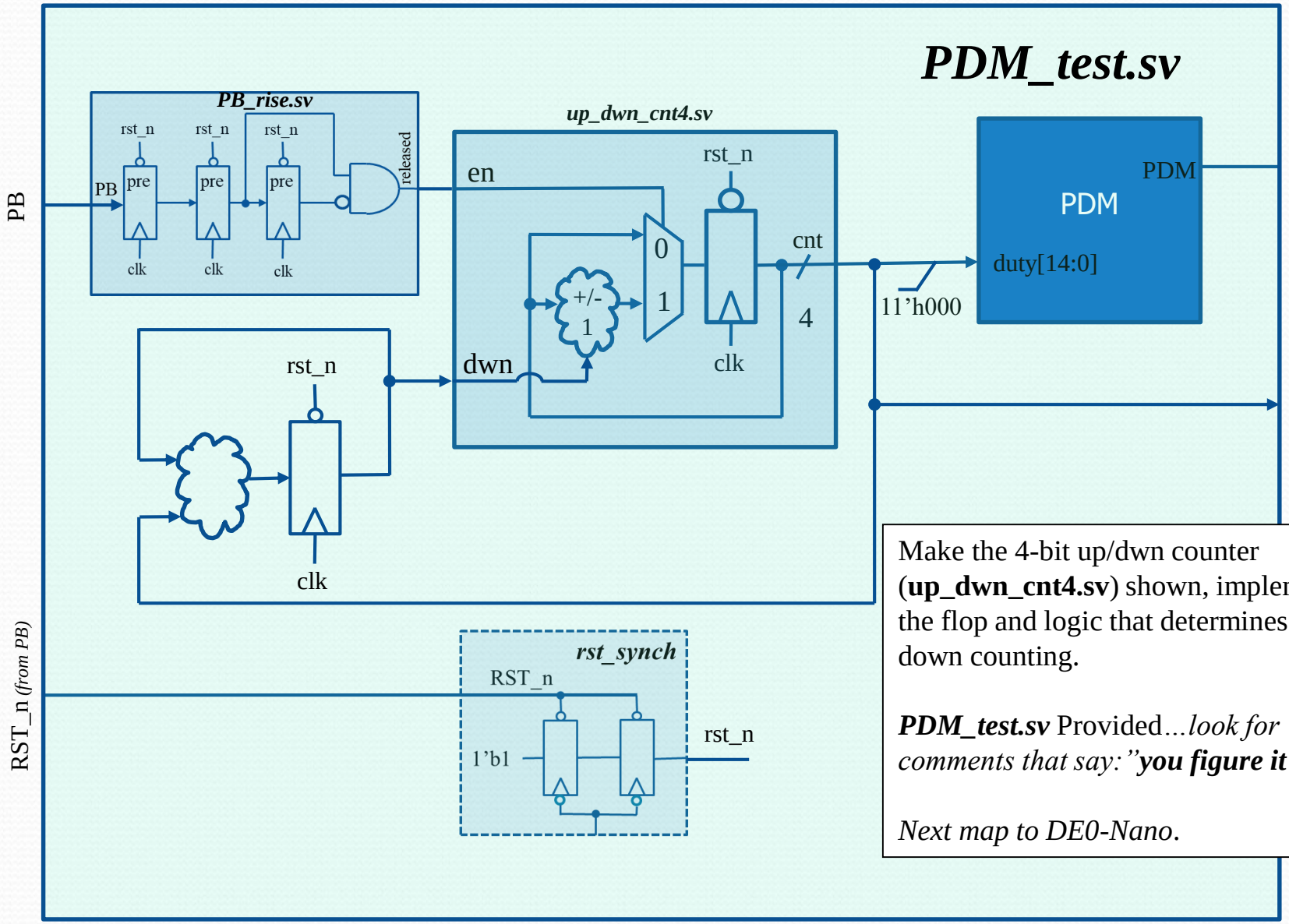
Exercise 10: Testing of PDM on DE0

- In Exercise07 you coded **PDM.sv** which has the interface shown below.

