BÁO CÁO THỰC HÀNH KIẾN TRÚC MÁY TÍNH TUẦN 6

Assignment 1

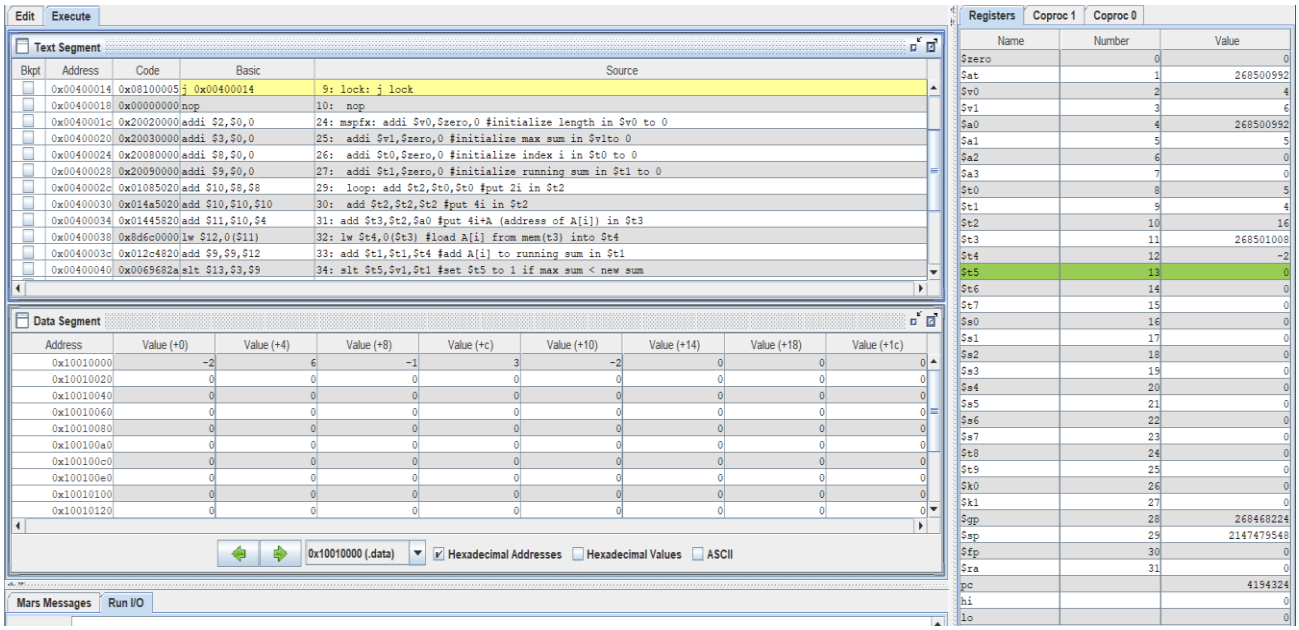
- Code:

```
.data
A: .word -2, 6, -1, 3, -2
.text
main: la $a0,A
 li $a1,5
 j mspfx
 nop
continue:
lock: j lock
 nop
end_of_main:
#---------------------------------------------------------------
#Procedure mspfx
# @brief find the maximum-sum prefix in a list of integers
# @param[in] a0 the base address of this list(A) need to be processed
# @param[in] a1 the number of elements in list(A)
# @param[out] v0 the length of sub-array of A in which max sum reachs.
# @param[out] v1 the max sum of a certain sub-array
#---------------------------------------------------------------
#Procedure mspfx
#function: find the maximum-sum prefix in a list of integers
#the base address of this list(A) in $a0 and the number of
#elements is stored in a1
mspfx: addi $v0,$zero,0 #initialize length in $v0 to 0
 addi $v1,$zero,0 #initialize max sum in $v1to 0
 addi $t0,$zero,0 #initialize index i in $t0 to 0
```

```
addi $t1,$zero,0 #initialize running sum in $t1 to 0

loop: add $t2,$t0,$t0 #put 2i in $t2
add $t2,$t2,$t2 #put 4i in $t2
add $t3,$t2,$a0 #put 4i+A (address of A[i]) in $t3
lw $t4,0($t3) #load A[i] from mem(t3) into $t4
add $t1,$t1,$t4 #add A[i] to running sum in $t1
slt $t5,$v1,$t1 #set $t5 to 1 if max sum < new sum
bne $t5,$zero,mdfy #if max sum is less, modify results
j test #done?
mdfy: addi $v0,$t0,1 #new max-sum prefix has length i+1
addi $v1,$t1,0 #new max sum is the running sum
test: addi $t0,$t0,1 #advance the index i
slt $t5,$t0,$a1 #set $t5 to 1 if i<n
bne $t5,$zero,loop #repeat if i<n
done: j continue
mspfx_end:
```

