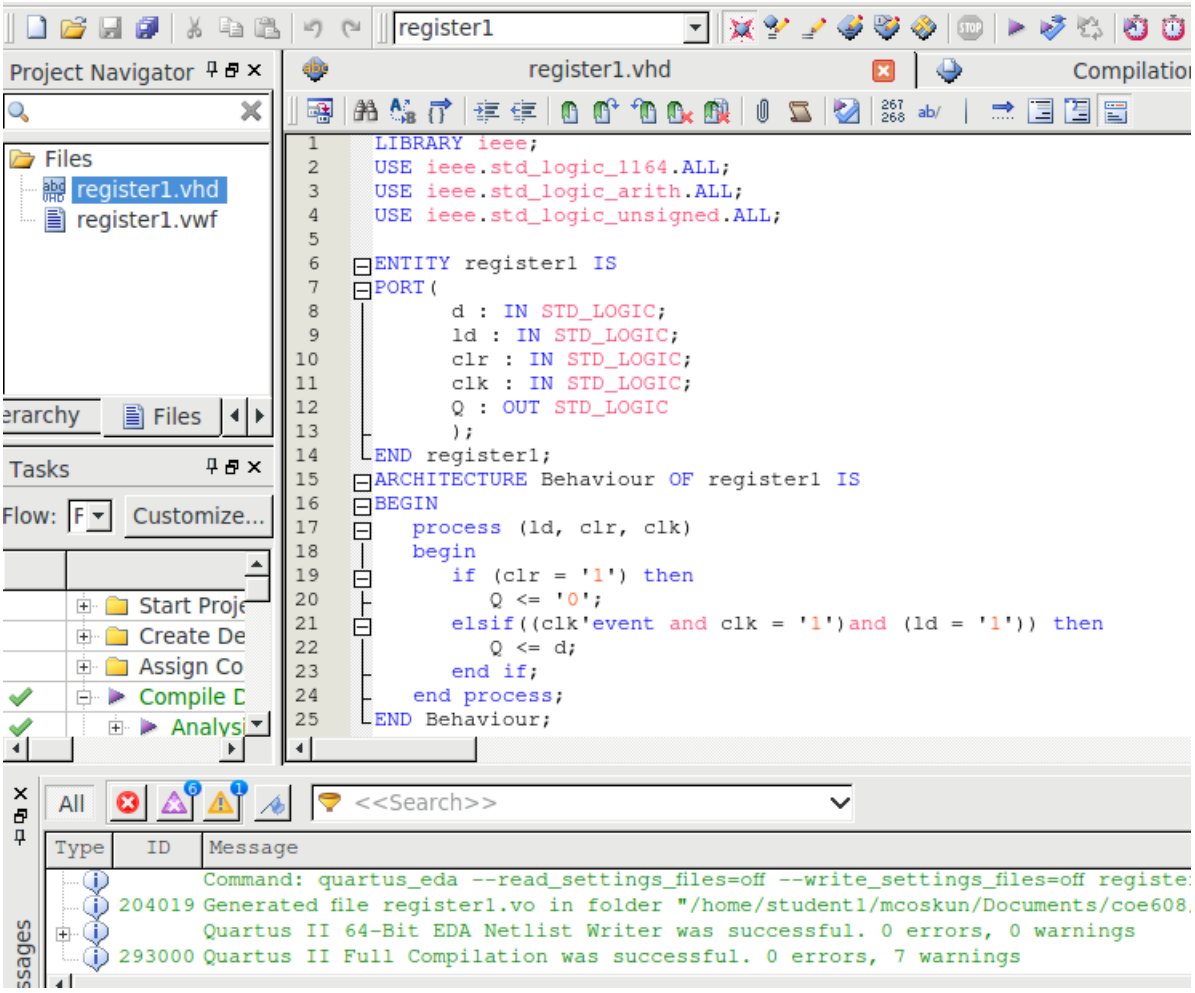
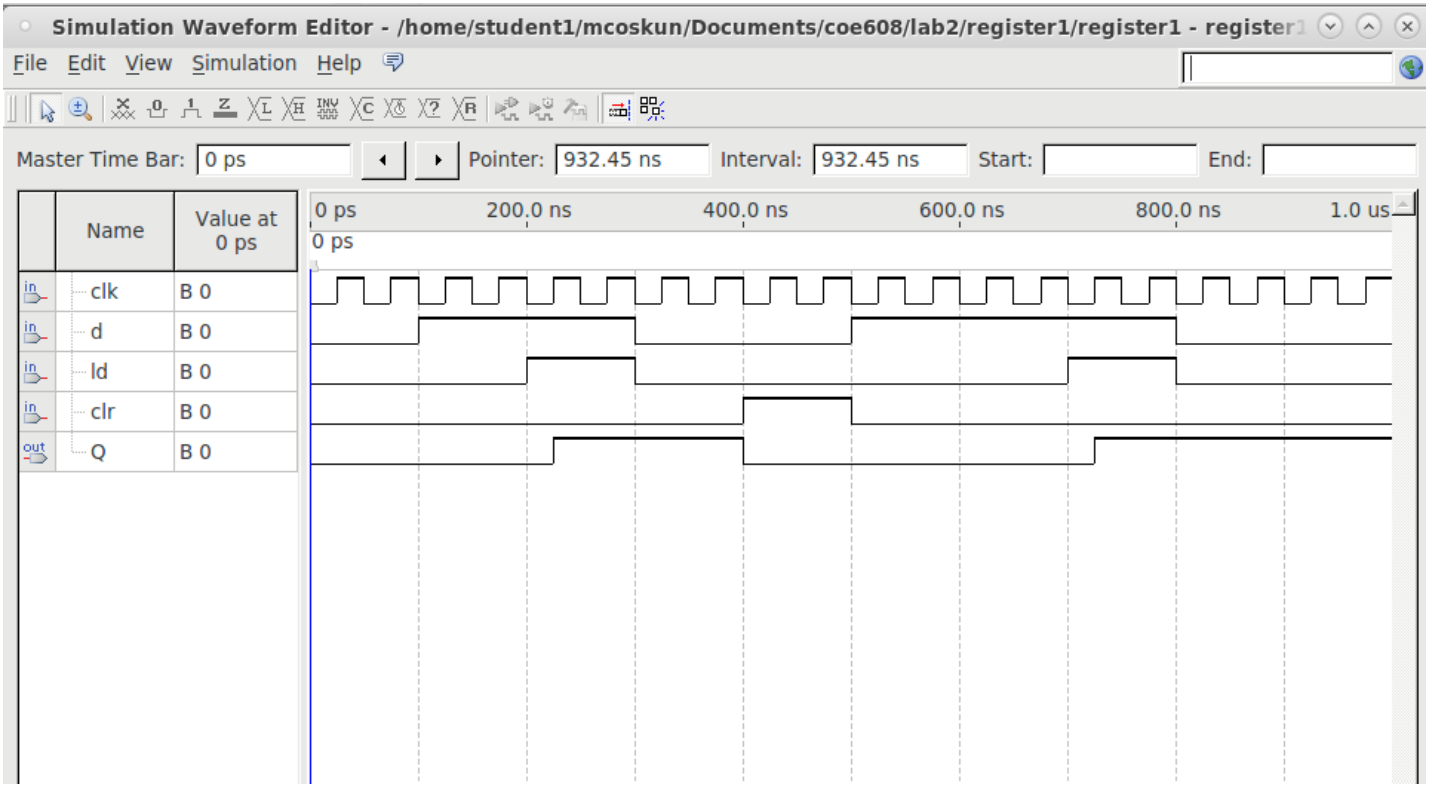
Below, you will see the implementation of 1-bit, 32-bir registers and program counter (32-bit register with additional control signals) using VHDL.

