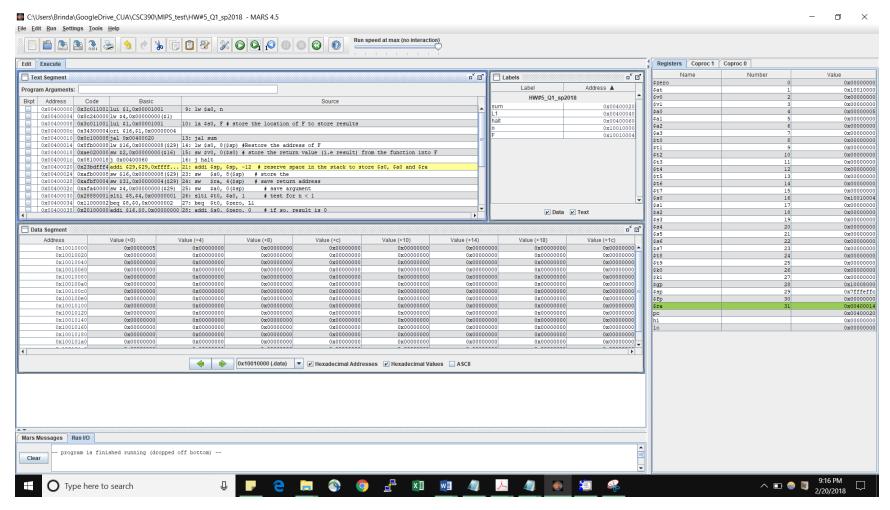
Solution: HW#5 CSC390

HW#5 Q1:

```
1 # Procedure Example (Nested Procedure)
 2 # Call a function to perform n+(n-1)
 3 .data
 4 n: .word 5
 5 F: .word 0 # store the result
 6 .text
 7 # put the data in the argument register.
 8 # arguments resisters are used to pass-parameters in the procedure (function)
 9 lw $a0, n
10 la $50, F # store the location of F to store results
11
12 # Call the sum nested procedure
13 jal sum
14 lw $s0, 8($sp) #Restore the address of F
15 sw $v0, 0($s0) # store the return value (i.e result) from the function into F
16
   j halt
17
   #the nested procedure (sum)
18
19
```

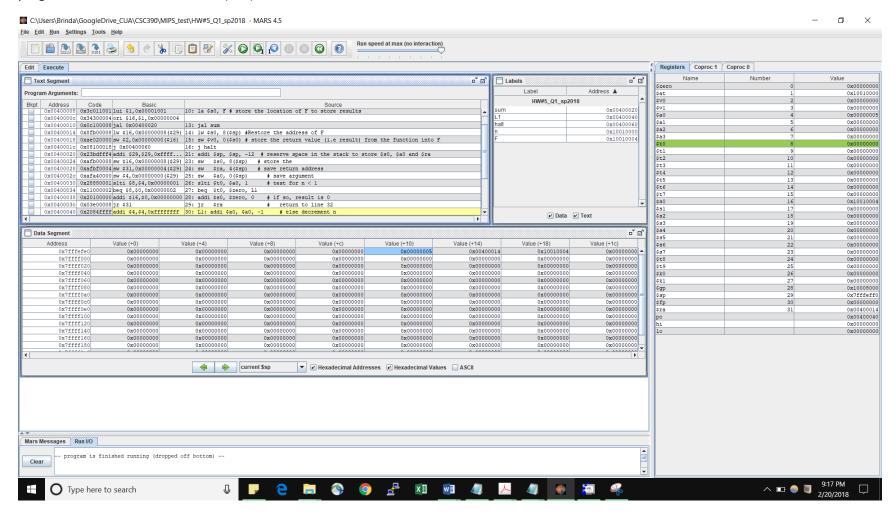
```
20 sum:
21 addi $sp, $sp, -12 # reserve space in the stack to store $s0, $a0 and $ra
                   # adjust stack for 3 items
22
23 sw $s0, 8($sp) # store the
24 sw $ra, 4($sp) # save return address
25 sw $a0, 0($sp) # save argument
26 slti $t0, $a0, 1 # test for n < 1
27 beg $t0, $zero, L1
28 addi $s0, $zero, 0 # if so, result is 0
  jr $ra # return to line 32
29
  L1: addi $a0, $a0, -1 # else decrement n
30
   jal sum # recursive call
31
32
   addi $sp, $sp, 12 # Increment stack by 12
   lw $ra, 4($sp) # Restore $ra
33
  lw $a0, 0($sp) # restore $a0
34
35 addu $s0, $a0, $s0  # Add to get result
   add $v0, $s0, $zero # Copy the result to $V0
36
37
38 jr $ra # and return
39 halt:
40 nop
```

