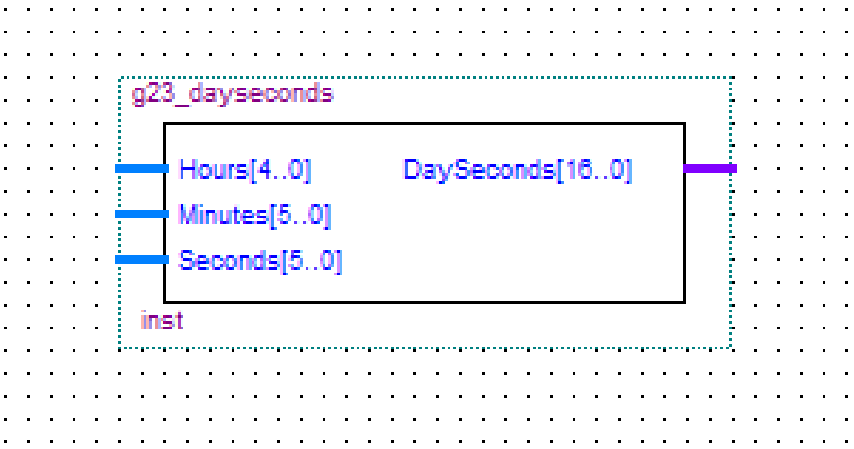
Charles-Antoine de Salaberry
260400928

Graham Ludwinski
260395716

Title: g23_dayseconds

Circuit Description: the g23_dayseconds circuit calculates how many seconds have passed since midnight on any day. It takes a 5 bit unsigned input 'Hours', a 6 bit unsigned input 'Minutes', and a 6 bit unsigned input 'Seconds'. It outputs a 17 bit unsigned signal 'DaySeconds' which represents the total number of seconds since midnight.

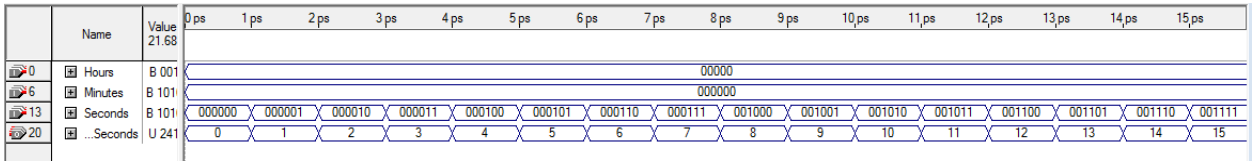


dayseconds block diagram

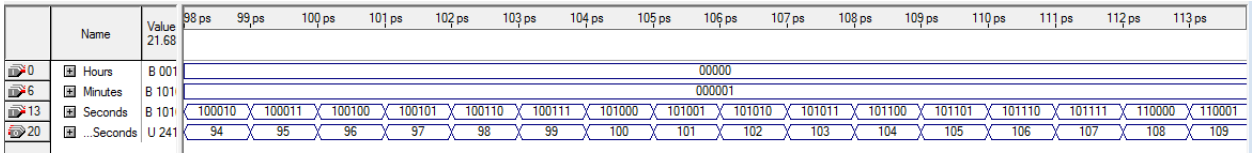
How the circuit was tested:

To test the circuit, we created a symbol for our circuit, created a new block diagram with our circuit, added input and output lines, and ran the circuit with seconds incrementing every 1ps, minutes every 60ps, and hours every 3600ps. This gave us the following wave form which is also included in our submission as a vwf file.

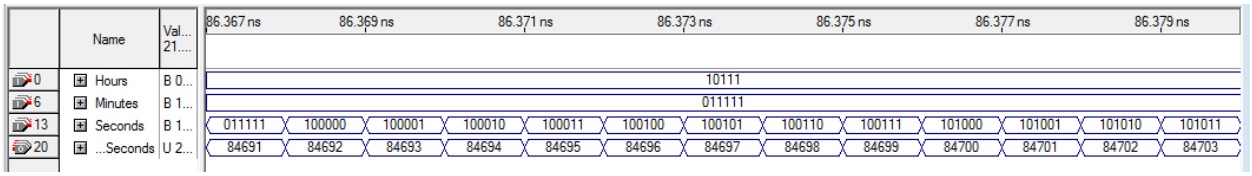
Representative simulation plots:



Beginning of plot



Middle of plot



End of plot

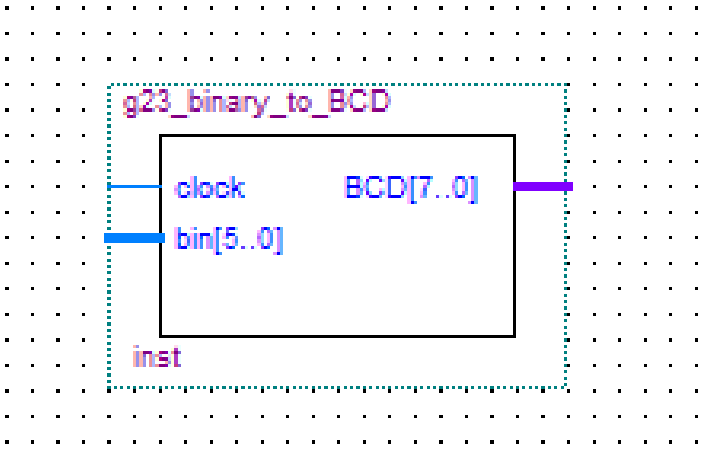
How do you know the circuit works correctly?

