

Homework 10 - Datapath and Control

- Template file for submitting the solutions:
https://grader.eecs.jacobs-university.de/courses/320241/2019.2/lectures/template_hw.tex
- The TAs are grading solutions to the problems according to the following criteria:
<https://grader.eecs.jacobs-university.de/courses/320241/2019.2/Grading-Criteria.CAPL.pdf>

Problem 10.1 *Control lines in datapaths* (1 point)

Why are control lines necessary in a single cycle datapath? How exactly do they interact with the multiplexors?

Problem 10.2 *Build single cycle datapath* (3 points)

Build and draw a datapath which can execute `add` and `addi` instructions only. Shortly explain the components and their interactions while executing the two instructions.

Problem 10.3 *Latencies in the datapath* (4 points)

Latencies of individual components of the datapath affect the clock cycle time of the entire datapath. Mux in the table below is short for multiplexer and Regs is short for registers. You can assume the following latencies in the logic blocks of a single-cycle datapath:

I-Mem	Add	Mux	ALU	Regs	D-Mem	Sign-Extend	Shift-left-2
450ps	110ps	30ps	120ps	250ps	350ps	20ps	0ps

- What is the clock cycle time, if the only type of instruction we need to support are the ALU instructions (`add`, `and`, etc.)?
- What is the clock cycle time, if we only have to support `sw` instructions?
- What is the clock cycle time, if we have to support `add`, `beq`, `lw`, and `sw` instructions?

Write down your computations and explain your reasons of including or excluding components from the table above.

How to submit your solutions

You can submit your solutions via *Grader* at <https://grader.eecs.jacobs-university.de> as a generated PDF file from the given template TEX file.

If there are problems with *Grader* (but only then), you can submit the file by sending mail to k.lipskoch@jacobs-university.de with a subject line that starts with CO20-320241.

Please note, that after the deadline it will not be possible to submit solutions. It is useless to send solutions by mail, because they will not be graded.

This homework is due by Monday, November 25th, 23:00.