Lab2. MIPS Simulation

In this lab, we are going to review MIPS using MARS(MIPS Assembler and Runtime Simulator). We will also get familiar with assembly language programming, how MIPS are connected with physical address, as well as how to translate HLL into Assembly language and vice versa.

MARS is a lightweight IDE (interactive development environment) for programming in MIPS assembly language. It can be downloaded from http://courses.missouristate.edu/KenVollmar/MARS/.
While it is written in Java, please make sure that your computer has the **JDK** (Java SE Development Kit) installed, or you can get the Java SE from here: http://www.oracle.com/technetwork/java/javase/downloads/index.html.

To run MARS, unzip the downloaded file first. Then, open a terminal window. Type "java.Mars" in your terminal window to start. A GUI should be shown on the screen. A tutorial for MARS can be found here: http://courses.missouristate.edu/KenVollmar/MARS/tutorial.htm

We also need the first demo on the website, please download the Fibonacci.asm file as well.

Q1: Run the demo in MARS and then use your own words to explain the purpose of this demo.

Q2: a) 'Calculate' your "First Name" and "Last Name" on paper. Here, "First Name" is the sum of all the letters in your first name, while each letter is represented by its position in the alphabet. For example, "Wendy" is 23+5+14+4+25=71. Repeat this for your "Last name". Write down your answers.

b) Write your own program using MARS :

- store the numbers corresponding to the letters of your first name into Array A, where the base address of the array A is in $s0. Also store those of your last name into Array B, where the base address of the array B is in $s1.
- Then, load the entries from A and B to calculate your "First Name" and "Last Name". Verify the answers from part a.
- Furthermore, compute the addition of your "First Name" and "Last Name", subtraction of your "First Name" and "Last Name", and put the final values into registers $t0 and $t1 respectively.

C) Now, change the first two numbers from 1, 1 (Fibonacci.asm file on the website) to the value of register $t0, and $t1. Set the length of "Fibonacci

numbers” to the number of letters in your name. Write your own program to print out the Fibonacci numbers array.

Q3: a)Translate the following C code to MIPS, and program it in MARS. The code is given below: (HINT: push items onto stack so that it can be recorded and retrievable)

```
int iLoveEE126(int n)
    {
        if (n <1) return (1);
        else return (n * iLoveEE126(n-1));
    }
```

b) Call iLoveEE126(4), while the default value of following parameters are:

$ra=204; $PC=400; $SP=10000;

Write down the important steps in this calling. Record any change of former parameters. Draw a sketch using viso software to show what the stack should be like after calling.