Universidade de Aveiro

Mestrado Integrado em Engenharia de Computadores e Telemática

Arquitectura de Computadores Avançada

DLX – Pipelining 1

Academic year 2019/2020 Adaptation of exercise guide by Nuno Lau/José Luís Azevedo

1. The `DLX.zip` archive contains a DLX/MIPS compatible graphical pipeline simulator written in Java that will be used to run a few simple code examples that illustrate some features of pipelining.

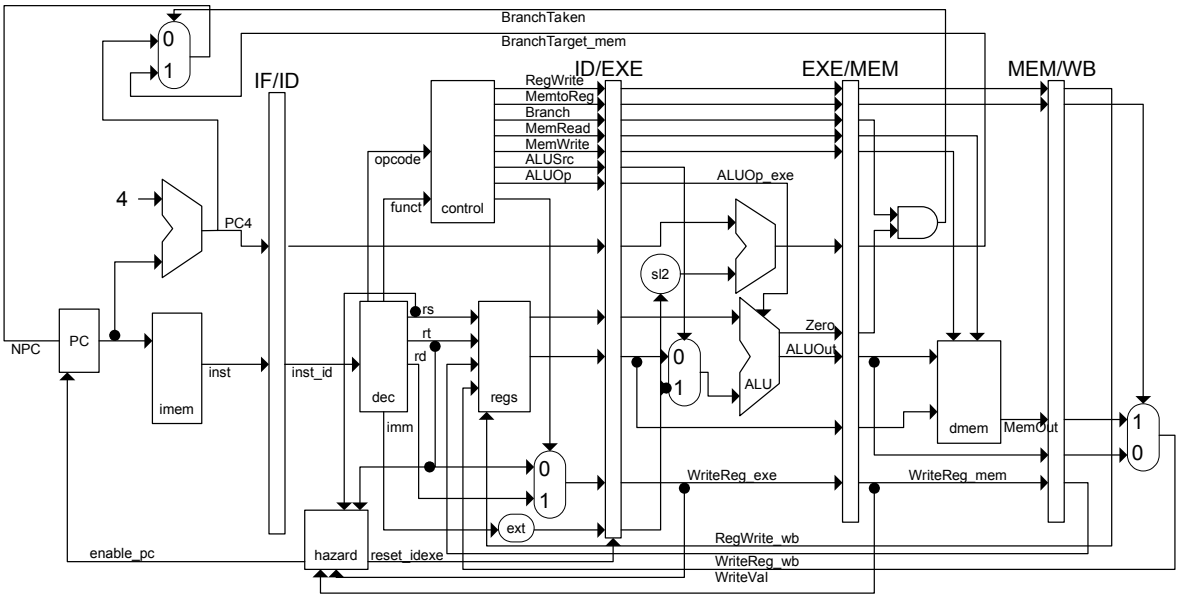
   1.1. Download and decompress the `DLX.zip` archive to your workspace under Linux.

   1.2. Read the `README` file to learn how you can run it.

2. Consider the programs `ex_1.s` and `ex2.s` located in the directory `./DLX/apps/dlx_apps` in turn. Read them carefully, trying to understand what they do.

   2.1. Determine the values that should be stored in the registers at the end of the execution.

   2.2. Sketch the clock cycle diagram of the execution in a processor with the five-stage pipeline architecture depicted below.



   2.3. Run the code in the DLX simulator with the *forwarding* option turned off. Check if the execution is correct. If not, explain what has happened?

   2.4. Intersperse `nop` instructions in the code so that the program now behaves as expected. What is the new clock cycle count for running the program?

   2.5. Run the original code in the DLX simulator with the *forwarding* option turned on. Compare the results with the previous runs.

3. Write a program that adds up the values of an integer array stored in memory. Run the code in the DLX simulator with the *forwarding* option turned off and then on. Take also into account in your runs the *branch predictor* alternatives: *none*, *static – predict always not taken* and *static – predict always taken*, and *initial predictor state* equal to *no initial state*. Discuss the results.