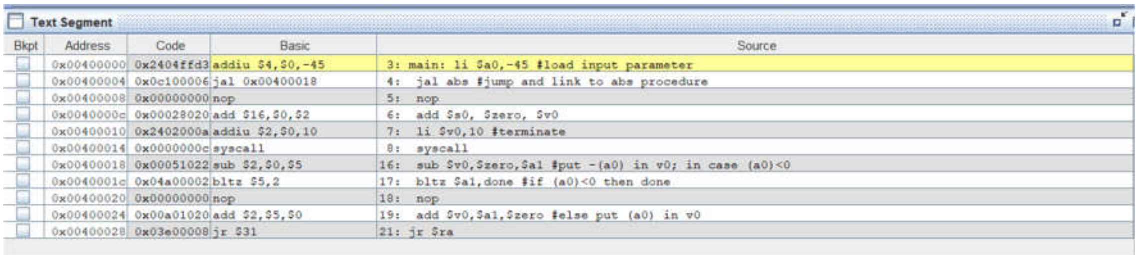
# Bài tập thực hành week7

## 1) Assignment 1

**Mã nguồn**

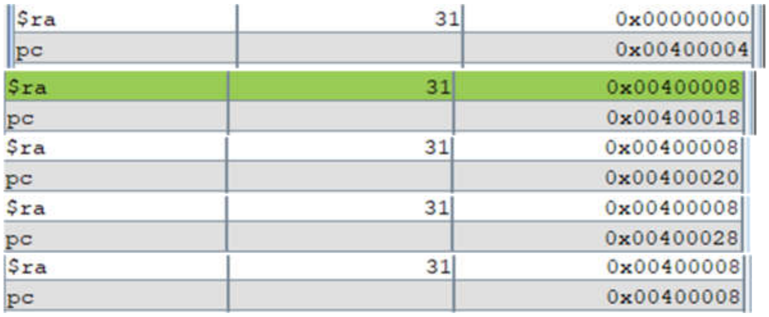
```
#Laboratory Exercise 7 Home Assignment 1
.text
main: li $a0,-45 #load input parameter
 jal abs #jump and link to abs procedure
 nop
 add $s0, $zero, $v0
 li $v0,10 #terminate
 syscall
endmain:
#------------------------------------------------------------------
# function abs
# param[in] $a1 the interger need to be gained the absolute value
# return $v0 absolute value
#------------------------------------------------------------------
abs:
 sub $v0,$zero,$a1 #put -(a0) in v0; in case (a0)<0
 bltz $a1,done #if (a0)<0 then done
 nop
 add $v0,$a1,$zero #else put (a0) in v0
done:
jr $ra
```

