

Exercise sheet 4 – Hardware, Processor architecture

Goals:

- Interrupt handling

Exercise 4.1: Processor architecture: Interrupt handling (theoretical)

Given information:

- Interrupt vector address is 0x20
- Position of interrupt service routine (ISR) starts at 0x4000
- Stackpointer (SP) contains 0xFFFF74
- Program counter (PC) respectively instruction pointer (IP) contains 0x10000
- Consider a micro controller without an operating system

- Recapitulate the sequence of an interrupt.
- Draw a sketch and show the changes according to the processing of an interrupt in different colours. The drawing should contain at least a memory view including addresses (32 bit: 4 byte with) and the PC and SP registers.

Exercise 4.2: Short introduction into Arduino programming with Tinkercad circuits (coding)

We do this together, as a kick starter for you.

- Login into <https://www.tinkercad.com>. Use the *ad hoc* provided link (during the exercise) to login to the Tinkercad class room.
- Open circuits
- Create new circuit
- Open „Button“ example: *Starters Arduino: „Button“*
- Start simulation and then press the button
- Stop the simulation
- Inspect the code by changing to „Text“

Exercise 4.3: Update RA repository

- `cd RA_exercises`
- `git pull`

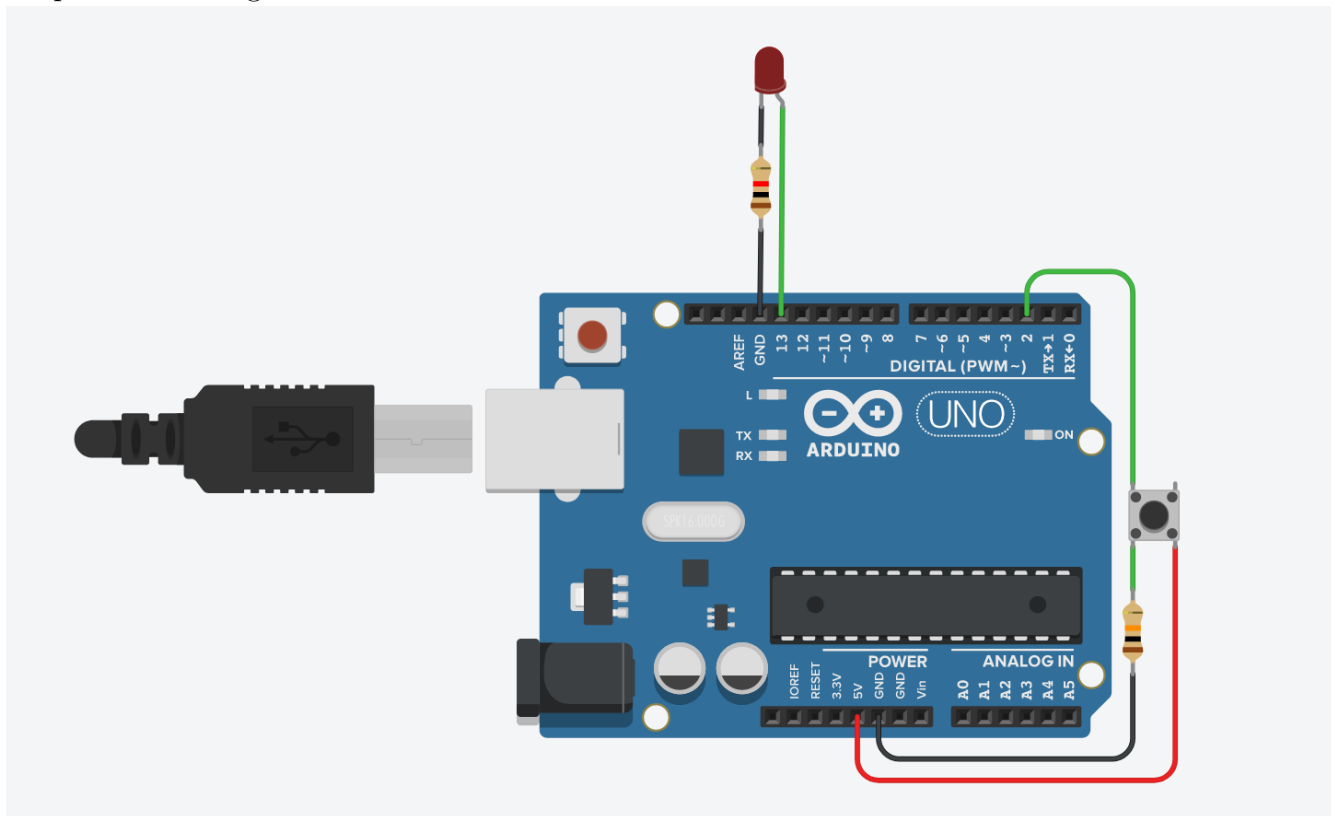
Exercise 4.4: Processor architecture: Interrupt handling (coding)

We want to write an Arduino sketch which toggles the built-in LED when a button is pressed. If the button is pressed, an interrupt occurs which calls an ISR.

- Use the *ad hoc* provided link (during the exercise) to login to the Tinkercad class room.
- Create a new circuit using the *Starters Arduino: „Button“*



(c) Prepare the wiring as follows:



- (d) Copy the content of the `RA_exercises/sheet_04_online_only/io_interrupt/io_interrupt.ino` template into the code part of your Tinkercad circuit.
- (e) Follow the TODOs in the code. Some configuration depends on your wiring of the I/O pins.
Hint: The Arduino reference contains descriptions of the used functions: <https://www.arduino.cc/reference/en>.
- (f) Start the simulation
- (g) Press the button to test your sketch. Does it work as expected?
- (h) You can also open the „Serial Monitor“ to do some debugging with the text based logging.