

## Laboratory Session 2

### Testing and Branching

#### 1. MIPS assembler directives

#### 2. Pseudo-instructions

The real instructions work of “li \$t0, -5”:

**lui \$1, -1**

**ori \$8, \$1, -5**

The real instructions work of “li \$t0, 0xaabbccdd”:

**lui \$1, -21829**

**ori \$8, \$1, -13091**

#### 3. Branching

##### 3.1

The secret number is: 506 (0x1FA)

##### 3.2

I suppose that deleting “jr \$ra” in the WIN label can run the LOSE label after the WIN label.

##### 3.3

Help

Text

```
[00400000] 8fa40000 lw $4, 0($29) ;
[00400004] 27a50004 addiu $5, $29, 4 ;
[00400008] 24a60004 addiu $6, $5, 4 ;
[0040000c]
[00400010] Phan Tran Thanh Huy
[00400014] ITCSIU22056
[00400018] Guess a number (1 - 1000): 123
[0040001c] You lose!!
[00400020] Your number is smaller than the secret number!!
[00400024]
[00400028]
[0040002c]
[00400030]
[00400034]
[00400038]
[0040003c]
[00400040]
[00400044]
[00400048]
[0040004c]
[00400050]
[00400054]
[00400058]
[0040005c]
[00400060]
[00400064]
[00400068]
[0040006c]
[00400070]
[00400074]
[00400078]
[0040007c]
```

Console

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Lab2\_3.3

File Edit View

```
.data          # the data segment
strName: .asciiz "Phan Tran Thanh Huy\n"
strID: .asciiz "ITCSIU22056\n"
prompt: .asciiz "Guess a number (1 - 1000): "
win: .asciiz "You win!!\n"
lose: .asciiz "You lose!!\n"
small: .asciiz "Your number is smaller than the secret number!!\n"
big: .asciiz "Your number is bigger than the secret number!!\n"
newline: .asciiz "\n"

.text          # the code segment
.globl main

main:

    li $t0, 0x1fa # 0x1fa --> t0=506

    la $a0, strName
    li $v0, 4
    syscall

    la $a0, strID
    li $v0, 4
    syscall
    # print out the prompt
    la $a0, prompt
    li $v0, 4
    syscall

    # read in an integer
    li $v0, 5
    syscall
    move $t1, $v0 # move the input number (user) to t1; e.g 506

    bne $t0, $t1, LOSE #compare value of t1 and t0
    beq $t0, $t1, WIN

WIN:
    # print out "win"
    la $a0, win
    li $v0, 4
    syscall
```

Ln 21, Col 15 | 1,129 characters | 100% | Windows (CRLF) | UTF-8

## 3.4

```
0] 8fa40000 lw $4, 0($29) ;
:] 27a50004 addiu $5, $29, 4 ;
:] 24a60004 addiu $6, $5, 4 ;

Console
Phan Tran Thanh Huy
ITCSIU22056
Guess a number (1 - 1000): 123
You lose!!
Your number is smaller than the secret number!!
Guess a number (1 - 1000): 705
You lose!!
Your number is bigger than the secret number!!
Guess a number (1 - 1000): 506
You win!!

Lab2_3.4
File Edit View
.data # the data segment
strName: .asciiz "Phan Tran Thanh Huy\n"
strID: .asciiz "ITCSIU22056\n"
prompt: .asciiz "Guess a number (1 - 1000): "
win: .asciiz "You win!!\n"
lose: .asciiz "You lose!!\n"
small: .asciiz "Your number is smaller than the secret number!!\n"
big: .asciiz "Your number is bigger than the secret number!!\n"
newline: .asciiz "\n"

.text # the code segment
.globl main

main:
    la $a0, strName
    li $v0, 4
    syscall

    la $a0, strID
    li $v0, 4
    syscall

    li $t0, 0x1fa # 0x1fa --> t0=506

LOOP:
    # print out the prompt
    la $a0, prompt
    li $v0, 4
    syscall

    # read in an integer
    li $v0, 5
    syscall
    move $t1, $v0 # move the input number (user) to t1; e.g 506

    bne $t0, $t1, LOSE #compare value of t1 and t0
    beq $t0, $t1, WIN

LOSE:
    # print out "lose"
    la $a0, lose
    li $v0, 4
    syscall

WIN:
    # print out "win"
    la $a0, win
    li $v0, 4
    syscall

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Ln 21, Col 1 | 1,072 characters | 100% | Windows (CRLF) | UTF-8
```