Based on the output values from our test, we can verify that our circuit works correctly by manually calculating the proper output for a given input.

For example:
at 104ps, seconds is 101000 minutes is 1, and hours is 0.
In decimal, seconds is 32+8=40 and minutes is 60 seconds so 40+60=100. Our output DaySeconds is 100 at that time period, confirming the validity of our circuit.

Title: g23_binary_to_BCD

Circuit Description: the g23_binary_to_BCD circuit calculates a 2 digit binary coded decimal (BCD) based on a binary input. We used a lookup table to 'lookup' values in a ROM instead of creating a complex sequence of logic gates because it was less tedious and had much shorter propagation delays. It takes a 6 bit binary input bin, and it outputs a 8 bit logic vector 'BCD' which represents the a 2 digit binary coded decimal.

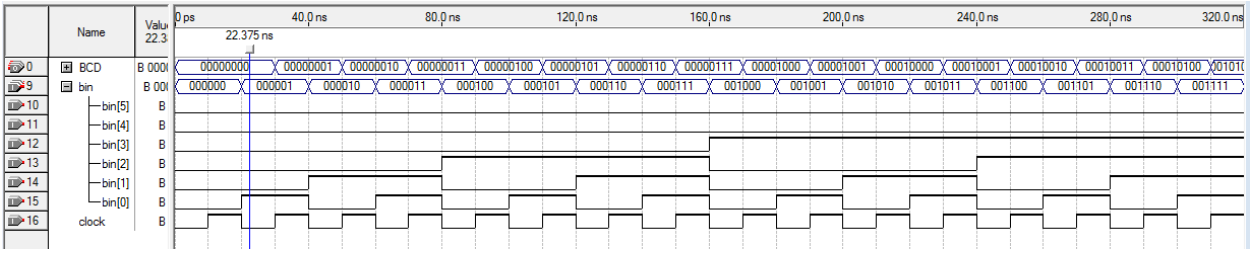


binary_to_BCD block diagram

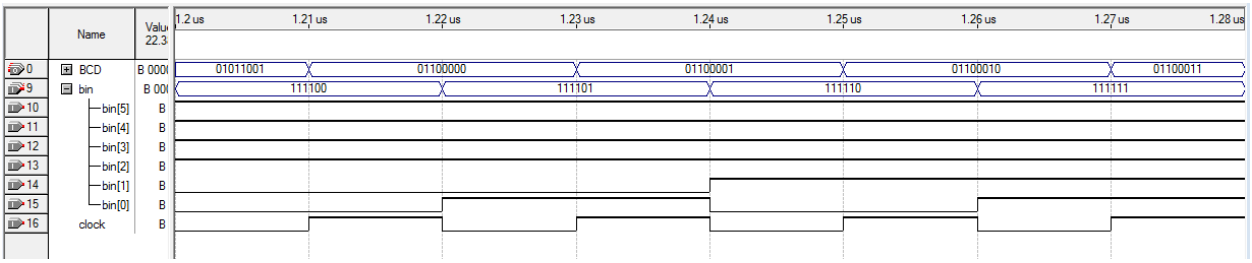
How the circuit was tested:

To test the circuit, we created a symbol for our circuit, created a new block diagram with our circuit, added input and output lines, and ran the circuit with ‘bin’ incrementing every 20ns. This gave us the following wave form which is also included in our submission as a vwf file. Because of the propagation delay, BCD values are output slightly after the inputs are set.

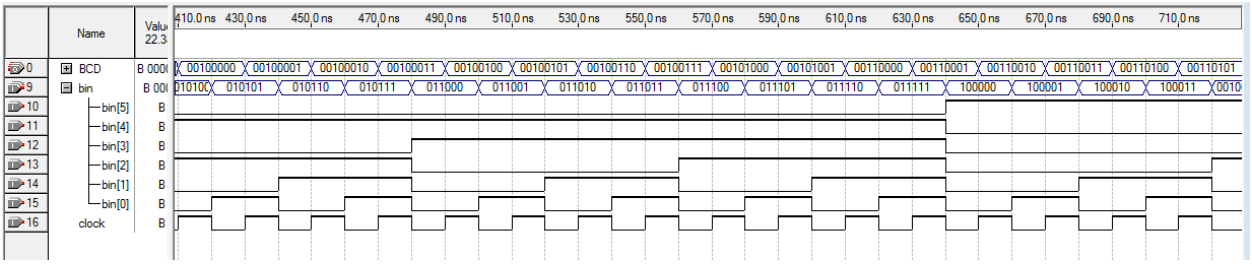
Representative simulation plots:



Beginning of plot



Middle of plot



End of plot

How do you know the circuit works correctly?

Based on the output values from our test, we can verify that our circuit works correctly by calculating the proper BCD output for a given 6 bit binary input.

For example:
When passed the input 110101 (which is 53 in decimal), our output is 0101 0011 when you manually convert the first 4 bits to decimal it gives 5 and when you convert the last 4 bits of the output, it gives 3. Thus our binary input of 53 gives an output of 53 encoded as a BCD.