## Part 1:

The VHDL code of the first register (Register1) can be seen below.

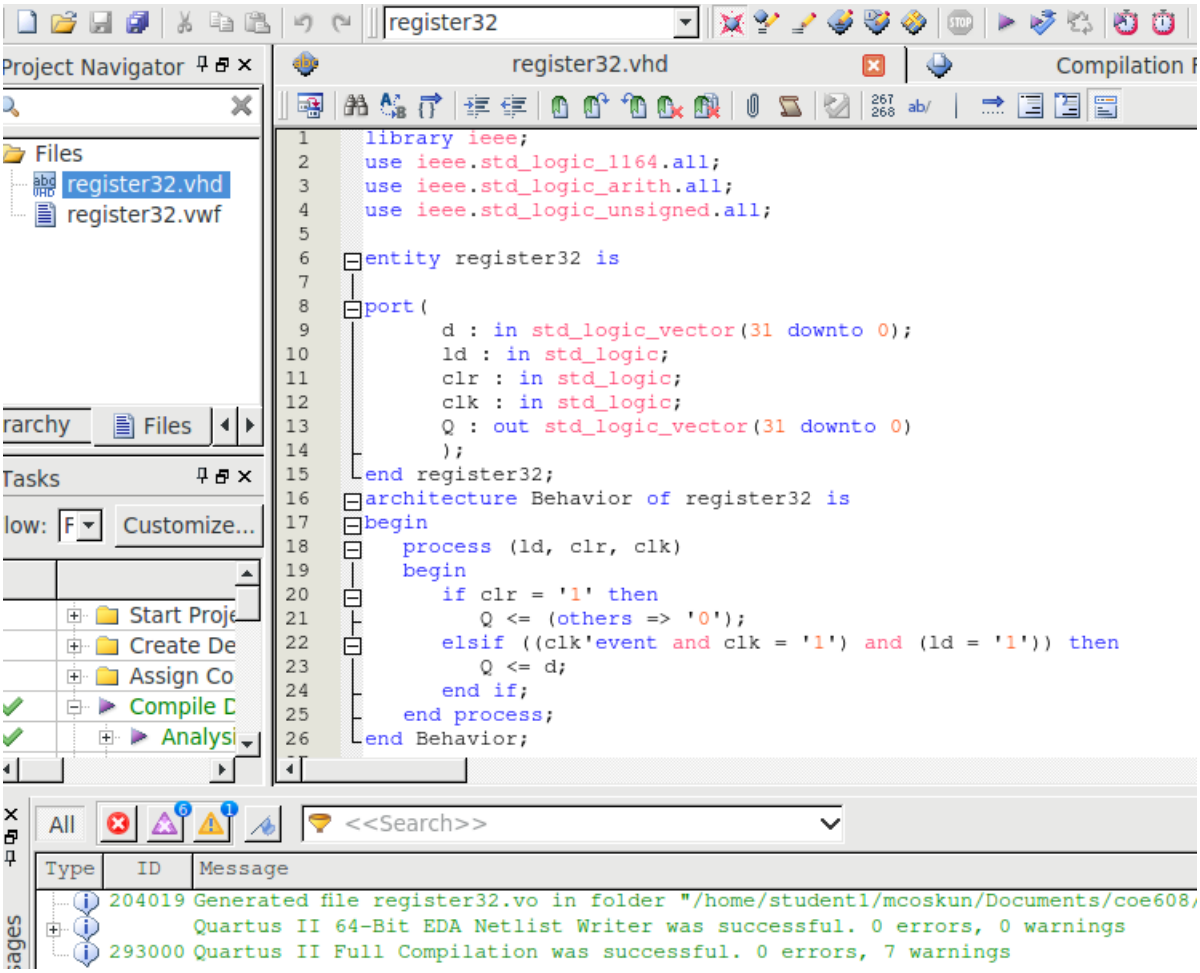



After compiling successfully, the waveform of register1 created following the lab manual instructions is displayed below.