Signal:	Dir:	Description:
clk	in	50MHz clock
rst_n	in	Active low asynch reset
duty[14:0]	in	Duty cycle (from equalizer indicating drive level to speaker)
PDM	Out	Output to the H-bridge to control speaker drive

- Now you are going to build a test wrapper (**PDM_test.sv**) for this that will be mapped to your DE0-Nano board and used to test it.
- The test wrapper (**PDM_test.sv**) will contain a 4-bit up/down counter that is enabled by the signal from **PB_rise.sv** (which you just made in Ex09).
- The 4-bit counter is connected to bits [14:11] of **duty[14:0]**. Bits [10:0] being 0.
- The counter will start at 0000 and initially count up with every push of a button (coming from **PB_rise.sv**) and when it hits its full value (1111) it will toggle a flop and then start counting down.

Exercise 10 (Testing of PDM):



Make the 4-bit up/dwn counter (**up_dwn_cnt4.sv**) shown, implement the flop and logic that determines up vs down counting.

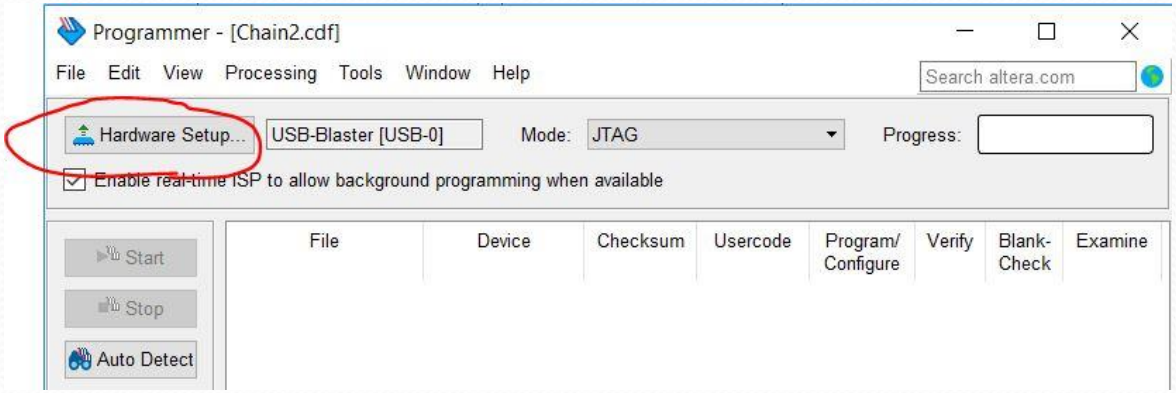
PDM_test.sv Provided…*look for comments that say:"**you figure it out**"*

Next map to DE0-Nano.

Exercise 10 (Testing of PDM) (Mapping to DE0):

- Download **PDM_test.qpf** (Quartus Project File) and **PDM_test.qsf** (Quartus Settings File) from the website and store in your Exercise10 directory

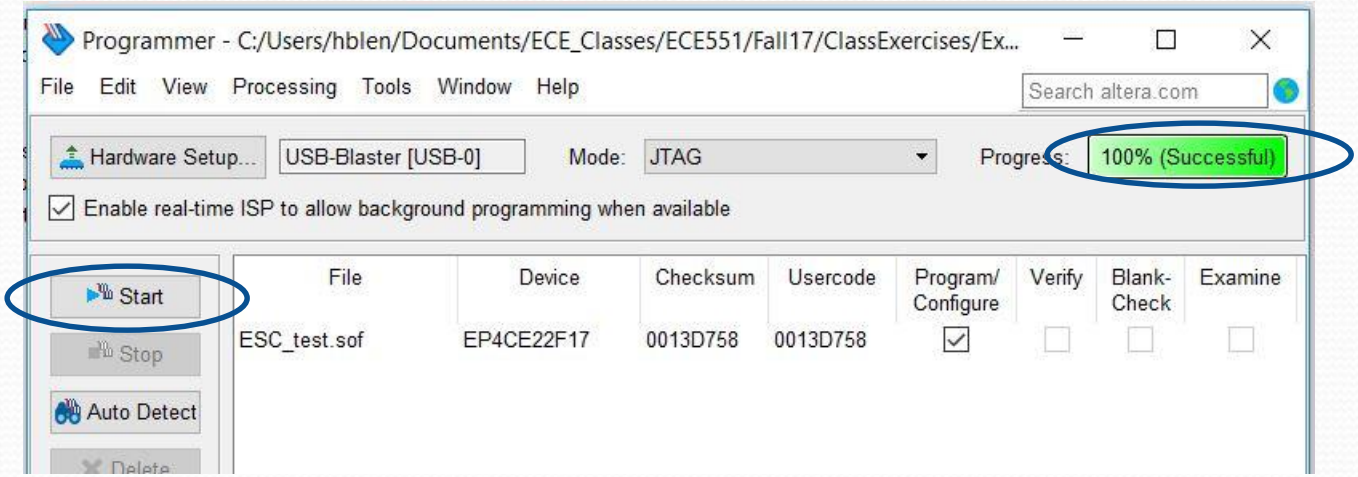
- Open up Quartus
  - Do a: **File → Open Project** and open up the **PDM_test.qpf**
  - Compile the design and fix any errors
  - Plug in your DE0-Nano Board.
  - Do a: **Tools → Programmer** and check that the USB Blaster shows up (see below) (you may have to wait a while on these CAE machines for it to enumerate)