- Kết quả chạy chương trình:



Nhận xét:

Chương trình load địa chỉ phần tử đầu tiên của mảng vào a0, rồi sau đó chạy vòng lặp từ đầu array đến cuối và tính tổng prefix vào running sum, lấy phần lớn nhất trong các tổng đã tính vào max sum, nếu running sum hiện tại lớn hơn max sum thì sẽ nhảy đến nhãn mdfy để thay thế max sum bằng running sum.

Assignment 2

- Code:

```
.data
A: .word 7, -2, 5, 1, 5,6,7,3,6,8,8,59,5
Aend: .word
.text
main: la $a0,A #$a0 = Address(A[0])
 la $a1,Aend
 addi $a1,$a1,-4 #$a1 = Address(A[n-1])
 j sort #sort
after_sort: li $v0, 10 #exit
 syscall
end_main:
#---------------------------------------------------------------
#procedure sort (ascending selection sort using pointer)
#register usage in sort program
#$a0 pointer to the first element in unsorted part
#$a1 pointer to the last element in unsorted part
#$t0 temporary place for value of last element
#$v0 pointer to max element in unsorted part
#$v1 value of max element in unsorted part
```

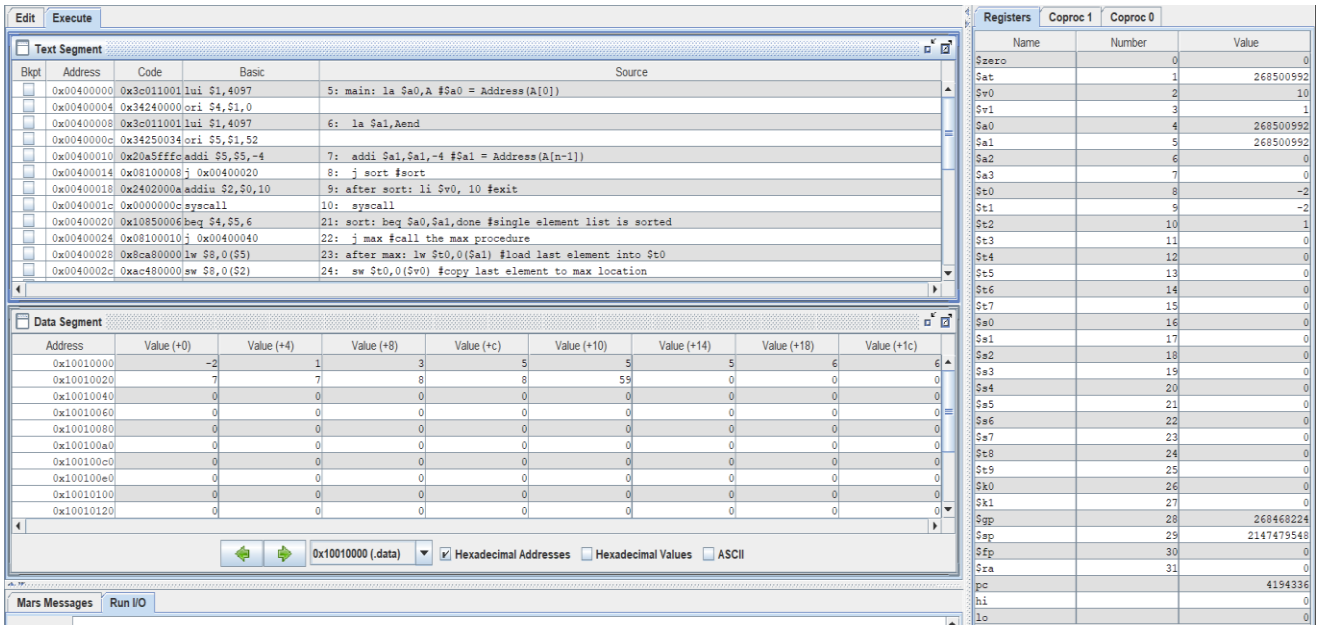
```
#-------------------------------------------------------------
sort: beq $a0,$a1,done #single element list is sorted
 j max #call the max procedure
after_max: lw $t0,0($a1) #load last element into $t0
 sw $t0,0($v0) #copy last element to max location
 sw $v1,0($a1) #copy max value to last element
 addi $a1,$a1,-4 #decrement pointer to last element
 j sort #repeat sort for smaller list
done: j after_sort
#--------------------------------------------------------------------
#Procedure max
#function: fax the value and address of max element in the list
#$a0 pointer to first element
#$a1 pointer to last element
#--------------------------------------------------------------------
max:
addi $v0,$a0,0 #init max pointer to first element
lw $v1,0($v0) #init max value to first value
addi $t0,$a0,0 #init next pointer to first
loop:
beq $t0,$a1,ret #if next=last, return
addi $t0,$t0,4 #advance to next element
lw $t1,0($t0) #load next element into $t1
slt $t2,$t1,$v1 #(next)<(max) ?
bne $t2,$zero,loop #if (next)<(max), repeat
addi $v0,$t0,0 #next element is new max element
addi $v1,$t1,0 #next value is new max value
```