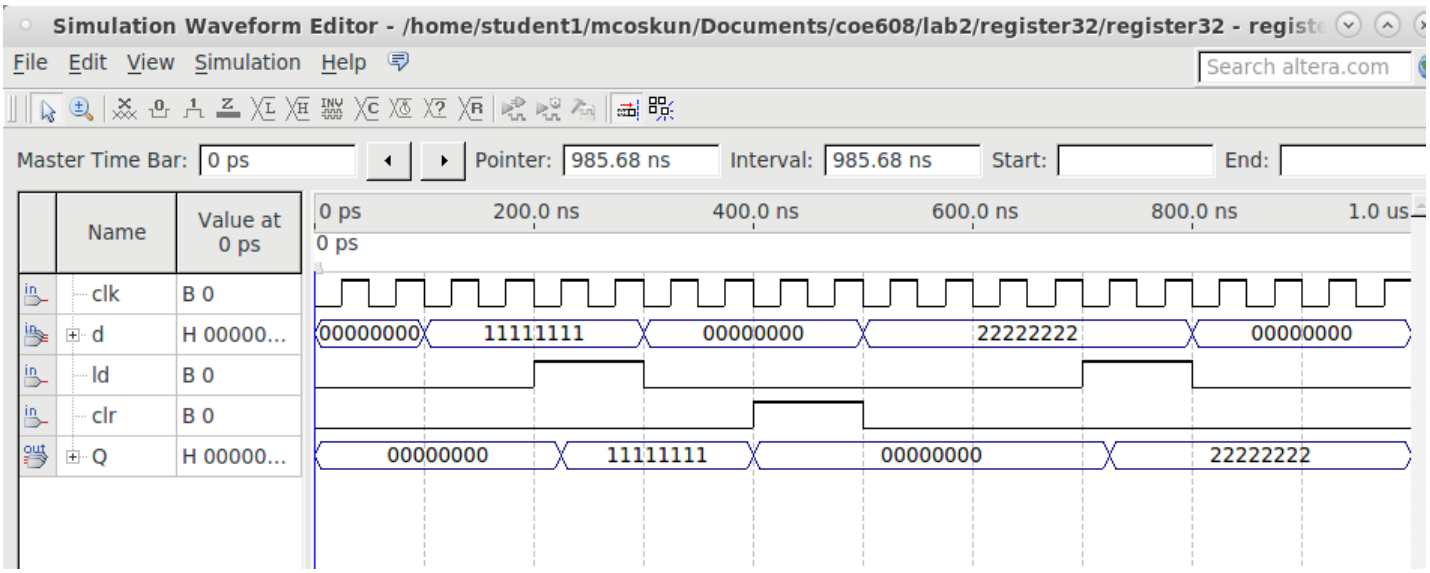



## Part 2:

The VHDL code of the second register (Register32) can be seen below.




After compiling successfully, the waveform of register32 created following the lab manual instructions is displayed below.




## Part 3:

The program counter consists of a multiplexer, addition code and register32 from the previous part (displayed below).

