

# LAB 3

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## Assignment 1

Code:

```
#Lab Ex 3, Assigment 1
```

```
.data
```

```
I: .word 2
```

```
J: .word 1
```

```
.text
```

```
#Load i and j
```

```
la $t8, I
```

```
la $t9, J
```

```
lw $s1, 0($t8)
```

```
lw $s2, 0($t9)
```

```
start:
```

```
slt $t0, $s2, $s1
```

```
bne $t0, $zero, else
```

```
addi $t1, $t1, 1
```

```
addi $t3, $zero, 1
```

```
j endif
```

```
else:
```

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

```
add $t3, $t3, $t3
```

```
endif:
```

Result:

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380000 ori \$24,\$1,0x00000000	8:	la \$t0, J
	0x00400008	0x3011001 lui \$1,0x00001001	9:	la \$t0, J
	0x00400010	0x34390004 ori \$25,\$1,0x00000004	10:	lw \$t0, 0(\$t0)
	0x00400014	0x8f110000 lw \$t0,0x00000000(\$...)	11:	lw \$t0, 0(\$t0)
	0x00400018	0x0251402a bne \$t0,\$10,0x00000003	12:	bne \$t0, \$zero, else
	0x00400020	0x21290001 addi \$t0,\$t0,0x00000001	13:	addi \$t0, \$t0, 1
	0x00400024	0x20000001 addi \$t1,\$t0,0x00000000...17:	14:	addi \$t1, \$t0, 0
	0x00400028	0x0200000d j 0x040034	15:	j endif
	0x0040002c	0x214affff addi \$t0,\$t0,0xffff...21:	16:	addi \$t0, \$t0, -1

**Labels**

Label	Address
start	0x00400018
else	0x0400002c
endif	0x04000034
I	0x10010000
J	0x10010004

**Registers**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x00000000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000000
\$t10	18	0x00000000
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00000000
\$t17	25	0x00000000
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xffffffff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000000
hi		0x00000000
lo		0x00000000

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000000	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100e0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages**

Reset: reset completed.

**Run I/O**

Clear

Reset: reset completed.

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380000 ori \$24,\$1,0x00000000	8:	la \$t0, J
	0x00400008	0x3011001 lui \$1,0x00001001	9:	la \$t0, J
	0x00400010	0x34390004 ori \$25,\$1,0x00000004	10:	lw \$t0, 0(\$t0)
	0x00400014	0x8f110000 lw \$t0,0x00000000(\$...)	11:	lw \$t0, 0(\$t0)
	0x00400018	0x0251402a bne \$t0,\$10,0x00000003	12:	bne \$t0, \$zero, else
	0x00400020	0x21290001 addi \$t0,\$t0,0x00000001	13:	addi \$t0, \$t0, 1
	0x00400024	0x20000001 addi \$t1,\$t0,0x00000000...17:	14:	addi \$t1, \$t0, 0
	0x00400028	0x0200000d j 0x040034	15:	j endif
	0x0040002c	0x214affff addi \$t0,\$t0,0xffff...21:	16:	addi \$t0, \$t0, -1

**Labels**

Label	Address
start	0x00400018
else	0x0400002c
endif	0x04000034
I	0x10010000
J	0x10010004

**Registers**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x00000000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000000
\$t10	18	0x00000000
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00000000
\$t17	25	0x00000000
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xffffffff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000000
hi		0x00000000
lo		0x00000000

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000000	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages**

Reset: reset completed.

**Run I/O**

Clear

Reset: reset completed.

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Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380001ori \$24,\$1,0x00000000	8:	la \$t9, J
	0x00400008	0x3011001 lui \$1,0x00001001	8:	la \$t9, J
	0x0040000c	0x34390004ori \$25,\$1,0x00000004	9:	lw \$s1, 0(\$t8)
	0x00400010	0x8f110000lw \$17,0x00000000(\$...:10)	9:	lw \$s2, 0(\$t9)
	0x00400014	0x8f320000lw \$18,0x00000000(\$...:10)	10:	bne \$t0, \$zero, else
	0x00400018	0x0251402aalt \$8,\$18,\$17	14:	slt \$t0, \$s2, \$s1
	0x0040001c	0x15000003bne \$8,\$0,0x00000003	15:	addi \$t3, \$zero, 1
	0x00400020	0x21280001addi \$9,\$9,0x00000001	16:	addi \$t1, \$t1, 1
	0x00400024	0x20000001addi \$11,\$0,0x00000000...17:		addi \$t3, \$zero, 1
	0x00400028	0x02100004j 0x0400034	18:	j endif
	0x0040002c	0x214fffffaddi \$10,\$10,0xfffff...21:		addi \$t2, \$t2, -1

**Labels**

Label	Address
start	0x00400018
else	0x00400034
endif	0x00400034
I	0x10010000
J	0x10010004

**Registers**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000000
\$t10	18	0x00000000
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00100000
\$t17	25	0x00000000
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xfffffeff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000008
hi		0x00000000
lo		0x00000000

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100e0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages**

Reset: reset completed.

