Practical Exercise – Microcontroller Techniques
Prof. Dr. L. Reindl
Laboratory for Electrical Instrumentation

Contact: Sebastian Stöcklin
sebastian.stoecklin@imtek.uni-freiburg.de

Winter term 2016/2017

Exercise sheet 1 - Digital outputs

The digital in- and output (I/O) ports are among the basic peripherals of a microcontroller. Depending on the device family, there are several universal I/O ports. In this case, a "port" is the grouping of usually eight bi-directional I/O terminals, which are controlled by a register of the processor. The respective connections are referred to as "pins". As a microcontroller typically has significantly more peripheral functionality than pins, the funcational elements being provided by a single pin have to be multiplex. The pin's routing is thereby determined by the configuration of a special register.

In experiment 1, we will take a closer look into the configuration of the registers controlling the digital I/O ports. First of all, a digital port must be initialized. For that purpose, the desired functionality of the port pins must be defined in the function select register (PxSEL)[1]. Next, the direction of the pins has to be selected, by granting either read access (input pin) or write access (output pin). For this, the corresponding bits must be set in the direction register PxDIR[2]. If the direction is set (input or output), the status (High / Low) of each port pin can be changed by the PxOUT register[3].

Note:
Unless noted otherwise, you should always merge all tasks of an exercise sheet into one piece of source code. The required tasks are intended to run in parallel. ***Keep that in mind for the following exercise sheets!***

Task 1

a) Connect `K3` (`LED rt`) with `CON3:P1.4`. Let the red LED flash with a visible frequency of about 2 Hz, the duty cycle[4] should be 50 %. (**3 pts.**)

b) Let the blue LED `CON3:P1.5` blink with the half of the frequency of the red LED. Therefore, look for the required pin in the circuit diagram (**2 pts.**). Please enter a comment section in your program giving additional information on the functionality of this pin. Which other the devices can be controlled by the pin? Which other conditions have to be fulfilled for operating this addtional device properly? (**1 pt.**).

c) Whenever data is received by the serial interface (and only then!), return the current state of the blue LED to the serial interface (is it on or off?). For this purpose, use the predefined functions from the EMP template, which can also be found on the web platform.[5] (**3 pts.**).

Please also consider page 2.

[1] see MSP430x2xx Family User Guide: Section 8.2.5, page 329 and Datasheet MSP430G2x53 page 42ff
[2] see MSP430x2xx Family User Guide: Section 8.2.3, page 337
[3] see MSP430x2xx Family User Guide: Section 8.2.2, page 336
[4] duty cycle D = time the signal is active T to the total period of the signal $\tau \Leftrightarrow D = \frac{T}{\tau}$
[5] The serial functions all work on the serial console, which can not be accessed directly by CCS; instead, use HTerm: `http://www.der-hammer.info/terminal/`

Task 2

a) Create a file `feedback.txt` with a brief feedback statement, which contains specific problems and issues you experienced while solving the exercise, additional requests, positive remarks, etc. (**1 pt.**).

b) Import this text file `feedback.txt` in your Code Composer Studio project, so that you can upload it together with your software deliverable.