### 3.5

'0' is the **flag** character.

```
05c] 00024821 addu $9, $0, $2 ;
060] 1009001a beq $0, $9, 104 [EXIT-0x0040
064] 15090007 bne $8, $9, 28 [LOSE-0x00400
068] 11090001 beq $8, $9, 4 [WIN-0x0040000
06c] 3c011001 lui $1, 4097 [winl
070] Console
072 Phan Tran Thanh Huy
074 ITCSIU22056
076 Guess a number (1 - 1000): 123
078 You lose!!
080 Your number is smaller than the secret number!!
082 Guess a number (1 - 1000): 0
084 Thanks for playing!
090
094
096
098
09c
0a0
0a4
0a8
0ac
0b0
0b4
0b8
0bc
0c0
0c4
0c8
0cc
0d0
0d4
0d8
0dc
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Lab2_3.4 Lab2_3.5
File Edit View
.data # the data segment
strName: .asciiz "Phan Tran Thanh Huy\n"
strID: .asciiz "ITCSIU22056\n"
prompt: .asciiz "Guess a number (1 - 1000): "
win: .asciiz "You win!!\n"
lose: .asciiz "You lose!!\n"
small: .asciiz "Your number is smaller than the secret number!!\n"
big: .asciiz "Your number is bigger than the secret number!!\n"
exit: .asciiz "Thanks for playing!"
newline: .asciiz "\n"

.text # the code segment
.globl main
main:
    la $a0, strName
    li $v0, 4
    syscall

    la $a0, strID
    li $v0, 4
    syscall

    li $t0, 0x1fa # 0x1fa --> t0=506

LOOP:
    # print out the prompt
    la $a0, prompt
    li $v0, 4
    syscall

    # read in an integer
    li $v0, 5
    syscall
    move $t1, $v0 # move the input number (user) to t1; e.g 506

    beq $0, $t1, EXIT

    bne $t0, $t1, LOSE #compare value of t1 and t0
    beq $t0, $t1, WIN

WIN:
    # print out "win"

Ln 9, Col 34 | 1,190 characters | 100% | Windows (CRLF) | UTF-8
```

## 4. String

```

User Text Segment
00000] 8fa40000 lw $4, 0($29) ; 183: lw $a0 0($sp)
00004] 27a50004 addiu $5, $29, 4 ; 184: addiu $a1 $s0, 4
00008] 24a60004 addiu $6, $5, 4 ; 185: addiu $a2 $a1, 4
0000c] 00041080 sll $2, $4, 2 ; 186: sll $v0 $a0, 2
00010] 00c23021 addu $6, $6, $2 ; 187: addu $a2 $a2, $a2

Console
Phan Tran Thanh Huy
ITCSI022056
Input: the supreme art of war is to subdue the enemy without fighting.
Output: The Supreme Art Of War Is To Subdue The Enemy Without Fighting.

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Lab2_3.5 Lab2_4.1
File Edit View
# read a string
li $v0, 8
la $a0, buffer
li $a1, 100
syscall

# print out the result
la $a0, output
li $v0, 4
syscall

la $t0, buffer
li $s0, 32

lb $t1, 0($t0)
sub $t1, $t1, 32
sb $t1, 0($t0)

loop:
lb $t1, 0($t0)
beq $t1, 32, CASE
beq $t1, 0, exit
addi $t0, $t0, 1
j loop

CASE:
addi $t0, $t0, 1
lb $t1, 0($t0)
blt $t1, 'a', loop
bgt $t1, 'z', loop
sub $t1, $t1, 32
sb $t1, 0($t0)
addi $t0, $t0, 1
j loop

exit:
la $a0, buffer
li $v0, 4
syscall

jr $ra # return to caller (__start)

Ln 28, Col 13 937 characters 100% Windows (CRLF) UTF-8
```