**Kết quả :**

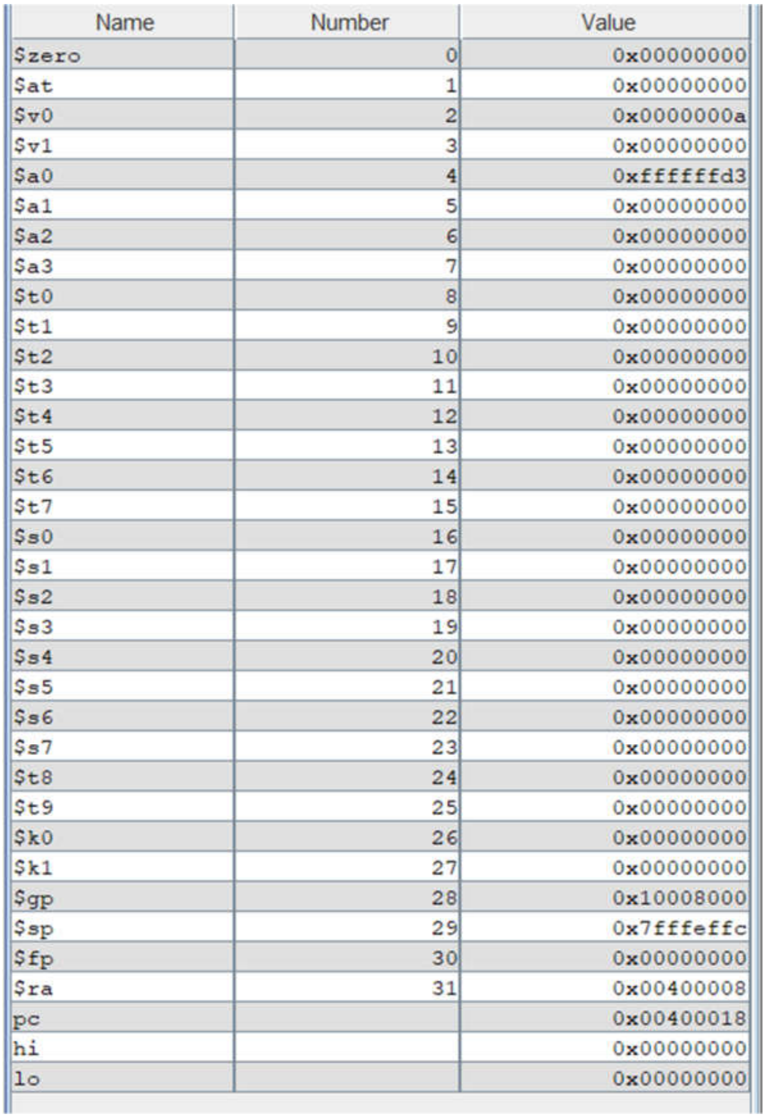


Text Segment

| Bkpt | Address | Code | Basic | Source |
|---|---|---|---|---|
| □ | 0x00400000 | 0x2404ffd3 | addiu $4,$0,-45 | 3: main: li $a0,-45 #load input parameter |
| □ | 0x00400004 | 0x0c100006 | jal 0x00400018 | 4: jal abs #jump and link to abs procedure |
| □ | 0x00400008 | 0x00000000 | nop | 5: nop |
| □ | 0x0040000c | 0x00028020 | add $16,$0,$2 | 6: add $s0, $zero, $v0 |
| □ | 0x00400010 | 0x2402000a | addiu $2,$0,10 | 7: li $v0,10 #terminate |
| □ | 0x00400014 | 0x0000000c | syscall | 8: syscall |
| □ | 0x00400018 | 0x00051022 | sub $2,$0,$5 | 16: sub $v0,$zero,$a1 #put -(a0) in v0; in case (a0)<0 |
| □ | 0x0040001c | 0x04a00002 | bltz $5,2 | 17: bltz $a1,done #if (a0)<0 then done |
| □ | 0x00400020 | 0x00000000 | nop | 18: nop |
| □ | 0x00400024 | 0x00a01020 | add $2,$5,$0 | 19: add $v0,$a1,$zero #else put (a0) in v0 |
| □ | 0x00400028 | 0x03e00008 | jr $31 | 21: jr $ra |



| | | |
|---|---|---|
| $ra | 31 | 0x00000000 |
| pc | | 0x00400004 |
| $ra | 31 | 0x00400008 |
| pc | | 0x00400018 |
| $ra | 31 | 0x00400008 |
| pc | | 0x00400020 |
| $ra | 31 | 0x00400008 |
| pc | | 0x00400028 |
| $ra | 31 | 0x00400008 |
| pc | | 0x00400008 |



| Name | Number | Value |
|---|---|---|
| $zero | 0 | 0x00000000 |
| $at | 1 | 0x00000000 |
| $v0 | 2 | 0x0000000a |
| $v1 | 3 | 0x00000000 |
| $a0 | 4 | 0xffffffd3 |
| $a1 | 5 | 0x00000000 |
| $a2 | 6 | 0x00000000 |
| $a3 | 7 | 0x00000000 |
| $t0 | 8 | 0x00000000 |
| $t1 | 9 | 0x00000000 |
| $t2 | 10 | 0x00000000 |
| $t3 | 11 | 0x00000000 |
| $t4 | 12 | 0x00000000 |
| $t5 | 13 | 0x00000000 |
| $t6 | 14 | 0x00000000 |
| $t7 | 15 | 0x00000000 |
| $s0 | 16 | 0x00000000 |
| $s1 | 17 | 0x00000000 |
| $s2 | 18 | 0x00000000 |
| $s3 | 19 | 0x00000000 |
| $s4 | 20 | 0x00000000 |
| $s5 | 21 | 0x00000000 |
| $s6 | 22 | 0x00000000 |
| $s7 | 23 | 0x00000000 |
| $t8 | 24 | 0x00000000 |
| $t9 | 25 | 0x00000000 |
| $k0 | 26 | 0x00000000 |
| $k1 | 27 | 0x00000000 |
| $gp | 28 | 0x10008000 |
| $sp | 29 | 0x7fffeffc |
| $fp | 30 | 0x00000000 |
| $ra | 31 | 0x00400008 |
| pc |  | 0x00400018 |
| hi |  | 0x00000000 |
| lo |  | 0x00000000 |

