

National Taiwan Normal University  
Department of Computer Science and Information Engineering  
CSU0029, Homework 2

## 1 Information

1. The assignment is worth 100 points.
2. Individual work.
3. Due at 12:00 on 3/30, i.e., Thursday noon.
4. When asked, use a scientific notation, i.e., show a value in the form  $m \times 10^n$ , where  $1 \leq |m| < 10$  and  $n$  is an integer.
5. If any fractional part, round to the second decimal place.
6. Submit the assignment to the course website.
7. Write the assignment in English or Chinese MS Word or PDF format.

## 2 Contents

1. (a) (10 points) Consider the addition of two 8-bit 2's-complement integers. Assuming that the sum needs to be fit into an 8-bit binary representation, we will say that there is an overflow when the sum is larger than max. Then, what is the value of max in its decimal form?  
(b) (10 points) What range of integer number can be represented by 16-bit 2's complement number?
2. (a) (10 points) Convert the following decimal numbers to unsigned 8-bit binary numbers: (1)15 (2) 113  
(b) (10 points) Convert the following unsigned 8-bit binary numbers to decimal numbers: (1)00010001 (2)10000010
3. Let the decimal numbers  $A = 54$ ,  $B = -77$ , answer the following questions.  
(a) (10 points) Compute  $A + B$  in 8-bit 2's complement, is it overflow?  
(b) (10 points) Compute  $A - B$  in 8-bit 2's complement, is it overflow?

4. (20 points) The following C codes are compiled into the corresponding MIPS assembly codes.

Assume that i and k correspond to registers \$s3 and \$s5, and the base of the array save is in \$s6.

**C codes:**

```
while( save[i] == k)
{
    i += 1;
}
```

**MIPS assembly codes:**

```
Loop: sll $t1, $s3, 2
      add $t1, $t1, OP1
      OP3 $t0, 0(OP2)
      bne $t0, $s5, Exit
      add $s3, $s3, 1
      j   Loop
Exit
```

Please determine the proper values for operands (OP1, OP2), and the proper instruction for the operator (OP3). Copy the following table (Table 1) to your answer sheet and fill in the two operand values and the one instruction.

**Table 1**

Operand/Operator	Value / Instruction
OP1	
OP2	
OP3	

5. (20 points) The following binary codes are corresponding to their MIPS instructions, respectively. Find binary codes of **add \$s4, \$t3, \$t2** and **lw \$s0, 48(\$t1)** Also, what type (I-type, R-type, J-type) are they?