

Homework 2

Question 1: Find Min and Max of Array

CIS-655 ADVANCED COMPUTER ARCHITECTURE

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The following program creates an array of 10 integers and finds the minimum and maximum values in the array. The minimum value is stored in register \$s0, and the maximum value is stored in register \$s1.

The array is [10, 5, 15, 3, 18, 7, 20, 2, 16, 1]. After running the program, register \$s0 should have the value 1 stored, representing the minimum, and register \$s1 should have the value 20 stored, representing the maximum.

```
#
```

```
# The following program simply creates an array of 10 integers
```

```
# and runs a loop to find the minimum and maximum values in
```

```
# the array. The minimum value is stored in register $s0 and
```

```
# the maximum value is stored in register $s1.
```

```
#
```

```
.data          # Defines variable section of an assembly routine.
```

```
array: .word 10, 5, 15, 3, 18, 7, 20, 2, 16, 1 # Define a variable named array as a word
```

```
            # (integer) array.
```

```
.text          # Defines the start of the code section for the program.
```

```
.globl main
```

```
main:
```

```
la $t0, array    # Move the address of array into register $t0.
```

```
addi $t1, $zero, 10 # t1 will have the number of elements inside of it (10) (array length)
```

```
lw $s0, 0($t0)    # min = array[0]
```

```
lw $s1, 0($t0)    # max = array[0]
```

```
addi $t2, $zero, 1 # t2 represents i which will start at index 1 in the array (not index 0)
```

```
loop:
```

```
beq $t1, $t2, exit_loop
```

```
sll $t3, $t2, 2    # t3 holds the offset to be applied later to the original address of the array
```

```
add $t3, $t3, $t0  # t3 holds the address of array[i]
```

```
lw $t4, 0($t3)      # t4 holds the value of array[i]
```

```
slt $t5, $t4, $s0    # slt = set less than. Set t5 if s0 (min) is less than t4 (array[i])
```

```
beq $t5, $zero, do_not_set_min
```

```
add $s0, $zero, $t4  # set min = array[i]
```

```
do_not_set_min:
```

```
slt $t5, $t4, $s1    # set t5 if t4 (array[i]) is less than s1 (max)
```

```
bne $t5, $zero, do_not_set_max
```

```
add $s1, $zero, $t4  # set max = array[i]
```

```
do_not_set_max:
```

```
addi $t2, $t2, 1
```

```
j loop
```

```
exit_loop:
```

```
li $v0, 10           # System Service call to terminate program run.
```

```
syscall
```

Registers			Coproc 1	Coproc 0
Name	Number	Value		
\$zero	0	0		
\$at	1	268500992		
\$v0	2	10		
\$v1	3	0		
\$a0	4	0		
\$a1	5	0		
\$a2	6	0		
\$a3	7	0		
\$t0	8	268500992		
\$t1	9	10		
\$t2	10	10		
\$t3	11	268501028		
\$t4	12	1		
\$t5	13	1		
\$t6	14	0		
\$t7	15	0		
\$s0	16	1		
\$s1	17	20		
\$s2	18	0		
\$s3	19	0		
\$s4	20	0		
\$s5	21	0		
\$s6	22	0		
\$s7	23	0		
\$t8	24	0		
\$t9	25	0		
\$k0	26	0		
\$k1	27	0		
\$gp	28	268468224		
\$sp	29	2147479548		
\$fp	30	0		
\$ra	31	0		
pc		4194384		
hi		0		
lo		0		

Data Segment										
Address	Value (+0)	Value (+4)	Value (+8)	Value (+12)	Value (+16)	Value (+20)	Value (+24)	Value (+28)		
268500992	10	5	15	3	18	7	20	2		
268501024	16	1	0	0	0	0	0	0		
268501056	0	0	0	0	0	0	0	0		
268501088	0	0	0	0	0	0	0	0		
268501120	0	0	0	0	0	0	0	0		
268501152	0	0	0	0	0	0	0	0		
268501184	0	0	0	0	0	0	0	0		
268501216	0	0	0	0	0	0	0	0		
268501248	0	0	0	0	0	0	0	0		
268501280	0	0	0	0	0	0	0	0		
268501312	0	0	0	0	0	0	0	0		
268501344	0	0	0	0	0	0	0	0		
268501376	0	0	0	0	0	0	0	0		
268501408	0	0	0	0	0	0	0	0		
268501440	0	0	0	0	0	0	0	0		
268501472	0	0	0	0	0	0	0	0		