

COEN 311 Section W (Computer Organization and Software)

Assignment 4

Due Friday November 17, 2023

Note: Please submit only one PDF file through Moodle.

Question 1)

Suppose

R0 = 0xFFFFFFFF,

R1 = 0x00000001,

R2 = 0x00000000,

and initially N, Z, C, V flags are zero. Find out the value of the NZCV flags of the following instructions. (Assume each instruction runs individually, i.e., these instructions are not part of a program.) (10 points)

- a) ADD R3, R0, R2
- b) SUBS R3, R0, R0
- c) ADDS R3, R0, R2
- d) LSL R3, R0, #1
- e) LSRS R3, R1, #1
- f) ANDS R3, R0, R2

Question 2)

Suppose R0 = 0x20000000, R1 = 0x12345678 and R2 = 0x00000001. All bytes in memory are initialized to 0x00. The following assembly program has been executed successfully.

```
STR R1, [R0], #4
STR R1, [R0, #4]!
STR R1, [R0, #4]
LDR R1, [R0], -R2, LSL#3
LDR R1, [R0, R2, LSR#1]
```

- a) What are the register R0, R1 and R2 values after each instruction.
- b) Show the corresponding memory values after each instruction if the processor uses **Big Endian**. (20 points)

Question 3)

Given an array of characters terminated with a zero. For example,

Array1: .word 'h','e','l','l','o', 0

Write an assembly program using ARM instructions that copies the source string at address Array1 to a destination string at address Array2.

Note that characters are byte size.

(20 points)

Question 4)

An assembly program is to be written to calculate the Greatest Common Divider (gcd) using the following Euclid's Algorithm: (20 points)

```
uint32_t a, b;
while (a != b) {
    if (a > b)
        a = a - b;
    else
        b = b - a;
}
```

Given register R0 = a and register R1 = b

- a) Write an assembly program using SIMARM instruction set.
- b) Rewrite the program for ARM processor using conditional execution of Data instructions.

Question 5)

Write a program that compares two arrays, A and B. Each array contains 100 8-bit signed numbers. Compare corresponding elements of the two arrays until either two elements are found to be unequal or all elements of the arrays have been compared and found to be equal. Assume the arrays start at addresses 0xA000 and 0xB000, respectively. If the two arrays are found to be unequal save the address of the first unequal element of A array in the memory location with address FOUND, otherwise write all 0s in this location. (30 points)