**Run I/O**

Clear

Reset: reset completed.

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380001ori \$24,\$1,0x00000000	8:	la \$t9, J
	0x00400008	0x3011001 lui \$1,0x00001001	8:	la \$t9, J
	0x0040000c	0x34390004ori \$25,\$1,0x00000004	9:	lw \$s1, 0(\$t8)
	0x00400010	0x8f110000lw \$17,0x00000000(\$...:10)	9:	lw \$s2, 0(\$t9)
	0x00400014	0x8f320000lw \$18,0x00000000(\$...:10)	10:	bne \$t0, \$zero, else
	0x00400018	0x0251402aalt \$8,\$18,\$17	14:	slt \$t0, \$s2, \$s1
	0x0040001c	0x15000003bne \$8,\$0,0x00000003	15:	addi \$t3, \$zero, 1
	0x00400020	0x21280001addi \$9,\$9,0x00000001	16:	addi \$t1, \$t1, 1
	0x00400024	0x20000001addi \$11,\$0,0x00000000...17:		addi \$t3, \$zero, 1
	0x00400028	0x02100004j 0x0400034	18:	j endif
	0x0040002c	0x214fffffaddi \$10,\$10,0xfffff...21:		addi \$t2, \$t2, -1

**Labels**

Label	Address
start	0x00400018
else	0x00400034
endif	0x00400034
I	0x10010000
J	0x10010004

**Registers**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000000
\$t10	18	0x00000000
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00100000
\$t17	25	0x00000000
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xfffffeff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000008
hi		0x00000000
lo		0x00000000

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages**

Reset: reset completed.

**Run I/O**

Clear

Reset: reset completed.

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380000 ori \$24,\$1,0x00000000	8:	la \$t0, J
	0x00400008	0x3011001 lui \$1,0x00001001	9:	lw \$t0, 0(\$t0)
	0x00400010	0x34390004 ori \$25,\$1,0x00000004	10:	bne \$t0, \$zero, else
	0x00400014	0x8f110000 lw \$17,0x00000000(\$...)	11:	lw \$t1, 0(\$t0)
	0x00400018	0x0251402a bne \$8,\$18,\$17	12:	slt \$t0, \$t2, \$t1
	0x0040001c	0x15000003 bne \$8,\$0,0x00000003	13:	addi \$t0, \$zero, 1
	0x00400020	0x21280001 addi \$9,\$9,0x00000001	14:	addi \$t1, \$t1, 1
	0x00400024	0x20000001 addi \$11,\$0,0x00000000...17:	15:	addi \$t2, \$zero, 1
	0x00400028	0x0100000d j 0x040034	18:	j endif
	0x0040002c	0x214fffff addi \$10,\$10,0xfffff...21:	19:	addi \$t2, \$t2, -1

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100e0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages Run I/O**

Reset: reset completed.

**Registers Coproc 1 Coproc 0**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000000
\$t10	18	0x00000000
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00000000
\$t17	25	0x00000004
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xfffffeff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000010
hi		0x00000000
lo		0x00000000

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380000 ori \$24,\$1,0x00000000	8:	la \$t0, J
	0x00400008	0x3011001 lui \$1,0x00001001	9:	lw \$t0, 0(\$t0)
	0x00400010	0x34390004 ori \$25,\$1,0x00000004	10:	bne \$t0, \$zero, else
	0x00400014	0x8f110000 lw \$17,0x00000000(\$...)	11:	lw \$t1, 0(\$t0)
	0x00400018	0x0251402a bne \$8,\$18,\$17	12:	slt \$t0, \$t2, \$t1
	0x0040001c	0x15000003 bne \$8,\$0,0x00000003	13:	addi \$t0, \$zero, 1
	0x00400020	0x21280001 addi \$9,\$9,0x00000001	14:	addi \$t1, \$t1, 1
	0x00400024	0x20000001 addi \$11,\$0,0x00000000...17:	15:	addi \$t2, \$zero, 1
	0x00400028	0x0100000d j 0x040034	18:	j endif
	0x0040002c	0x214fffff addi \$10,\$10,0xfffff...21:	19:	addi \$t2, \$t2, -1

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages Run I/O**

Reset: reset completed.