Might have to go under "Hardware Setup" to get it to choose USB-Blaster

Exercise 10 (Testing of PDM) (Mapping to DE0):

- Program the DE0-Nano



- Hit “Start” and look for 100% Success

- See next page for mapping of functions to DE0-Nano

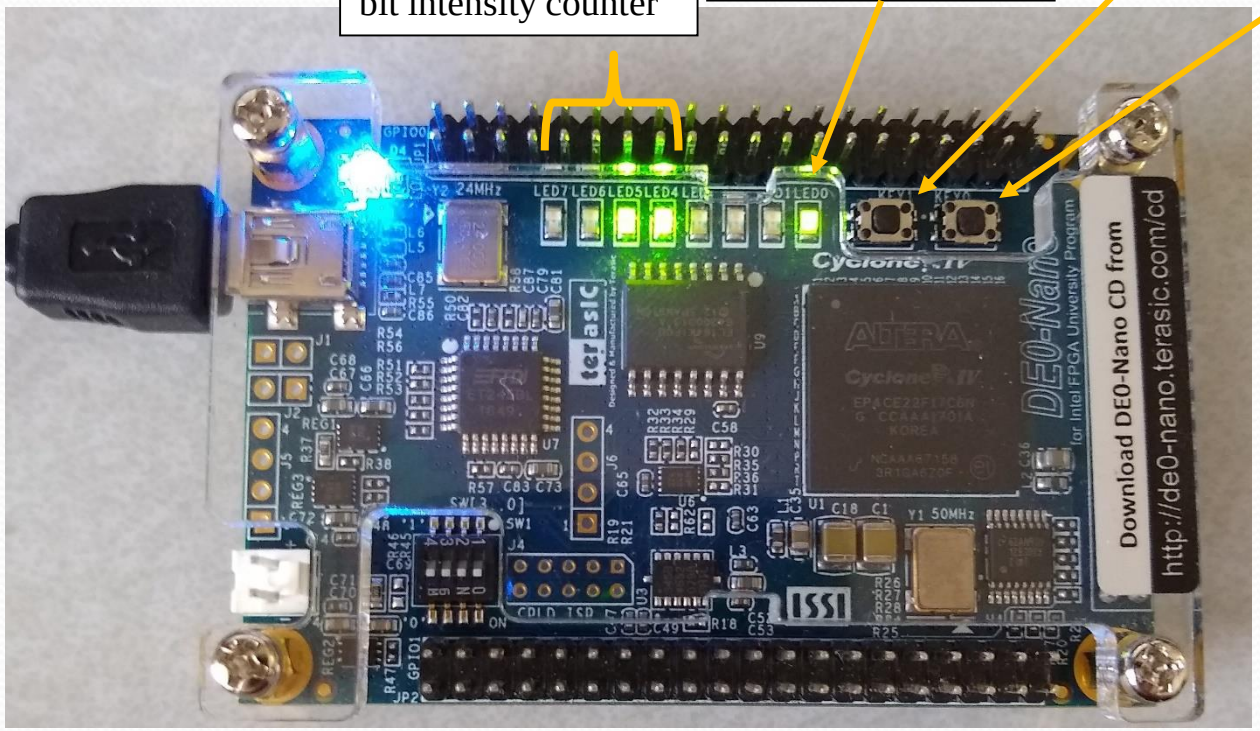
Exercise 10 (Testing of PDM) (Mapping to DE0):

Upper nibble of LEDs will be your 4-bit intensity counter

Lowest bit of LEDs will vary in intensity with duty cycle of PDM

"PB" push button

"RST_n" push button



Test your design. Intensity of LED[0] should increase at first as counter increases. When count gets to 1111 then counter should reverse and start counting down. Call us over when you have it working and we will "check you off"