Stack Status Diagram:

Address Data

|  |  |  |
| --- | --- | --- |
| FC |  | ←$sp $v0 = 78h |
| F8 | $a1 (0x5) |  |
| F4 | $ra (3054) | ←$sp $a1 = 5 , $v0 = 24 \* 5 |
| F0 | $a1 (0x4) |  |
| EC | $ra (3088) | ←$sp $a1 = 4, $v0 = 6 \* 4 |
| E8 | $a1 (0x3) |  |
| E4 | $ra (3088) | ←$sp $a1 = 3, $v0 = 3 \* 2 |
| E0 | $a1 (0x2) |  |
| DC | $ra (3088) | ←$sp $a1 = 2, $v0 = 2 \* 1 |
| D8 | $a1 (0x1) |  |
| D4 | $ra (3088) | ←$sp $a1 = 1, $v0 = 1 \* 1 |

Cmpe 140 Lab 4 Test Log:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Addr | MIPS Instruction | Machine Code | Registers | | | | Memory Content | |
| $a1 | $sp | $ra | $v0 | [0x00] | [0x10] |
| 034 | Lw $t2, 356($0) | 8c0a0164 | 32 | 2ffc | 0 | 0 | 0 | 0 |
| 038 | Lw $t3, 376($0) | 8c0b0178 | 32 | 2ffc | 0 | 0 | 0 | 0 |
| 03c | Add $t2, $t2, $t3 | 014b5020 | 32 | 2ffc | 0 | 0 | 0 | 0 |
| 040 | Addiu $t3, $0, 30 | 240b001e | 32 | 2ffc | 0 | 0 | 0 | 0 |
| 044 | Div $t2, $t3 | 014b001a | 32 | 2ffc | 0 | 0 | 0 | 0 |
| 048 | Mflo $a1 | 00002812 | 5 | 2ffc | 0 | 0 | 0 | 0 |
| 04c | Addi $v0, $0, 1 | 20020001 | 5 | 2ffc | 0 | 1 | 0 | 0 |
| 050 | Jal factorial | 0c000c17 | 5 | 2ffc | 3054 | 1 | 0 | 0 |
| 054 | Add $s0, $v0, $0 | 00408020 | 5 | 2ffc | 3054 | 78 | 0 | 0 |
| 058 | J end | 08000c26 | 5 | 2ffc | 3054 | 78 | 0 | 0 |
| 05c | factorial: addi $s0, $v0, $0 | 00003098 | 5 | 2ff4 | 3054 | 1 | 0 | 0 |
| 060 | Sw $a1, 4($sp) | afa50004 | 5 | 2ff4 | 3054 | 1 | 0 | 0 |
| 064 | Sw $ra, 0($sp) | afbf0000 | 5 | 2ff4 | 3054 | 1 | 0 | 0 |
| 068 | Slti $t4, $a1, 2 | 28ac0002 | 5 | 2ff4 | 3054 | 1 | 0 | 0 |
| 070 | Addi $sp, $sp, 8 | 23bd0008 | 5 | 2ff4 | 3054 | 1 | 0 | 0 |
| 074 | Jr $ra | 03e00008 | 1 | 2fdc | 3080 | 1 | 0 | 0 |
| 078 | Addi $a1, $a1, -1 | 20a5ffff | 4 | 2ff4 | 3054 | 1 | 0 | 0 |
| 07c | Jal factorial | 0c000c17 | 4 | 2ff4 | 3080 | 1 | 0 | 0 |
| 080 | Lw $ra, 0($sp) | 8fbf0000 | 1 | 2fdc | 3080 | 1 | 0 | 0 |
| 084 | Lw $a1, 4($sp) | 8fa50004 | 2 | 2fdc | 3080 | 1 | 0 | 0 |
| 088 | Addi $sp, $sp, 8 | 23bd0008 | 2 | 2fe4 | 3080 | 1 | 0 | 0 |
| 08c | Mult $v0, $a1 | 00450018 | 2 | 2fe4 | 3080 | 1 | 0 | 0 |
| 090 | Mflo $v0 | 00001012 | 2 | 2fe4 | 3080 | 2 | 0 | 0 |
| 094 | Jr $ra | 03e00008 | 2 | 2fe4 | 3080 | 2 | 0 | 0 |
| 098 | Sw $a1, 0($0) | Ac050000 | 5 | 2ffc | 3054 | 78 | 5 | 0 |
| 09c | Sw $s0, 16($0) | Ac100010 | 5 | 2ffc | 3054 | 78 | 5 | 78 |

Source Code:

# $a0 = array base address

# $a1 = n

# $s0 = n!

Main:

li $a0, 0x100 #array base address = 0x100

li $a1, 0 #i = 0

li $t0, 3

li $t1, 50 # $t1 = 50

CreateArray\_Loop: slt $t2, $a1, $t1 #i < 50?

beq $t2, $0, Exit\_Loop #if not then exit loop

sll $t2, $a1, 2 #$t2 = i \* 4

add $t2, $t2, $a0 # address of array[i]

mult $a1, $t0

mflo $t3 # $t3 = i \* 3

Sw $t3, 0($t2) #save array[i]

addi $a1, $a1, 1 #i = i + 1

j CreateArray\_Loop

Exit\_Loop:

#my code

lw $t2, 356($0) #t2 = my\_array[25]

lw $t3, 376($0) #t3 = my\_array[30]

add $t2, $t2, $t3 #t2 = t2 + t3

addiu $t3, $0, 30 #t3 = 30

div $t2, $t3 # (my\_array[25] + my\_array[30]) / 30

mflo $a1 # n = (my\_array[25] + my\_array[30]) / 30

addi $v0, $0, 1

jal factorial #call procedure

add $s0, $v0, $0 #return value

j end

factorial: addi $sp, $sp, -8 #make room on stack

sw $a1, 4($sp) # store $a1

sw $ra, 0($sp) # store $ra

# your code goes in here

slti $t4, $a1, 2

beq $t4, $0, else

addi $sp, $sp, 8

jr $ra

else: addi $a1, $a1, -1

jal factorial

lw $ra, 0($sp)

lw $a1, 4($sp)

addi $sp, $sp, 8

mult $v0, $a1

mflo $v0

jr $ra

end: sw $a1, 0($0)

sw $s0, 16($0)