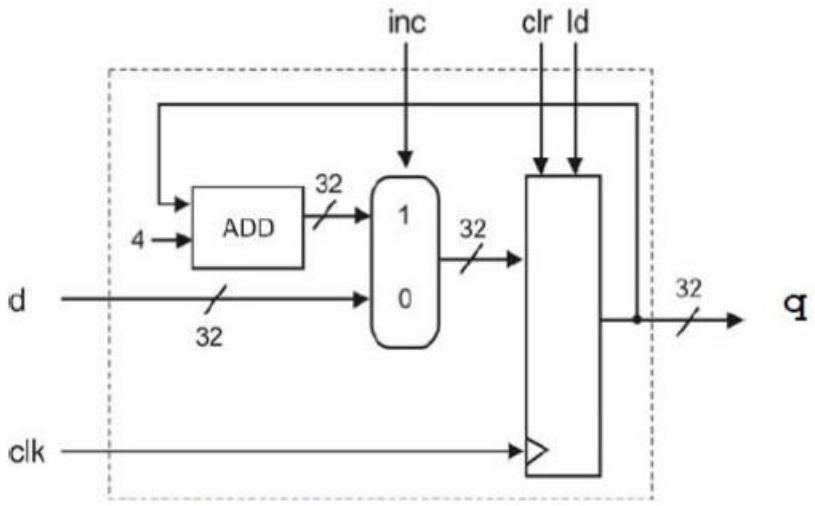
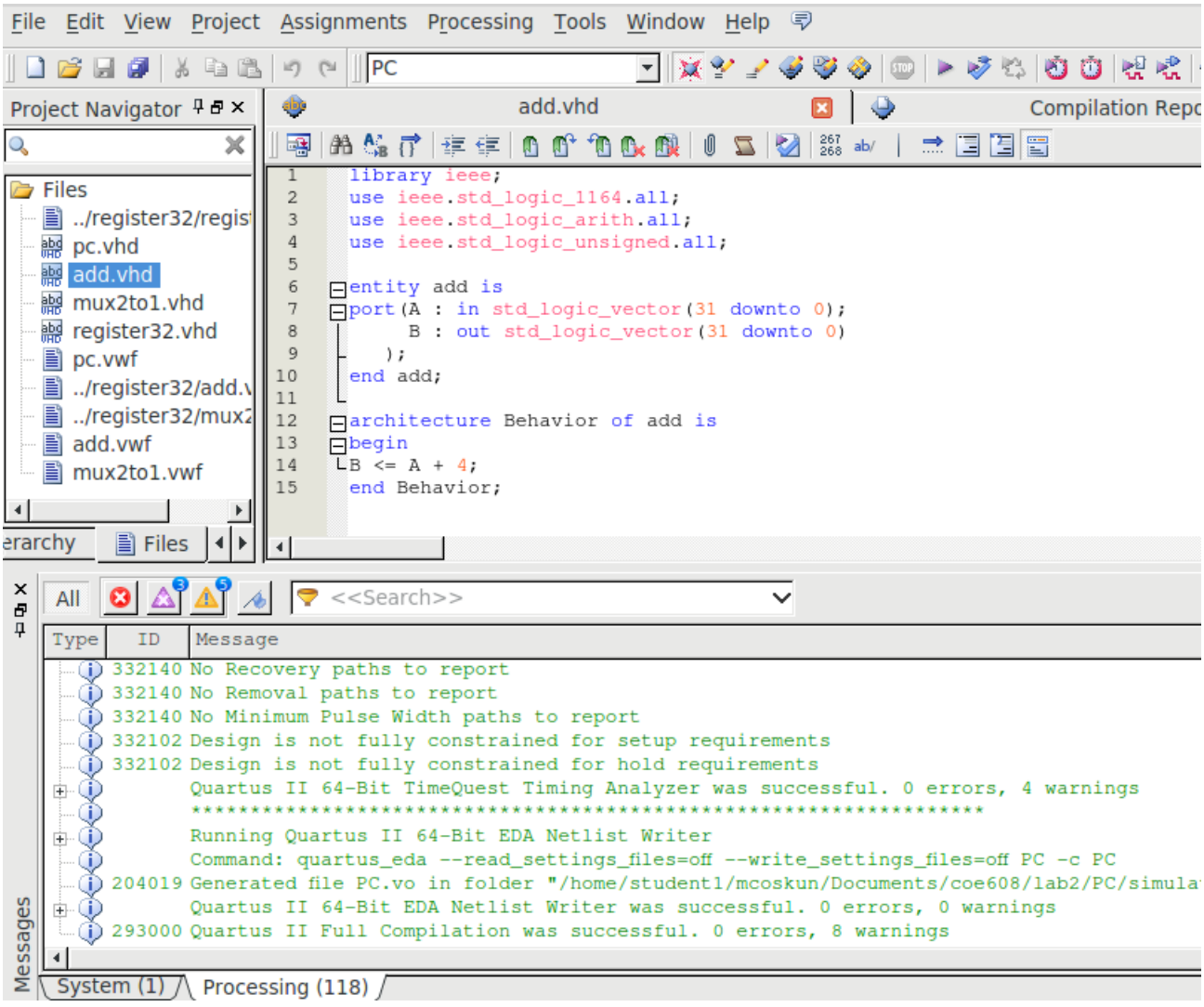
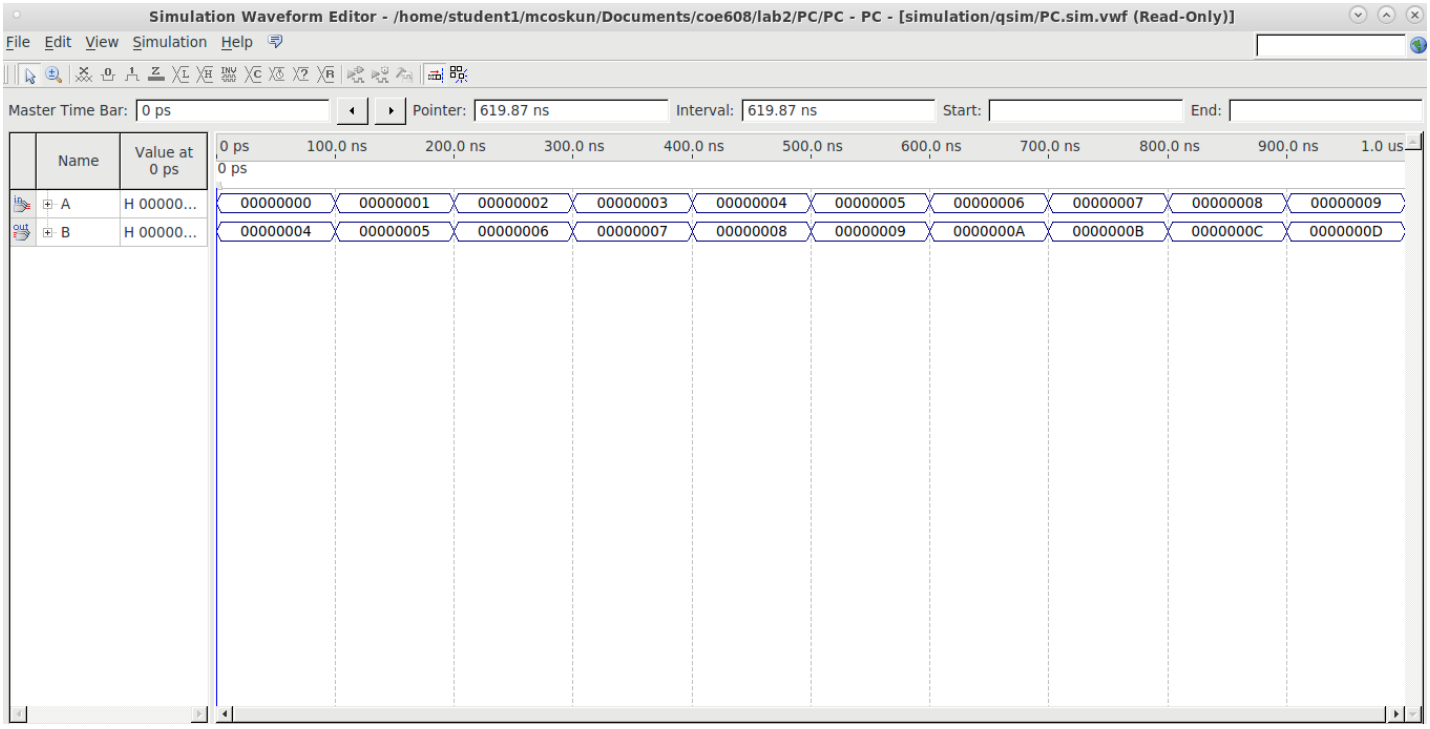



