Important: You have to do this exercise in room 1-250.

You have to use a Hitex STR9 stick and   
an add-on board with LEDs and 7-segment display.

**Exercise 1: Traffic light (40)**

Copy your exercise 5-1 directory or unpack the tgz- file in a new directory

(Exercise6-1).

Rename the main program and change the Makefile accordingly.

Program a traffic light on the str9Stick. First design a finite state automate. Note that the transitions are bound to time constraints. Use the add-on board for this task. It must be connected to the cable to the connector. The LEDs (red, yellow, green) on this board are active high, so they light up when writing a 1 to the port. Ignore the 7-segment display, it does not matter for this task!

Specifications for the traffic light:

* The green phase is 2 sec, 1 sec yellow , red 3.5 sec and yellow/red for 0.5 sec Then it starts again.
* The LEDs are connected to the following ports:
  + red at GPIO 4.0,
  + yellow at GPIO 4.1,
  + green at GPIO 4.2.
* You should use the 0.5sec Timer (HalfSecond) (see exercise 4-1). You can increment a time counter here.
* You can use the LED of Exercise 5-2 as a ’heartbeat’.

Note: Accessing the LED-port pins (GPIO 4.0, 4.1, 4.2) is   
similar to the Onboard – LED ( GPIO 9.0 ).

Remember to:

* switch on clock for GPIO 4.
* reset the clock for GPIO 4.
* Use the alternate function 1 (01b) for the GPIO ports.
* Set the Data Direction Register (DDR) to output (1).
* You can switch on data bit x with this command:   
  GPIO4->DATA[1«(2+x)] = BITx;

**Exercise 2: Students number (40)**

Copy your exercise 5-1 directory or unpack the tgz- file in a new directory   
(Exercise6-2).

Rename the main program and change the Makefile accordingly.

This program shall display your student number. Each number should be shown for 3 seconds, between 2 numbers the display is black for 0.5 seconds, at the end the display is black for 2 seconds and the program begins again.

The seven- segment display is connected to the following ports:

* + segment g at GPIO 4.0,
  + segment f at GPIO 4.1,
  + segment e at GPIO 4.2,
  + segment d at GPIO 4.3,
  + segment c at GPIO 4.4,
  + segment b at GPIO 4.5,
  + segment a at GPIO 4.6.
* The segments on this board are active low, so they light up when writing a 0 to the port.
* You can use a subprogram to display a number on the display   
  **(int segment(int num))**.
* You should use the 0.5sec Timer (HalfSecond) (see exercise 5-1). You can increment a time counter here.
* You can use the LED of Exercise-2 as a ’heartbeat’.
* Without the filter function you can set several bits at one time:   
  **GPIO4->DATA[255«2]= BITARRAY**;  
  e.g. a 1 (segment b and c are active low (0)):  
  **🡪 1100 1111 = 0xCF 🡪 GPIO4 🡪 DATA[255«2] = 0xCF;**



**Exercise 3: Combination Traffic light + students number (20)**

Copy your exercise 5-1 directory or unpack the tgz- file in a new directory   
(Exercise6-3).

Rename the main program and change the Makefile accordingly.

Change your program, so exercise 1 and 2 are executed after each other. Between both programs there should be a break (black display) of 2 seconds.

Important: You have to do this exercise in room 1-250. You have to use a Hitex STR9 stick and a Picoscope USB-oscilloscope.