Sum is called for the first time:

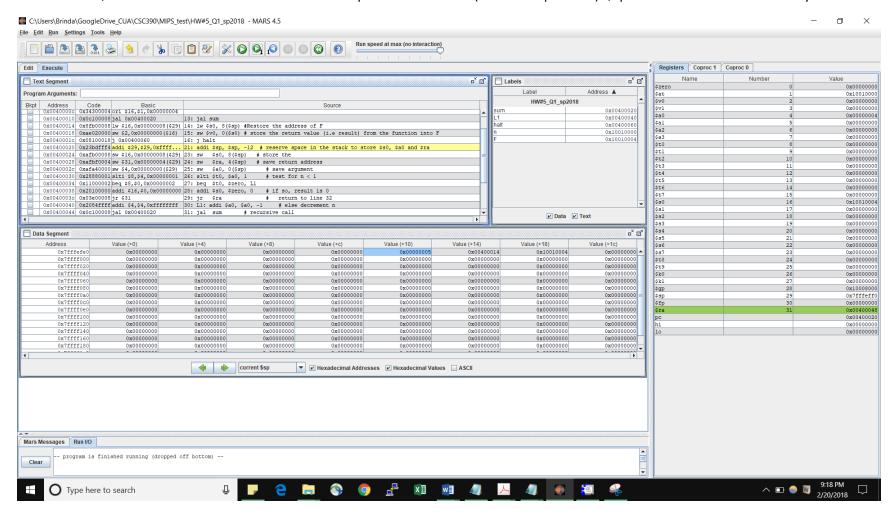


\$pc has the current location, \$ra contains the return address to the main program and \$sp has the highest location of the memory.

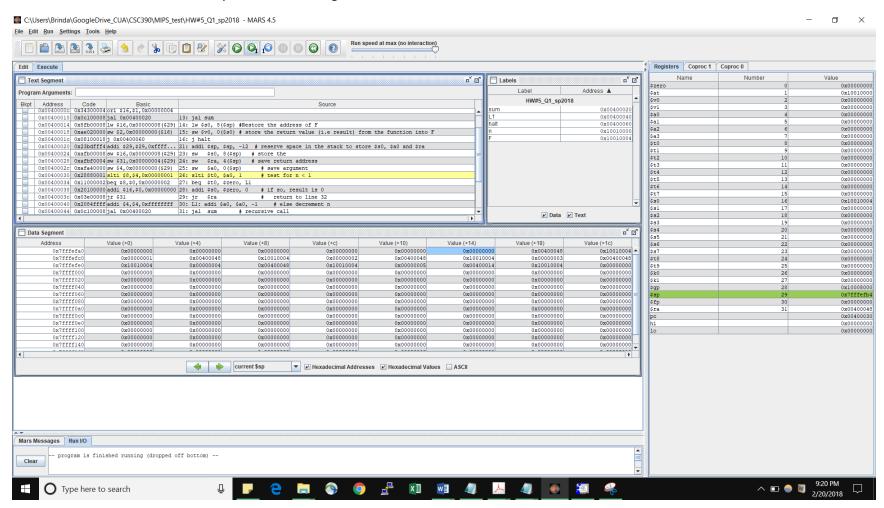
During the execution of sum procedure (1st iteration), the stack memory location is loaded the values of return address (\$ra) to the main program and the current valu of n (\$a0).