## 2) Assignment 2

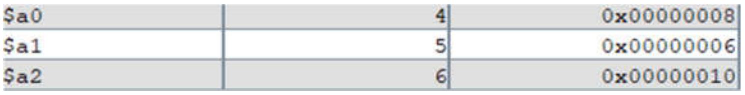
**Mã nguồn**

```
#Laboratory Exercise 7, Home Assignment 2
.text
main: li $a0,8 #load test input
 li $a1,6
 li $a2,16
 jal max #call max procedure
 nop
endmain:
#---------------------------------------------------------------------
#Procedure max: find the largest of three integers
#param[in] $a0 integers
#param[in] $a1 integers
```

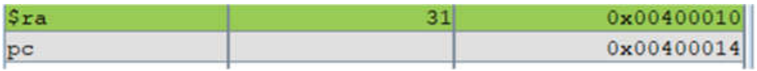
```
#param[in] $a2 integers
#return $v0 the largest value
#---------------------------------------------------------------------
max: add $v0,$a0,$zero #copy (a0) in v0; largest so far
 sub $t0,$a1,$v0 #compute (a1)-(v0)
 bltz $t0,okay #if (a1)-(v0)<0 then no change
 nop
 add $v0,$a1,$zero #else (a1) is largest thus far
okay: sub $t0,$a2,$v0 #compute (a2)-(v0)
 bltz $t0,done #if (a2)-(v0)<0 then no change
 nop
 add $v0,$a2,$zero #else (a2) is largest overall
done: jr $ra #return to calling program
```

**Kết quả :**

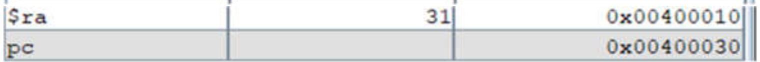
Nạp phần tử :



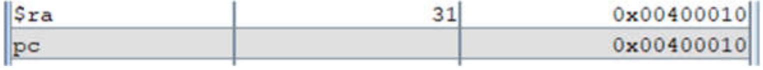
| | | |
|---|---|---|
| $a0 | 4 | 0x00000008 |
| $a1 | 5 | 0x00000006 |
| $a2 | 6 | 0x00000010 |



| | | |
|---|---|---|
| $ra | 31 | 0x00400010 |
| pc | | 0x00400014 |

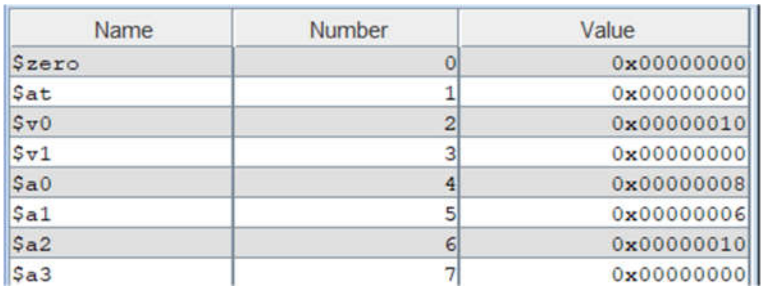


| | | |
|---|---|---|
| $ra | 31 | 0x00400010 |
| pc | | 0x00400030 |



| | | |
|---|---|---|
| $ra | 31 | 0x00400010 |
| pc | | 0x00400010 |

Kết quả cuối cùng :Tìm ra số lớn nhất max = 16



| Name | Number | Value |
|---|---|---|
| $zero | 0 | 0x00000000 |
| $at | 1 | 0x00000000 |
| $v0 | 2 | 0x00000010 |
| $v1 | 3 | 0x00000000 |
| $a0 | 4 | 0x00000008 |
| $a1 | 5 | 0x00000006 |
| $a2 | 6 | 0x00000010 |
| $a3 | 7 | 0x00000000 |