Figure 3: 32-bit Program Counter Internal Structure

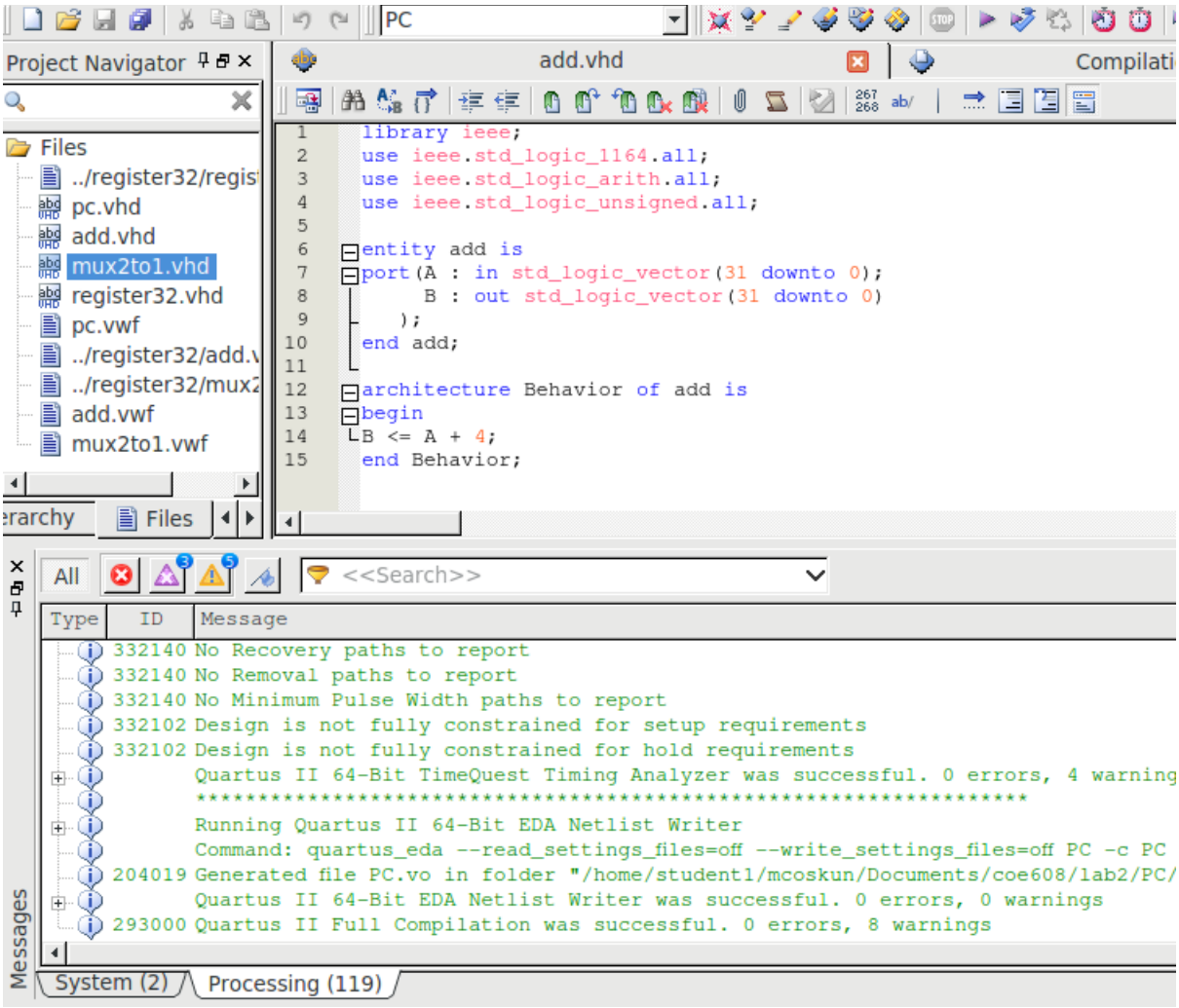
The VHDL code of the addition (add) can be seen below.



