

Exercise sheet 3 – Hardware

Goals:

- Basic knowledge about chip manufacturing
- Hardware circuits
- Interrupt handling

Exercise 3.1: Chip manufacturing?

We'll watch the *chip manufacturing* video from Infineon: https://www.youtube.com/watch?v=_Kj58yQ67KI

- What is the main commodity for computer chips.
- What is a transistor in the context of a microchip and how many pins does it have?
- How are the chips designed/programmed/planned?
- What kind of production environment is required to produce computer chips?
- How many chips can be produced on a wafer?
- How many pins does each chip have?

Exercise 3.2: Update RA repository

- `cd RA_exercises`
- `git pull`

Exercise 3.3: Hardware: combinatorial circuit vs. sequential circuit?

- Describe the difference between combinatorial circuits and sequential circuits.
- The programmable logic device (PLD) *GAL 16v8* can be run in 'simple mode' without a clock entry or in 'registered mode' with clock entry (cf. [RA_exercises/sheet_03/lattice_gal16v8.pdf](#)). State the reference to the question 3.3a.

Exercise 3.4: Hardware: GAL Programming

For this exercise use the [RA_exercises/sheet_03/gal16v8_logic_diagram_registered_mode.pdf](#) file as a template for your drawings (programming). Program the GAL16V8 in **registered mode**. *Hint: You may print this or you use a PDF annotator like Xournal++.*

- Denote the clock input as: CLK .
- Denote the inputs as: A_0, A_1, \dots
- Denote the outputs as: Q_0, Q_1, \dots
- Program $Q_0 = \bar{A}_2 + A_7$
- Program $Q_1 = A_3 \cdot \bar{A}_2 \cdot A_1 \cdot \bar{A}_0 + A_3 \cdot A_4 \cdot \bar{A}_5 + A_6$
- Program $Q_2 = A_7$
- Program $Q_3 = A_6 \cdot A_3 \cdot Q_0 + \bar{Q}_2$

Exercise 3.5: Signal propagation time of the Lattice GAL16V8

- The Lattice GAL16V8 has a maximum signal propagation time of $t_{max} = 3.5$ ns. What is the supported theoretical maximum frequency F_{max} in MHz?