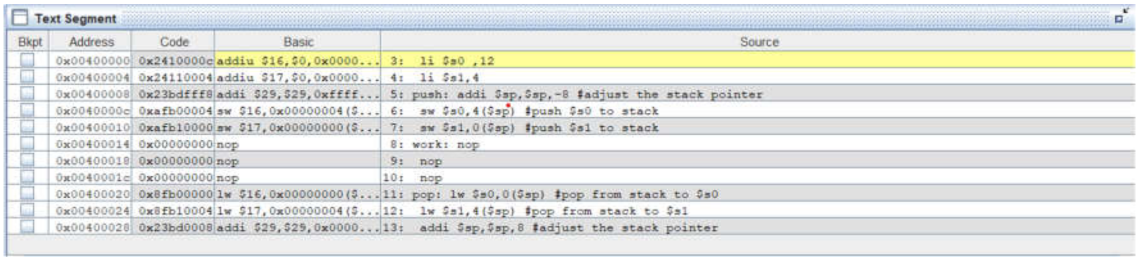
## 3) Assignment 3

**Mã nguồn**

```
#Laboratory Exercise 7, Home Assignment 3
.text
 li $s0 ,12
 li $s1,4
push: addi $sp,$sp,-8 #adjust the stack pointer
 sw $s0,4($sp) #push $s0 to stack
 sw $s1,0($sp) #push $s1 to stack
work: nop
```

```
 nop
 nop
pop: lw $s0,0($sp) #pop from stack to $s0
 lw $s1,4($sp) #pop from stack to $s1
 addi $sp,$sp,8 #adjust the stack pointer
```

**Kết quả thu được**

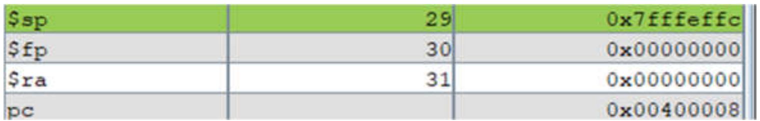


Text Segment

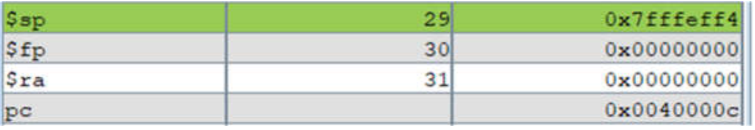
| Bkpt | Address | Code | Basic | Source |
|---|---|---|---|---|
| □ | 0x00400000 | 0x2410000c | addiu $16,$0,0x0000... | 3:  li $s0 ,12 |
| □ | 0x00400004 | 0x24110004 | addiu $17,$0,0x0000... | 4:  li $s1,4 |
| □ | 0x00400008 | 0x23bdfff8 | addi $29,$29,0xffff... | 5: push: addi $sp,$sp,-8 #adjust the stack pointer |
| □ | 0x0040000c | 0xafb00004 | sw $16,0x00000004($... | 6:  sw $s0,4($sp) #push $s0 to stack |
| □ | 0x00400010 | 0xafb10000 | sw $17,0x00000000($... | 7:  sw $s1,0($sp) #push $s1 to stack |
| □ | 0x00400014 | 0x00000000 | nop | 8: work: nop |
| □ | 0x00400018 | 0x00000000 | nop | 9:  nop |
| □ | 0x0040001c | 0x00000000 | nop | 10:  nop |
| □ | 0x00400020 | 0x8fb00000 | lw $16,0x00000000($... | 11: pop: lw $s0,0($sp) #pop from stack to $s0 |
| □ | 0x00400024 | 0x8fb10004 | lw $17,0x00000004($... | 12:  lw $s1,4($sp) #pop from stack to $s1 |
| □ | 0x00400028 | 0x23bd0008 | addi $29,$29,0x0000... | 13:  addi $sp,$sp,8 #adjust the stack pointer |

