School of Computer Science
Systems and Architecture (COMP1040) Autumn 2017

Assembly Programming Coursework
Deadline: Monday 4th of December, 2017

Collaborating in small groups of up to three students is permitted, but you must implement your own programs (absolutely *do not* copy and paste from others) and provide your own answers where appropriate.

Note that lacking proper comments and user prompts will lose mark.

Submit your UNCOMPRESSED assembly program files to Moodle.

1. Write a program in MIPS32 assembly language which reads a number n from the console, and prints out the sum of the numbers from 0 to n:

$$\sum_{i=0}^{n} i$$

The summation in C, given n, might look like:

```
int sum = 0;
for(int i = 0; i <= n; i++)
   sum = sum + i;
```

(15 marks)

2. Implement a program which prompts user two integers inputs x, y from the console and calculate the following expression in signed 32-bit arithmetic:

$$x^3 + 3x^2y + 3xy^2 + 9y^3$$

Note that you are NOT allowed to use pseudo-instructions with overflow checking for the calculation (i.e. you can not use `mulo`). If an overflow occurs during any step of the calculation, you should print an error message instead, and stop the program.

Hint: You could simplify the expression before calculation. Please remember to test your program with a range of different inputs, e.g. $x = 2, y = 3$; $x = -3, y = 4$; $x = 1\,000, y = 150\,000\ldots$

(25 marks)

3. Implement a MIPS assembly program which reads a string first, and then reads a character. The program should return the number of the occurrences of the character in the string, or `0` if the character cannot be found:

(a) Input string: *Hello* Input character: *e* Output:`1`

(b) Input string: *Hello* Input character: *l* Output:`2`

(c) Input string: *Hello* Input character: *a* Output:`0` (Not found)

To declare a `char buffer[`*n*`]` *of n bytes, use the* `.space` *n directive in the* `.data` *segment.*

(25 marks)

4. A *palindrome* is a word or sentence that spells exactly the same thing both forward and backward. For example, the string "anna" is a palindrome, while "ann" is not. Implement a MIPS assembly program which reads a line of text and determines whether or not the text is a palindrome.

   Note that in the more common definition of a palindrome, whitespace, capitalization, and punctuation are ignored, so the string "Able was I ere I saw Elba. would be considered a palindrome. Your program must be able to recognize the following strings as palindromes:

   (a) 1 2 321

   (b) Madam, I'm Adam.

   (c) A man, a plan, a canal - Panama!

   (d) Go hang a salami; I'm a lasagna hog

   (35 marks)