j loop #change completed; now repeat

ret:

j after_max

- Kết quả chạy chương trình:



- SORT TỪ LỚN HƠN ĐẾN NHỎ HƠN

.data

A: .word 7, -2, 5, 1, 5,6,7,3,6,8,8,59,5

Aend: .word

.text

main: la $a0,A #$a0 = Address(A[0])

la $a1,Aend

addi $a1,$a1,-4 #$a1 = Address(A[n-1])

j sort #sort

```
after_sort: li $v0, 10 #exit
 syscall
end_main:
#-------------------------------------------------------------
#procedure sort (ascending selection sort using pointer)
#register usage in sort program
#$a0 pointer to the first element in unsorted part
#$a1 pointer to the last element in unsorted part
#$t0 temporary place for value of last element
#$v0 pointer to max element in unsorted part
#$v1 value of max element in unsorted part
#-------------------------------------------------------------
sort: beq $a0,$a1,done #single element list is sorted
 j max #call the max procedure
after_max: lw $t0,0($a1) #load last element into $t0
 sw $t0,0($v0) #copy last element to max location
 sw $v1,0($a1) #copy max value to last element
 addi $a1,$a1,-4 #decrement pointer to last element
 j sort #repeat sort for smaller list
done: j after_sort
#-----------------------------------------------------------------------
#Procedure max
#function: fax the value and address of max element in the list
#$a0 pointer to first element
#$a1 pointer to last element
#-----------------------------------------------------------------------
max:
```

```
addi $v0,$a0,0 #init max pointer to first element
lw $v1,0($v0) #init max value to first value
addi $t0,$a0,0 #init next pointer to first
loop:
beq $t0,$a1,ret #if next=last, return
addi $t0,$t0,4 #advance to next element
lw $t1,0($t0) #load next element into $t1
slt $t2,$v1,$t1 #(next)<(max) ?
bne $t2,$zero,loop #if (next)<(max), repeat
addi $v0,$t0,0 #next element is new max element
addi $v1,$t1,0 #next value is new max value
j loop #change completed; now repeat
ret:
j after_max
```