**Nhận xét :**

-Khi thực hiện lệnh **addi $sp,$sp,-8** trong hàm push thì giá trị của thanh ghi $sp giảm đi 8 từ :

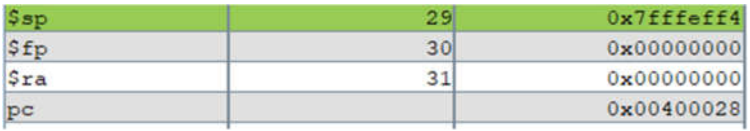


| | | |
|---|---|---|
| $sp | 29 | 0x7fffeffc |
| $fp | 30 | 0x00000000 |
| $ra | 31 | 0x00000000 |
| pc | | 0x00400008 |

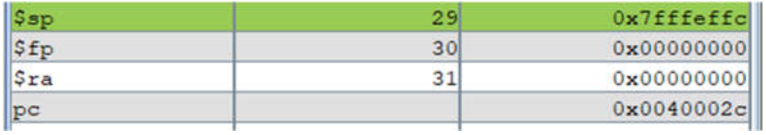


| | | |
|---|---|---|
| $sp | 29 | 0x7fffeff4 |
| $fp | 30 | 0x00000000 |
| $ra | 31 | 0x00000000 |
| pc | | 0x0040000c |

-Khi thực hiện lệnh **addi $sp,$sp,8** trong hàm pop thì giá trị của thanh ghi $sp tăng lên 8 từ:



| | | |
|---|---|---|
| $sp | 29 | 0x7fffeff4 |
| $fp | 30 | 0x00000000 |
| $ra | 31 | 0x00000000 |
| pc | | 0x00400028 |



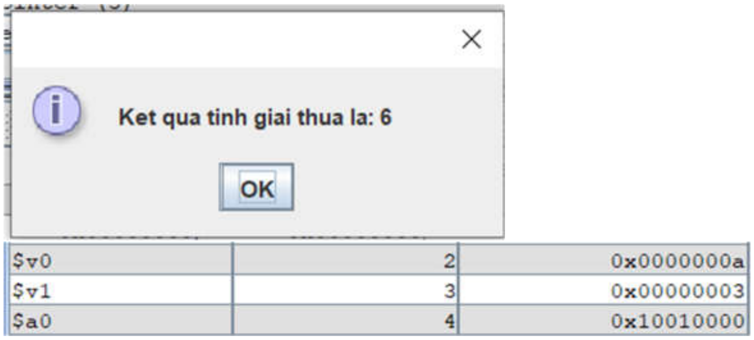
| | | |
|---|---|---|
| $sp | 29 | 0x7fffeffc |
| $fp | 30 | 0x00000000 |
| $ra | 31 | 0x00000000 |
| pc | | 0x0040002c |

