

6. In this question you will be asked to write a small subroutine using MIPS assembler. You will then write a second program that calls this subroutine more than once. *A copy of Appendix-B of your text book containing all MIPS Instructions has been provided to you.*
- (a) (9 points) Write a subroutine called `findmin` that will return the **minimum** value of an array. The location of the array in memory (`a0`) and the length of the array (`a1`) will be passed as parameters. The minimum value will be returned in the register `v0`.

Solution:

```

1 findmin:  lw $t4, 0($a0)           # t4 is minimum
2           addi $t1, $0, 0          # loop counter t1 init 0
3
4 loop:     addi $t1, $t1, 1          # t1 ++
5           beq $t1, $a1, done        # loop reaches a1 --> done
6           sll $t2, $t1, 2           # byte addressing, multiply
7           add $t2, $t2, $a0         # address of $t1 th member
8           lw $t3, 0($t2)           # load value from memory
9           slt $t5, $t4, $t3         # compare to $t4
10          beq $t5, $0, updatemin    # t3 is smaller
11          j loop                   # repeat
12
13 updatemin: add $t4, $0, $t3         # update $t4
14           j loop                   # continue loop
15
16 done:     add $v0, $0, $t4         # move result to $t4
17           jr $ra                   # jump to $ra

```

(b) (6 points) Now that you have the subroutine `findmin`, write a small MIPS assembly subroutine that:

- finds the minimum of a first array of 64 values starting from the address `0x0000 0400`
- finds the minimum of a second array of 64 values starting from the address `0x0000 0824`
- jumps to label (`first`) if the minimum value of the first array is greater than the minimum value of the second array otherwise execution jumps to label (`second`)
- At the end, jump back to the calling program
- If necessary, save values in stack before calling `findmin`.

Solution:

```

1 sol:    addi $sp, $sp, -4      # make room on stack
2         sw   $ra, 0($sp)      # save ra
3
4         addi $a0, $0, 0x0400   # first address
5         addi $a1, $0, 64       # number of elements
6         jal  findmin           # v0=findmin(a0,a1)
7         add  $s1,$0,$v0        # save result to $s1
8
9         addi $a0, $0, 0x0824   # second address
10        addi $a1, $0, 64       # number of elements
11        jal  findmin           # v0=findmin(a0,a1)
12
13        slt  $t0, $s1, $v0     # is $s1 less than v0
14        beq $t0, $0, first     # no : jump to first
15
16 second:                                     # do something
17        j    end               # jump over first
18
19 first:                                     # do something
20
21 end:    lw   $ra, 0($sp)       # restore ra
22        addi $sp, $sp, 4       # restore stack
23        jr   $ra               # jump to $ra

```