Linnéuniversitetet

1DT301, Computer Technology I, autumn 2019.
Lab. 3: Interrupts.

Goal for this lab:
Learn how to use interrupts for digital inputs.

Development environment: **AVR Studio4 or AVR Studio6**

You have to write comments that explain the code in each program. The structure of each program has to be explained with Flow Charts for each program. (each task)

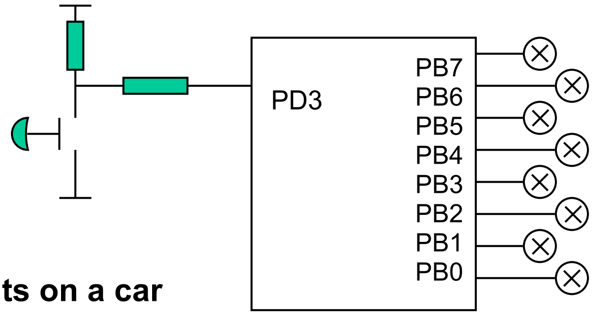
Presentation of results:

Present each task for the teacher when you have solved the task. A written report of all assignments should be submitted after each lab, containing the code and a brief description of results. The report must also include flowcharts for all programs.
The report should be sent to the lab teacher within 1 week, thus before next week lab. Use text in the programs (comments) to explain the function. Each program must also have a header like the example below.

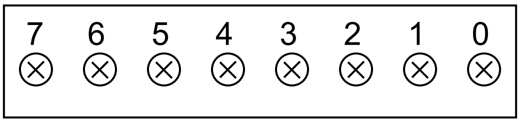
```
;>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
;           1DT301, Computer Technology I
;           Date: 2015-09-03
;           Author:
;                       Student name 1
;                       Student name 2
;
;           Lab number: 3
;           Title:      How to use interrupts
;
;           Hardware:   STK600, CPU ATmega2560
;
;           Function: Describe the function of the program, so that you can understand it,
;                     even if you're viewing this in a year from now!
;
;           Input ports: Describe the function of used ports, for example on-board switches
;                       connected to PORTA.
;
;           Output ports: Describe the function of used ports, for example on-board LEDs
;                       connected to PORTB.
;
;           Subroutines:          If applicable.
;           Included files:       m2560def.inc
;
;           Other information:
;
;           Changes in program: (Description and date)
;<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```

Task 1:
Write a program that turns **ON** and **OFF** a LED with a push button. The LED will be extinguished when pressing the button.
The program will use Interrupt. Connect the push buttons to PORT D.
The program should have a main program that runs in a loop and wait for the interrupts. An interrupt routine is called when the push button is pressed. Each time the button is pressed, the lamp should switch from ‘**OFF’** to ‘**ON**’, or from ‘**ON’** to ‘**OFF’**.

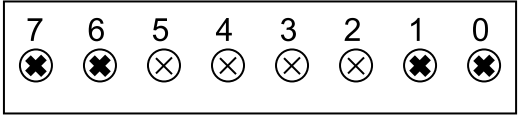
Task 2: Switch – Ringcounter / Johnsoncounter, with interrupt
Write a program that by means of a switch can choose to flash 8 LEDs either in the form of a ring counter or in the form of a Johnson counter. Use the switch SW0 connected to PORTD to switch between the two counters. Each time the button is pressed, a shift between the two counters should take place. By using interrupts you’ll swap directly with no delay.



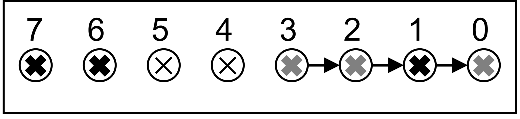
Task 3: Rear lights on a car
Interrupt.
Program that simulates the rear lights on a car
The 8 LEDs should behave like the rear lights.



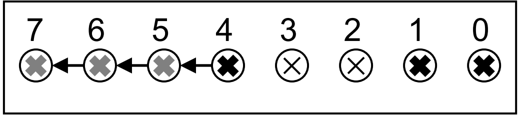
Normal light



Turning right. 3-2-1-0 ring counter.



Turning left. 4-5-6-7 ring counter.



Function:
Normal light: LED 0, 1, 6 and 7 ’ON’.

Turning right:
LED 6 – 7 on, LED 0 – 3 blinking as RING counter.

Turning left:
LED 0 – 1 on, LED 4 – 7 blinking as RING counter.

See manual for how to set Interrupt registers: EICRA and EIMSK

Task 4: Rear lights on a car, with light for brakes
Add function for the stop light to the previous task. When braking, all LEDs light up, if blink on the right or left is not going on.
Turning right and brake:
LED 4 – 7 on, LED 0 – 3 blinking as RING counter.

Turning left and brake:
LED 0 – 3 on, LED 4 – 7 blinking as RING counter.
Use INT2 for the Brake.