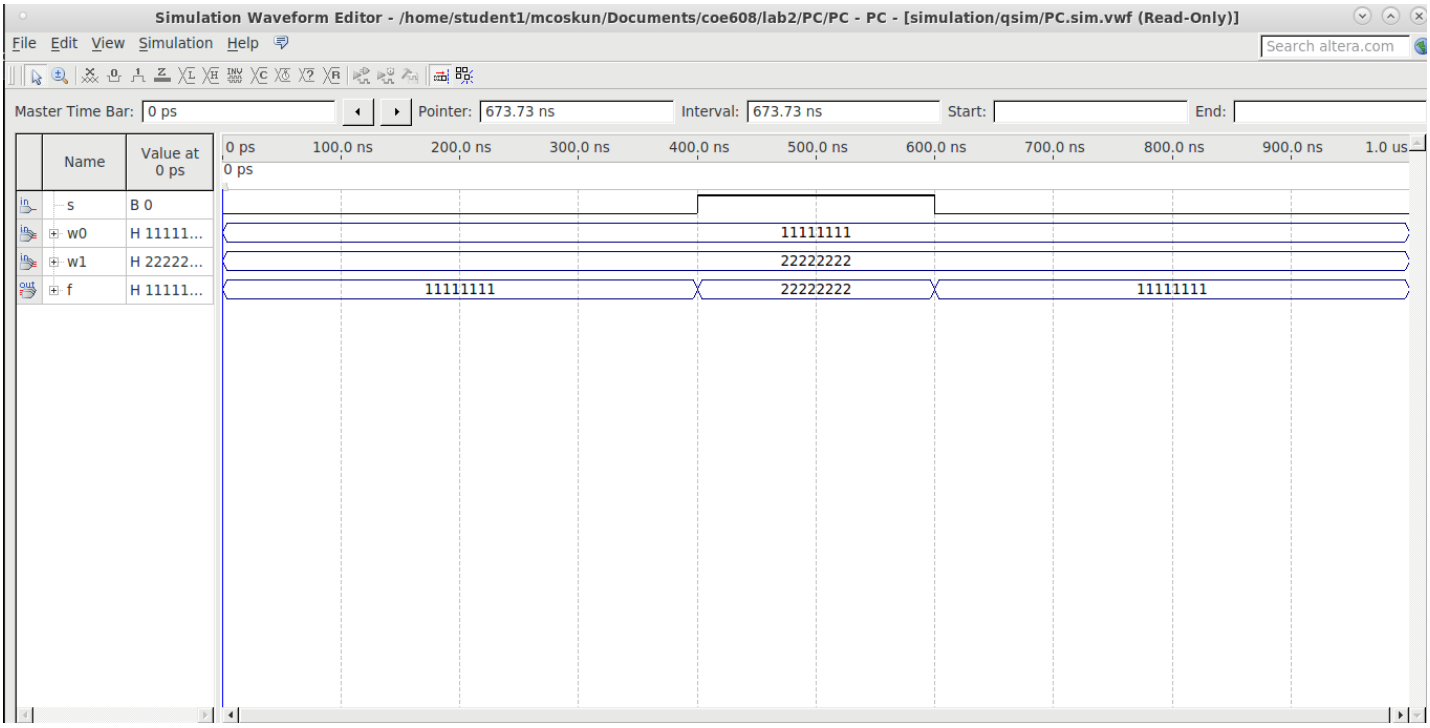
After compiling successfully, the waveform of add created following the lab manual instructions is displayed below.




The VHDL code of the multiplexer 2 to 1 (mux2to1) can be seen below.

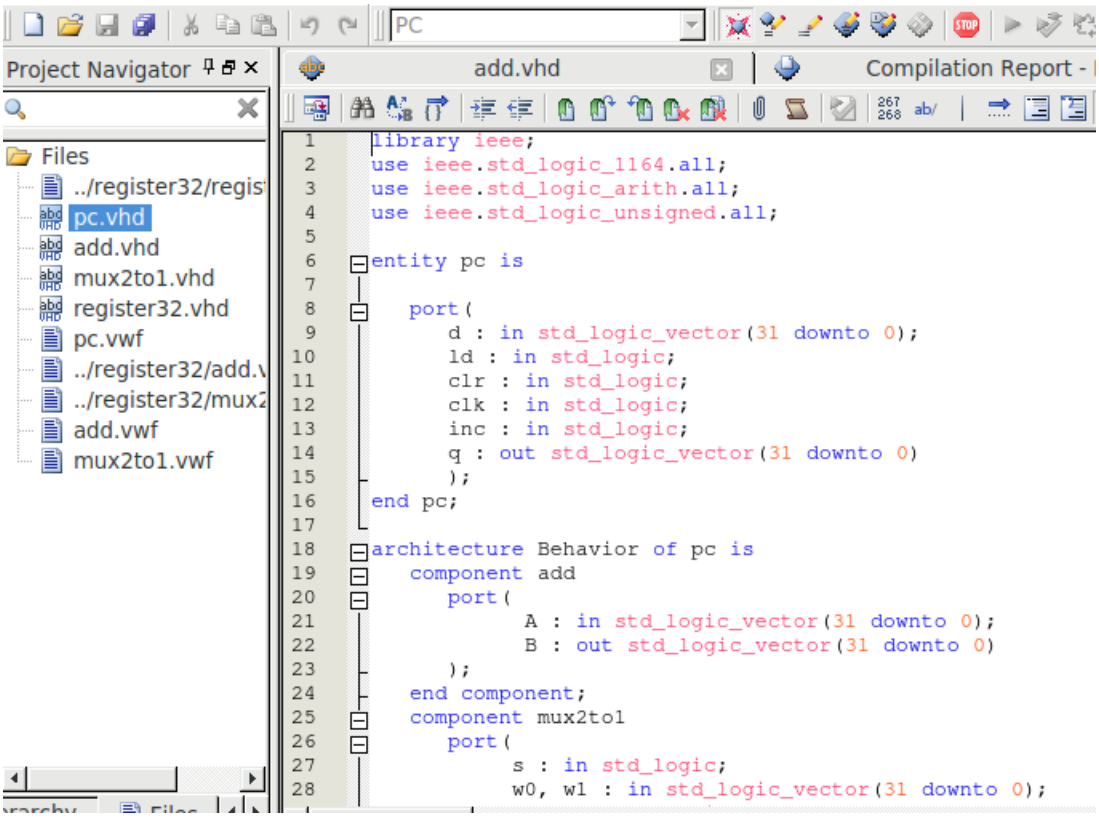



After compiling successfully, the waveform of mux2to1 created following the lab manual instructions is displayed below.