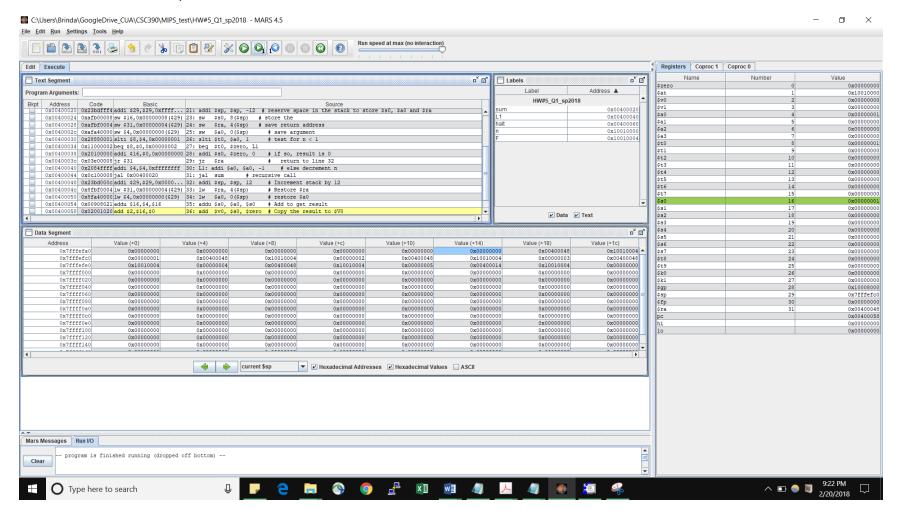
2nd Iteration: \$ra has now the return address to the sum procedure location (recursive operation). \$sp has the value decremented by 12.



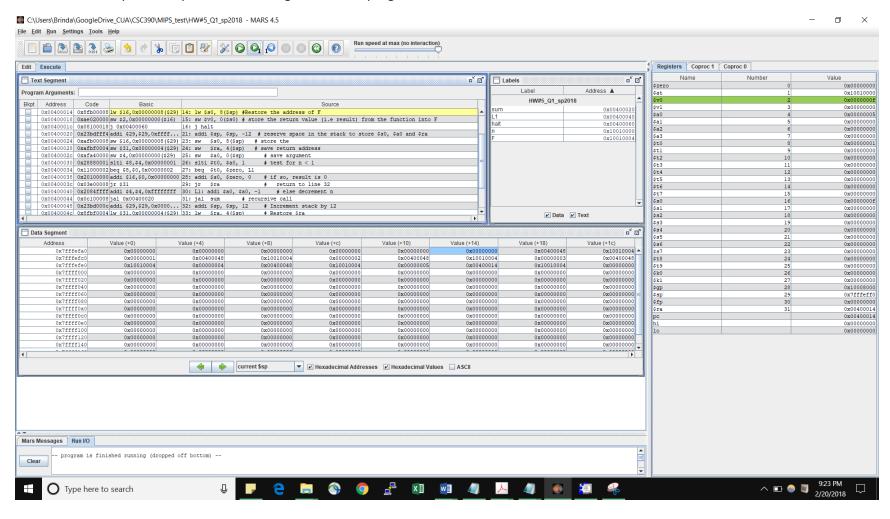
After 5 iterations: the stack memory locations showing the return addresses and the decremented values of n.



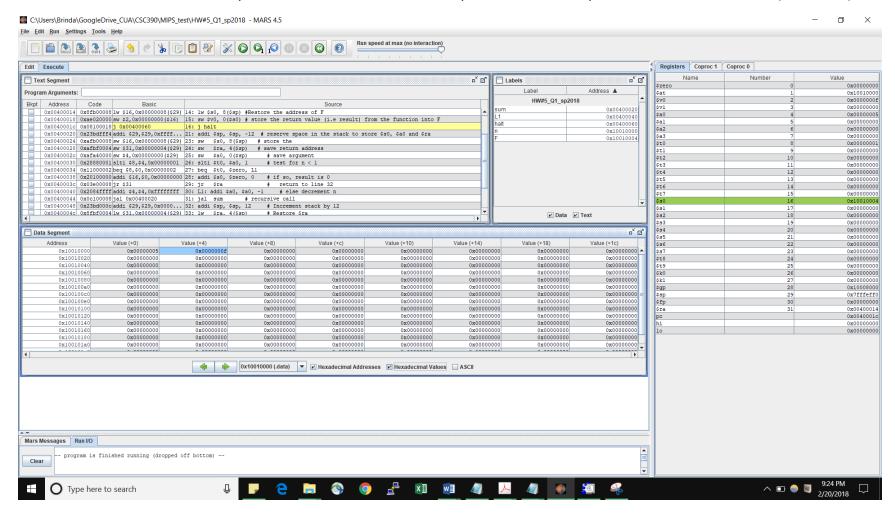
Values of the stack memory location when n decremented to 0



Contents of \$ra, \$pc, and \$sp before returning to the main program:



After result is stored into the memory location of F. check that the memory location indicated by \$50 has the correct results 15 (i.e. f in Hex).



```
2.26
2.26.1 20
2.26.2 i = 10;
    do {
        B += 2;
        i = i - 1;
    } while ( i > 0)
```

2.26.3 5*N+2