# 4) Assignment 4

**Mã nguồn**

```
#Laboratory Exercise 7, Home Assignment 4
.data
Message: .asciiz "Ket qua tinh giai thua la: "
.text
main: jal WARP

print: add $a1, $v0, $zero # $a0 = result from N!
 li $v0, 56
 la $a0, Message
 syscall
quit: li $v0, 10 #terminate
 syscall
endmain:
#------------------------------------------------------------------
#Procedure WARP: assign value and call FACT
#------------------------------------------------------------------
WARP: sw $fp,-4($sp) #save frame pointer (1)
 addi $fp,$sp,0 #new frame pointer point to the top (2)
 addi $sp,$sp,-8 #adjust stack pointer (3)
 sw $ra,0($sp) #save return address (4)
 li $a0,3 #load test input N
 jal FACT #call fact procedure
 nop

 lw $ra,0($sp) #restore return address (5)
 addi $sp,$fp,0 #return stack pointer (6)
 lw $fp,-4($sp) #return frame pointer (7)
 jr $ra
wrap_end:
#------------------------------------------------------------------
#Procedure FACT: compute N!
#param[in] $a0 integer N
#return $v0 the largest value
#------------------------------------------------------------------

FACT: sw $fp,-4($sp) #save frame pointer
 addi $fp,$sp,0 #new frame pointer point to stack’s top
 addi $sp,$sp,-12 #allocate space for $fp,$ra,$a0 in stack
 sw $ra,4($sp) #save return address
 sw $a0,0($sp) #save $a0 register

 slti $t0,$a0,2 #if input argument N < 2
 beq $t0,$zero,recursive#if it is false ((a0 = N) >=2)
 nop
 li $v0,1 #return the result N!=1
 j done
 nop
recursive:
 addi $a0,$a0,-1 #adjust input argument
 jal FACT #recursive call
 nop
 lw $v1,0($sp) #load a0
 mult $v1,$v0 #compute the result
 mflo $v0
done: lw $ra,4($sp) #restore return address
 lw $a0,0($sp) #restore a0
 addi $sp,$fp,0 #restore stack pointer
 lw $fp,-4($sp) #restore frame pointer
 jr $ra #jump to calling
fact_end:
```

**Kết quả thu được:**



Ket qua tinh giai thua la: 6

| | | |
|---|---|---|
| $v0 | 2 | 0x0000000a |
| $v1 | 3 | 0x00000003 |
| $a0 | 4 | 0x10010000 |

# 5) Assignment 5

**Mã nguồn**

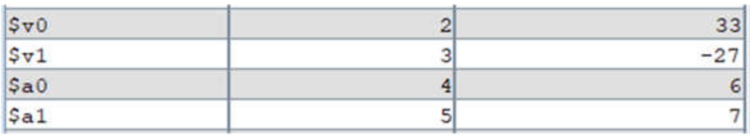
```
.text
main:
    li $s0, 13
    li $s1, 8
    li $s2, 9
    li $s3, -17
    li $s4, 31
    li $s5, 33
    li $s6, -27
    li $s7,5

    li $t1,1
    li $t2,1
    li $t3,1
    jal init
    nop
    li $t4,9
    sub $a0, $t4, $t2
    sub $a1, $t4, $t3
    j end
    nop
endmain:
init:
    add $v0, $s7, $zero
    add $v1, $s7, $zero
push:
    addi $sp, $sp, -32
    sw $s0,28 ($sp)
    sw $s1,24 ($sp)
    sw $s2,20 ($sp)
    sw $s3,16 ($sp)
    sw $s4,12 ($sp)
    sw $s5,8 ($sp)
    sw $s6,4 ($sp)
    sw $s7,0 ($sp)
pop:
        addi $sp,$sp,4
        lw $a1,0 ($sp)
        addi $t1,$t1,1
        sub $t0, $a1, $v0
        bltz $t0, parel
        nop
        add $v0, $a1, $zero
        add $t2, $t1, $zero
parel:
        sub $t0, $a1, $v1
        bgtz $t0, pare2
        nop
        add $v1, $a1, $zero
        add $t3, $t1, $zero
pare2:
        bne $a1, $s0, pop
        nop
done:
        jr $ra
end:
```

Ta đưa vào một mảng A gồm 8 phần tử và gắn lần lượt từ $s0 đến $s7:

**Mảng A**

| A[0] | A[1] | A[2] | A[3] | A[4] | A[5] | A[6] | A[7] |
|---|---|---|---|---|---|---|---|
| 13 | 8 | 9 | -17 | 31 | 33 | -27 | 5 |

**Kết quả:**



| | | |
|---|---|---|
| $v0 | 2 | 33 |
| $v1 | 3 | -27 |
| $a0 | 4 | 6 |
| $a1 | 5 | 7 |

**Largest :$v0,$a0**
**Smallest:$v1,$a1**

Ta thu được :

- Giá trị lớn nhất là 33 tại phần tử thứ 6(A[5])
- Giá trị nhỏ nhất là -27 tại phần tử thứ 7 (A[6])