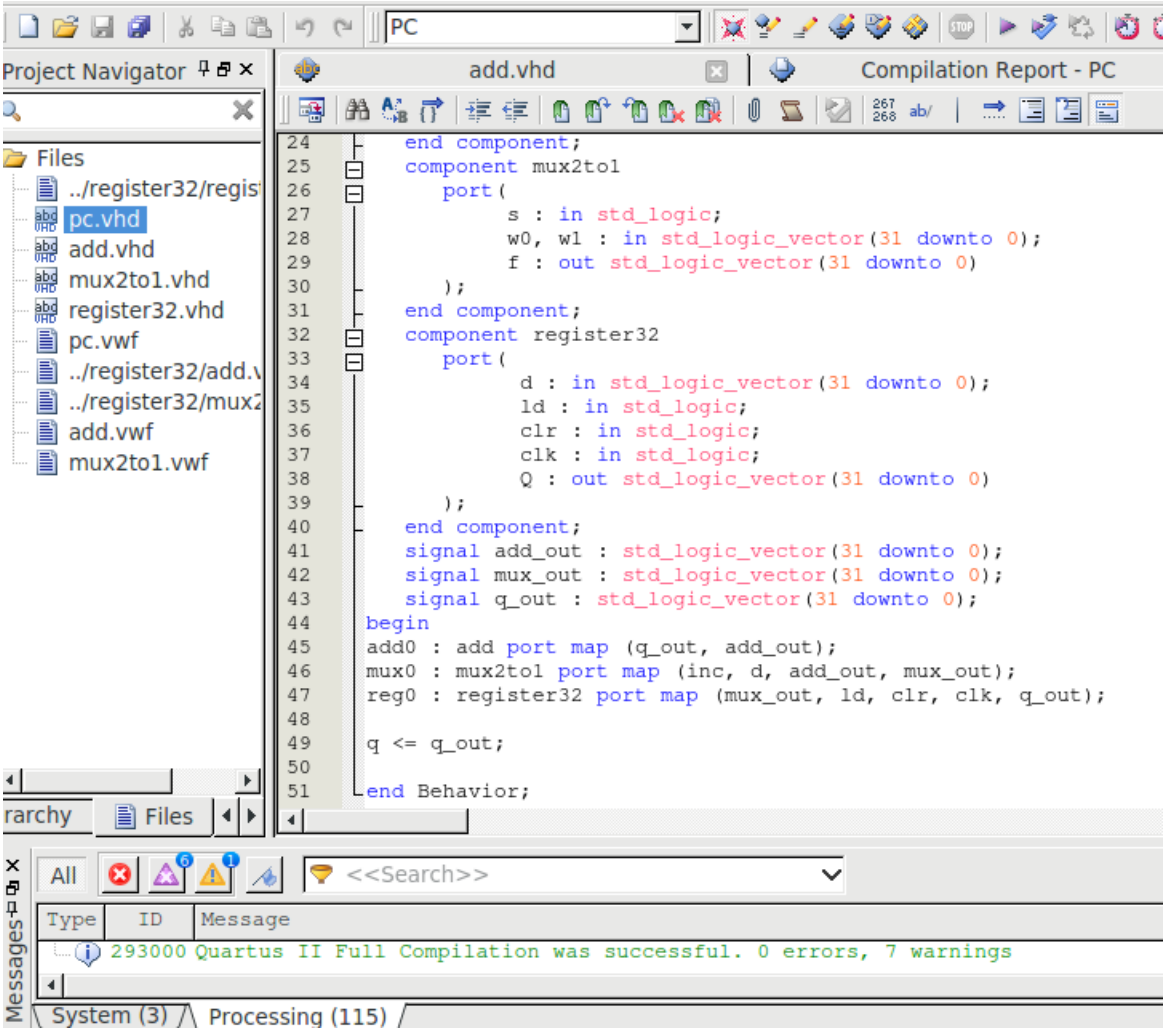



The VHDL code of the program counter (pc) can be seen below.