5.

```
00e8] 0000000c syscall ; 68: syscall
00ec] 3c011001 lui $1, 4097 [strLine] ; 70: la $a0, strLi
00f0] 34240035 ori $4, $1, 53 [strLine]
00f4] 34020004 ori $2, $0, 4 ; 71: li $v0, 4
00f8] 0000000c syscall ; 72: syscall
00fc] Console
1004 Phan Tran Thanh Huy
1008 ITCUI22056
100c Input a, b, c, d: 2
1010 3
1014 9
1018 6
101c The result of F is: 3.75
1020 The result of G is: 12.857142857142858
1024
1028
1030
1034
1038
103c
1040
1044
1048
104c
1050
1054
1058
105c
1060
1064
1068

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Lab2_5
File Edit View

.data
strName: .asciiz "Phan Tran Thanh Huy\n"
strID: .asciiz "ITCUI22056\n"
input: .asciiz "Input a, b, c, d: "
strLine: .asciiz "\n"
output1: .asciiz "The result of F is: "
output2: .asciiz "The result of G is: "
aNum: .word 0
bNum: .word 0
cNum: .word 0
dNum: .word 0

.text
.globl main

main:
la $a0, strName
li $v0, 4
syscall

la $a0, strID
li $v0, 4
syscall

la $a0, input
li $v0, 4
syscall

li $v0, 5
syscall
sw $v0, aNum

Ln 100, Col 8 | 1,166 characters | 130% | Windows (CRLF) | UTF-8
```

6.

a/

```
007c] ac220068 sw $2, 104($1)
0080] 3c011001 lui $1, 4097 [output] ; 40: la $a0, output
0084] 34240042 ori $4, $1, 66 [output]
0088] 34020004 ori $2, $0, 4 ; 41: li $v0, 4
008c] 0000000c syscall ; 42: syscall
0090]
0094] Phan Tran Thanh Huy
0098] ITCSIU22056
009c] Enter the N, M, X number: 2
00a0] 5
00a4] 3
00a8] The sequence of number is: 2, 10, 50,
00ac]
00b0]
00b4]
00b8]
00bc]
00c0]
00c4]
00c8]
00cc]
00d0]
00d4]
00d8]
00dc]
00e0]
00e4]
00e8]
00ec]
00f0]
00f4]
00f8]
00fc]

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```

```
Lab2_6a
File Edit View

.data
strName: .asciiz "Phan Tran Thanh Huy\n"
strID: .asciiz "ITCSIU22056\n"
strConmas: .asciiz ", "
strline: .asciiz "\n"
input: .asciiz "Enter the N, M, X number: "
output: .asciiz "The sequence of number is: "
numberN: .word 0
numberM: .word 0
numberX: .word 0

.text
.globl main

main:
la $a0, strName
li $v0, 4
syscall

la $a0, strID
li $v0, 4
syscall

la $a0, input
li $v0, 4
syscall

li $v0, 5
syscall
sw $v0, numberN

Ln 40, Col 15 866 characters 130% Windows (CRLF) UTF-8
```

b/

```

3f 81090000 lb $9, 0($8) ; 52: lb $t1, 0($t0
3d 3c011001 lui $1, 4097 ; 53: lw $s0, decim
0d 8c300068 lw $16, 104($1)
4d 34010031 ori $1, $0, 49 ; 54: beq $t1, 49,
31 10290003 beq $1, $9, 12 [case1=0x004000c8]

```

Console

```

Phan Tran Thanh Huy
ITCSIU22056
Enter the binary number: 111111111
The decimal number is: 1023

```

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```

File Edit View

.data
strName: .ascii "Phan Tran Thanh Huy\n"
strID: .ascii "ITCSIU22056\n"
input: .ascii "Enter the binary number: "
output: .ascii "The decimal number is: "
binary: .space 20
decimal: .word 0
limit: .word -2

.text
.globl main

main:
la $a0, strName
li $v0, 4
syscall

la $a0, strID
li $v0, 4
syscall

la $a0, input
li $v0, 4
syscall

la $a0, binary
li $a1, 20
li $v0, 8
syscall

la $t0, binary

```

Ln 45, Col 1 | 1,053 characters | 130% | Windows (CRLF)