Assignment 3

```
# bubble sort

   .data
Arr:      .word      1,2,3,4,5,6,7,8,9

   .text
   .globl  main
main:
   li     $t1,6              # lay so phan tu cua mang

# main_loop -- di vong qua array nhieu lan
main_loop:
   subi    $a1,$t1,1
   blez    $a1,main_done
```

```
    la      $a0,Arr
    li      $t2,0

    jal     pass_loop


    beqz    $t2,main_done          # trong vong lap hien tai k co swap la
xong
    subi    $t1,$t1,1              # tru di so lan lap con lai
    b       main_loop


main_done:
    j       end                    # end ctr


pass_loop:
    lw      $s1,0($a0)             # load phan tu dau tien vao s1
    lw      $s2,4($a0)             # load phan tu 2 vao s2
    bgt     $s1,$s2,pass_swap      # if (s1 > s2) swap

pass_next:
    addiu   $a0,$a0,4              # di chuyen toi phan tu tiep theo
    subiu   $a1,$a1,1
    bgtz    $a1,pass_loop          # kiem tra xem swap chua, neu khong se
loop
    jr      $ra

pass_swap:
    sw      $s1,4($a0)             # cho gia tri cua [i+1] vao s1
    sw      $s2,0($a0)             # cho gia tri cua [i] vao s2
    li      $t2,1                  # da swap
    j       pass_next

# End the program
end:
    li      $v0,10
    syscall
```

Assignment 4

```
.data
A: .word
.text
# ----------------------------------------------------------------
# $a0 store base address of A
# $s1 store value of n
# $s3 store value of i
# ----------------------------------------------------------------
main:
la $a0, A # $a0 = Address(A[0])
add $s2, $a0, $0 # $s2 -> add(A)
addi $s1, $0, 5 # n = 5
add $s3, $0, $0 # i = 0
generate_arr:
beq $s1, $s3, end_generate # i == n end
li $v0, 5 # read integer
syscall
sw $v0, 0($s2) # A[i] = integer
addi $s2, $s2, 4 # next to A{i+1]
addi $s3, $s3, 1 # i++
j generate_arr
end_generate:
addi $s3, $0, 1 # set i = 1
j sort
# ----------------------------------------------------------------
```

```
# $s2 store value of j
# $t0 is tmp
# $t1 is address of A[i]
# $t2 is address of A[j]
# $t3 to compare A[i] and A[j]
# $t4 is value of key
# $t5 is value of A[j]
# $s0 is address of A[j+1]
# $s4 is value of A[j+1]
# -----------------------------------------------------------------
after_sort:
li $v0, 10 # exit
syscall
end_main:
sort:
loop_1:
beq $s3, $s1, after_sort # if i == n end sort
addi $s2, $s3, -1 # set j = i - 1
sll $t1, $s3, 2 # $t1 = i*4
add $t1, $a0, $t1 # $t1 -> A[i]
lw $t4, 0($t1) # key = A[i]
j loop_2
after_loop_2:
addi $s3, $s3, 1 # i++
sll $s6, $s2, 2
addi $s6, $s6, 4
add $s0, $s6, $a0
```

```
sw $t4, 0($s0) # A[j+1] = key
j loop_1
loop_2:
sll $t2, $s2, 2 # $t2 = j*4
add $t2, $a0, $t2 # $t2 -> A[j]
lw $t5, 0($t2) # $t5 = A[j]
addi $s0, $t2, 4 # $s0 -> A[j+1]
lw $s4, 0($s0) # $s4 = A[j+1]
sgt $t6, $s2, $0 # j >= 0
beq $s2, $0, setequal
next:
sgt $t7, $t5, $t4 # A[j] > key
and $t8, $t6, $t7 # if(j>=n && A[j] > key)
beq $t8, $0, after_loop_2
sw $t5, 0($s0) # A[j+1] = A[j]
addi $s2, $s2, -1 # j--
j loop_2
setequal:
seq $t6, $s2, $0
j next
```