

# COMP9032 Experiment 3

Sept. 2015

## 1. Objectives

In this lab, you will learn AVR programming on

- Parallel input/output,
- Interrupt, and
- Input from keyboard

## 2. Preparation

Before coming to the laboratory, it is recommended that you:

- Download and install the Arduino software (avrdude-5.11-Patch7610-win32.zip available on the course website)
  - arduino-1.0.6-windows.exe
- Read “Introduction to Lab Board” and understand how to use the lab board.
- Write your programs at home in order to finish the experiment on time.

## 3. Tasks

### 3.1 Task 1 (due in week 8)

Implement a simple light flashing system, where LEDs are on and off every two seconds (1 second for each state) until the user presses a button.

Note: There are a number of ways to implement one-second delay. You can choose any one of them. But you need to use the external interrupt to stop LEDs flashing.

Assemble your program using AVR Studio, and run it on the AVR Microcontroller Board. Demonstrate your working program to the lab assessor.

### 3.2 Task 2 (due in week 9)

Write an assembly program that performs multiplication:  $a = b \times c$ , where  $a$ ,  $b$ ,  $c$  are all unsigned 1-byte numbers. The program takes  $b$  and  $c$  from the keypad and displays the result on LED bars. When there is an overflow in the calculation, the LED bar flashes 3 times.

Note: you can use "\*" key for "x" and the "=" key for "=". For example, to get  $12 \times 9$ , your input key sequence is  $1 \rightarrow 2 \rightarrow * \rightarrow 9 \rightarrow =$ .

Assemble your program using AVR Studio, and run it on the AVR Microcontroller Board. Demonstrate your working program to the Laboratory assessor.

Note: Task 1 is worth 6 marks and Task 2 is worth 8 marks. All your programs should be well commented. Up to 1 mark will be deducted for each program without proper and sufficient comments.