Lab#3 on Processor Design and Pipelining

1 Lab Outcomes

1. Understand processor design/ microprogramming at an elementary level.
2. Understand pipelinig at an elementary level.

2 Tasks

1. This lab/hw is worth 10%. Scoring is shown for 100.
2. This lab/hw tasks 1, and 2 do not use any software tool. TBD

2.1 Task: (2*25 points) Microprogramming

1. Exercise 17 on p327 Sarangi.
2. Exercise 18 on p327 Sarangi.

2.2 Task: (2*25 points) Pipeline Design

1. Exercise 20 on p409 Sarangi.
2. Exercise 21 on p409 Sarangi.

2.3 Bonus Optional Task: (30 points) Logisim and GHDL.

1. Do any one of Exercises 24, 25 or 26 on pp 327-328 Sarangi.
2. This task expects you to independently study (i) a tool called Logisim and/or (ii) a hardware design language (VHDL (VHSIC-HDL) (Very High Speed Integrated Circuit Hardware Description Language)) and its associated software.
3. The links given in Sarangi no longer work. See the References below.

3 Turn In

1. Submit a single pdf file with all answers in it. Including any diagrams and screenshots.

4 References

1. http://www.cburch.com/logisim/ "Logisim is a logic simulator which permits circuits to be designed and simulated using a graphical user interface. Released under the GNU Public License, Logisim is free software designed to run on the Windows, macOS, and Linux operating systems. Its code is in Java using the Swing graphical user interface library." {pmateti: No further development since 2014.}
2. https://www.youtube.com/watch?v=dYZ-Hwbcnq4 LogiSim ALU Tutorial
3. https://en.wikipedia.org/wiki/Hardware_description_language
4. https://github.com/ghdl/ghdl GHDL is an open-source analyzer, compiler and simulator for VHDL, a Hardware Description Language (HDL). GHDL is not an interpreter. It generates machine code from your design written in VHDL as a plain text file. GHDL runs on GNU/Linux, Windows and macOS; on x86,

x86$_{64}$, armv6/armv7/aarch32 and aarch64. You can freely download a binary distribution for your OS, use GHDL Docker images, or try to build it on your own machine.

5. https://www.youtube.com/watch?v=BDq8-QDXmek VHDL Lecture 1 VHDL Basics

5 End

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