Using the NIOS II Soft Processor with Cyclone IV FPGA on Quartus Prime 18.1 Lite Edition

Synthesizing the NIOS II Processor:

1. Create Project using the Quartus Project Wizard.
   1. Enter the name and the top-level entity of the project
   2. Select the required Target Device/Board
2. Lunch Platform Designer from the Tools menu.
3. Under IP Catalog, click on Embedded Processors and add NIOS II Processor.
   1. Use the NIOS II/e (economical version)
4. Add On-Chip Memory and enter the required memory size as required.
5. Add JTAG UART for serial communication between host computer and the NIOS II processor (DE0-Nano Board).
6. Add other modules if required.
7. Complete the necessary layouts and connections such as clock, clock reset, data bus and instruction bus.
8. Base address should be assigned to each module that is added. Go to System -> Assign Base Address.
9. Under NIOS 2 settings, go to vectors and change reset vector memory and except vector memory.
10. Click on Generate HDL. Save the file name same as the top-level entity. It will generate a ‘.qsys’ file.
11. Close the Platform Designer.
12. In Project Navigator, add the ‘.qip’ file from synthesis folder.
13. Run the Analysis and Synthesis.
14. Pins should be assigned to the design. Under Assignments, click on Pin Planner and assign the pins as required.
15. Compile the whole project.
16. Program the DE0-Nano board.
    1. Go to Tools -> Programmer -> Hardware setup
    2. Add the ‘.sof’ file and write.

Programming the NIOS II Processor:

1. Under Tools, click on ‘NIOS II Software Build Tools for Eclipse’
2. Choose the Eclipse workspace directory for the project.
3. Under New, clock on NIOS II Application and BSF from Template. Add ‘.sopcinfo’ file that was generated earlier.
4. Select the processor (if there are multiple processors), select the template.
5. Once the project has been created, program the NIOS II Processor using Embedded C Language.
6. After this, right click on the project and click on ‘Build All’.
7. To run the program, right click on the project and select ‘Run as NIOS II Hardware’.
8. Select the ‘.elf’ file and click finish.