

Assignment – 1

Due: Fri. 12 August (at 11:00 PM)

Submission:

- Upload your submission as one zip file on **Canvas**. The zip file should contain three completed assembly files named as:
 - a. assignment1-1.asm
 - b. assignment1-2.asm
 - c. assignment1-3.asm
- Use the given code template for each question and test your code using SPIM. **Codes should not have errors to get full marks.**
- **Late penalties: up to 24h late: -20% of achieved marks, 24h to 48h late: -30% of achieved marks, more than 48h late: 0 marks.**

**NOTE: Your assembly code must have comments if necessary.
Do not use pseudo instructions (except *la* if necessary.)**

1. An array of 40 integer elements is stored in memory. Write the MIPS assembly instructions to count how many elements of the array are less than 0 and print the result on SPIM Console. (Use the given code template *assignment1-1.asm*).

(2 Marks)

2. Write a MIPS assembly program that reads in a string of characters using the SPIM system call and finds how many words “the” are in the string and prints it on SPIM Console. For example, there are *three* “the” words in the string “London is the capital and largest city of the United Kingdom. It stands on the River Thames.” (The printed result on SPIM console for this example is:

... number of word 'the' in the string is: 3

The number of the characters in the string is less than 200.

(Use the given code template *assignment1-2.asm* and test your code using SPIM).

(2.5 Marks)

3. Using function ***fibonacci(n)***, the sequence of numbers 1, 1, 2, 3, 5, 8, 13, 21, ... for values of ***n*** equal to 1, 2, 3, 4, 5, 6, 7, 8, ... can be generated.

The result for each ***n*** is calculated as follows:

$$\begin{aligned} \text{fibonacci}(1) &= 1, \quad \text{fibonacci}(2) = 1, \\ \text{fibonacci}(n) &= \text{fibonacci}(n-1) + \text{fibonacci}(n-2) \quad \text{for } n > 2 \end{aligned}$$

(Note that the function is called recursively).

```
int fibonacci(int n)
{
    if (n < 1)    return 0;

    else if (n == 1 || n == 2)
        return 1;
    else
        return (fibonacci(n - 1) + fibonacci(n - 2));
}
```

- (a) Write the MIPS assembly code for function ***fibonacci***.

(2.5 Marks)

- (b) Write the main program, which reads the value of ***n*** from keyboard ($n < 12$) and prints the Fibonacci numbers up to the calculated value for ***n*** on SPIM Console. (For example, if ***n*** is 10, then the following sequence will be printed).

1, 1, 2, 3, 5, 8, 13, 21, 34,

To test your code using SPIM, consider two different values for ***n*** (6 and 11). (Use the given code template ***assignment1-3.asm***).

(1 Marks)