COMP9032 Lab 1

Sept. 2023

For this lab, you are required to work solo, and your work is assessed individually.

1. Objectives

In this lab, you will learn:

- · AVR instructions, and
- basic assembly programming.

2. Programming Style

The general practice, when you write an assembly program, is to maintain the readability and consistency of your code. For this reason, you are encouraged to adopt the following rules:

- Starting each source code file with a heading that includes:
 - your name so that it is easy to see who is responsible for the file, the date of last modification and a version number, and
 - a description of what the program does, possibly with a pseudo-code for a high-level abstraction.
- Including appropriate comments that explain the "why", not just the "how" of the program throughout the source code.
- Using a sensible layout for your code to make it easy to see the code structure, instructions, and any labels.

3. Tasks

There are three tasks in this lab.

3.1 Task 1 (15 marks, due your lab session in Week 2)

Write an assembly program that converts a signed number in a register into the decimal and store the decimal number in a group of registers where each register holds the ASCII value of the sign or the digit of the decimal. An example is shown in Figure 1, where the signed binary 11111011 in R3 is converted to decimal -5 which is stored in register pair R4:R5 in the ASCII format (See the ASCII table given at the end of this document).

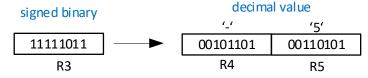


Figure 1: Signed binary 11111011 is converted to decimal and stored in R4:R5 in ASCII

Here we assume the input value will be manually set in the register before execution (See explanation on page 5 of Lab 0 on how to set a register value).

3.2 Task 2 (15 marks, due your lab session in Week 3)

Write an assembly program to calculate $a\sqrt{a}$, where a is a one-byte unsigned number and the result is rounded to integer, e.g. $5\sqrt{5} = 11.18 = 11$.

Here we assume value a is stored in a register, which will be manually set to the value before execution and the result will be saved in another register.

3.3 Task 3 (15 marks, due your lab session in Week 3)

The greatest common divisor (GCD) of two integers can be calculated in a way as given in a C-like pseudo code shown in Figure 2. Based on this calculation approach, write an assembly code to get the GCD of an array of 8-bit unsigned integers. The size of the array is less than 10 and is stored in register R0. The elements of the array are stored consecutively from register R1 up to R9. Both the array size and the array are manually set before execution.

Figure 2: Pseudo Code GCD

For this task, you are required to use a macro to improve your code. The concept of macro is discussed in Week 2.

NOTE:

- You can put your code for each task in the same project in microchip Studio for this lab.
 Run the program for each task by setting it as the entry file, which has been explained in lab 0
- All your programs should **be well commented on and easy to read**. Up to 10% marks will be deducted for each program without proper and sufficient comments.

Appendix: ASCII Table

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29 1D 035 GS (group separator) 61 3D 075 = = 93 5D 135]] 125 7D 175 } } 30 1E 036 RS (record separator) 62 3E 076 > > 94 5E 136 ^ ^ 126 7E 176 ~ ~	27	1B	033	ESC	(escape)	59					91				[
30 lE 036 RS (record separator) 62 3E 076 «#62; > 94 5E 136 «#94; ^ 126 7E 176 «#126; ~	28	10	034	FS	(file separator)	60					92				A.					
					(group separator)	61									-					
31 1F 037 US (unit separator) 63 3F 077 4#63; ? 95 5F 137 4#95; _ 127 7F 177 4#127; DEL	30	1E	036	RS	(record separator)										^					
	31	1F	037	US	(unit separator)	63	ЗF	077	4#63;	2	95	5F	137	6#95;	_	127	7F	177	6#127;	DEL

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