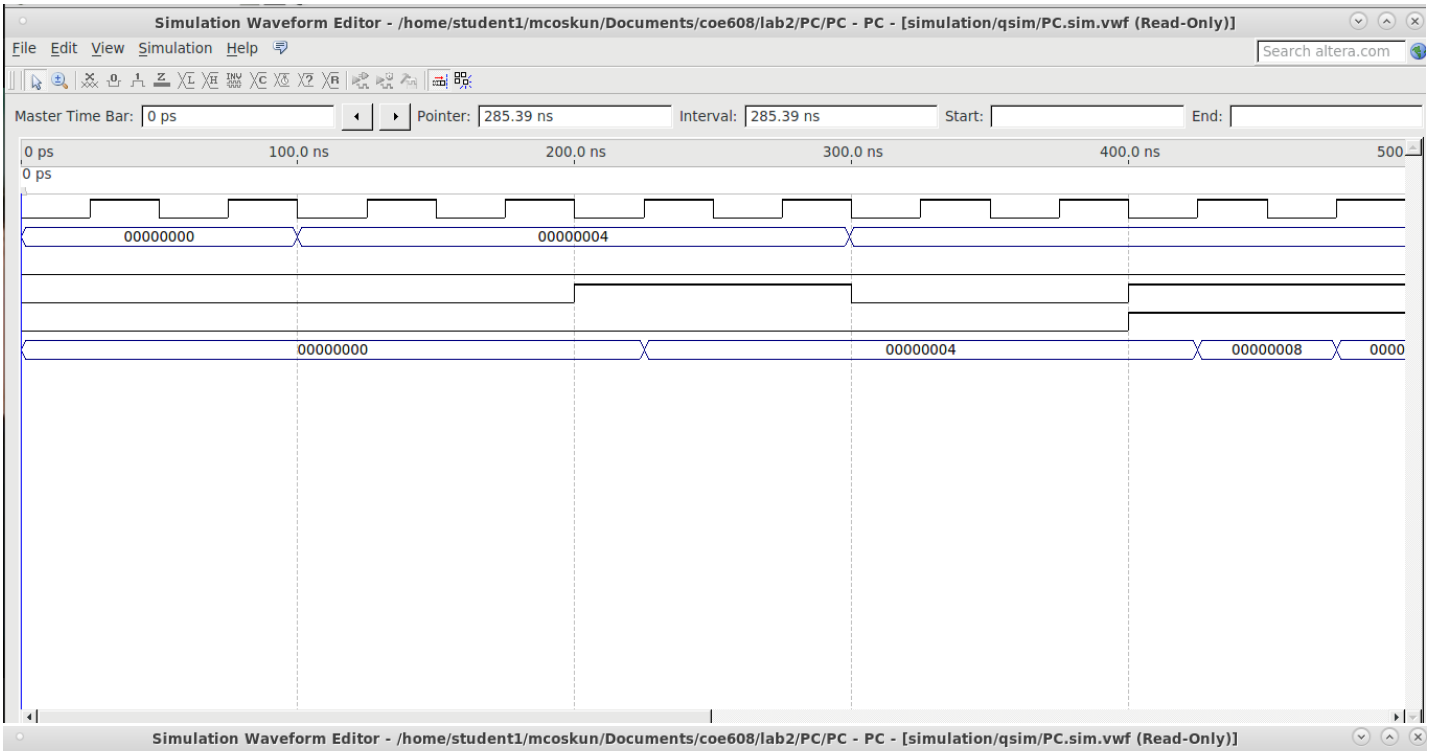
*First section:*

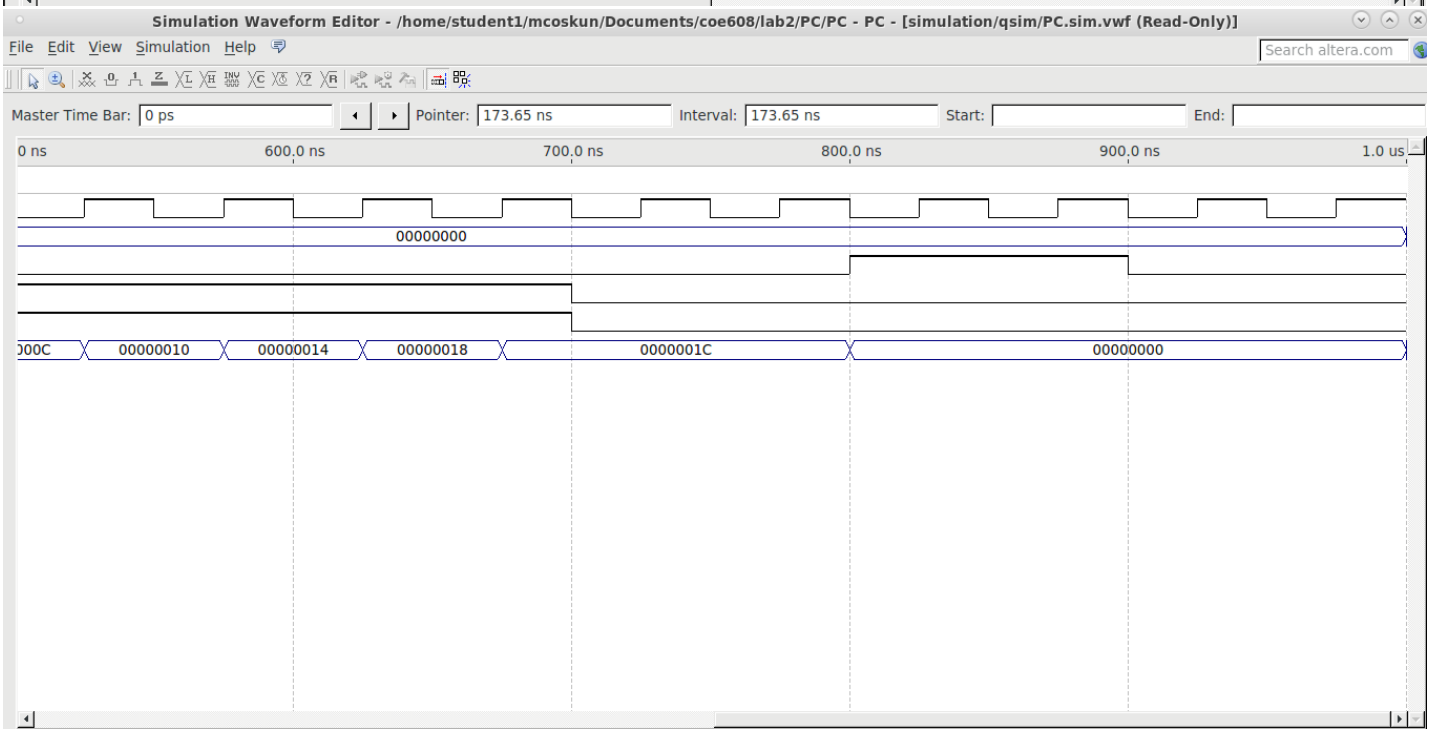


*Second section:*




After compiling successfully, the waveform of pc created following the lab manual instructions is displayed below.


Simulation Waveform Editor - /home/student1/mcoskun/Documents/coe608/lab2/PC/PC - PC - [simulation/qsim/PC.sim.vwf (Read-Only)]
File Edit View Simulation Help
Search altera.com
Master Time Bar: 0 ps
Pointer: 285.39 ns
Interval: 285.39 ns
Start:
End:
0 ps
100.0 ns
200.0 ns
300.0 ns
400.0 ns
500
00000000
00000004
00000000
00000004
00000008
0000


Simulation Waveform Editor - /home/student1/mcoskun/Documents/coe608/lab2/PC/PC - PC - [simulation/qsim/PC.sim.vwf (Read-Only)]
File Edit View Simulation Help
Search altera.com
Master Time Bar: 0 ps
Pointer: 173.65 ns
Interval: 173.65 ns
Start:
End:
0 ns
600.0 ns
700.0 ns
800.0 ns
900.0 ns
1.0 us
00000000
000C
00000010
00000014
00000018
0000001C
00000000