**Registers Coproc 1 Coproc 0**

Name	Number	Value
CPU registers	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000002
\$t10	18	0x00000000
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00000000
\$t17	25	0x00000004
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xfffffeff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000014
hi		0x00000000
lo		0x00000000

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380001ori \$24,\$1,0x00000000	8:	la \$t0, J
	0x00400008	0x3011001 lui \$1,0x00001001	9:	la \$t0, J
	0x0040000C	0x34390004ori \$25,\$1,0x00000004	10:	lw \$t0, 0(\$t0)
	0x00400010	0x8f110000lw \$17,0x00000000(\$...)	11:	lw \$t1, 0(\$t0)
	0x00400014	0x8f320000lw \$18,0x00000000(\$...)	12:	lw \$t2, 0(\$t0)
	0x00400018	0x0251402aalit \$8,\$18,\$17	13:	slt \$t0, \$t2, \$t1
	0x0040001C	0x15000003bne \$8,\$0,0x00000003	15:	bne \$t0, \$zero, else
	0x00400020	0x21280001addi \$9,\$9,0x00000001	16:	addi \$t1, \$t1, 1
	0x00400024	0x20000001addi \$11,\$0,0x00000000...17:		addi \$t2, \$zero, 1
	0x00400028	0x0810000djal \$0x040034	18:	j endif
	0x0040002C	0x214affffaddi \$10,\$10,0xffff...21:		addi \$t2, \$t2, -1

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100A0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100C0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100E0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Registers**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000000
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000002
\$t2	18	0x00000001
\$t3	19	0x00000000
\$t4	20	0x00000000
\$t5	21	0x00000000
\$t6	22	0x00000000
\$t7	23	0x00000000
\$t8	24	0x00000000
\$t9	25	0x00000004
\$t0	26	0x00000000
\$t1	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xfffffeffc
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000018
hi		0x00000000
lo		0x00000000

**Mars Messages**

Reset: reset completed.

**Run I/O**

Clear

Reset: reset completed.

D:\2023\2\TH KTM\KTM\Lab3\Assignment\_1.asm - MARS 4.5

File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3011001 lui \$1,0x00001001	7:	la \$t0, I
	0x00400004	0x34380001ori \$24,\$1,0x00000000	8:	la \$t0, J
	0x00400008	0x3011001 lui \$1,0x00001001	9:	la \$t0, J
	0x0040000C	0x34390004ori \$25,\$1,0x00000004	10:	lw \$t0, 0(\$t0)
	0x00400010	0x8f110000lw \$17,0x00000000(\$...)	11:	lw \$t1, 0(\$t0)
	0x00400014	0x8f320000lw \$18,0x00000000(\$...)	12:	lw \$t2, 0(\$t0)
	0x00400018	0x0251402aalit \$8,\$18,\$17	13:	slt \$t0, \$t2, \$t1
	0x0040001C	0x15000003bne \$8,\$0,0x00000003	15:	bne \$t0, \$zero, else
	0x00400020	0x21280001addi \$9,\$9,0x00000001	16:	addi \$t1, \$t1, 1
	0x00400024	0x20000001addi \$11,\$0,0x00000000...17:		addi \$t2, \$zero, 1
	0x00400028	0x0810000djal \$0x040034	18:	j endif
	0x0040002C	0x214affffaddi \$10,\$10,0xffff...21:		addi \$t2, \$t2, -1

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100A0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100C0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100E0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Registers**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000001
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000002
\$t2	18	0x00000001
\$t3	19	0x00000000
\$t4	20	0x00000000
\$t5	21	0x00000000
\$t6	22	0x00000000
\$t7	23	0x00000000
\$t8	24	0x00000000
\$t9	25	0x00000004
\$t0	26	0x00000000
\$t1	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0xfffffeffc
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000018
hi		0x00000000
lo		0x00000000

**Mars Messages**

Reset: reset completed.

**Run I/O**

Clear

Reset: reset completed.

D:\2023\2\TH KTM\KTM\Lab3\Assignment\_1.asm - MARS 4.5

File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400004	0x43100000	ori \$24,\$1,0x00000000	7: la \$t0, i
	0x00400005	0x43100000	ori \$24,\$1,0x00000000	8: la \$t9, J
	0x00400006	0x3c011001	lui \$1,\$0x00001001	
	0x00400007	0x43100004	ori \$25,\$1,0x00000004	
	0x00400010	0xbef10000	lw \$17,0x00000000(\$...)	9: lw \$t1, 0(\$t8)
	0x00400014	0xbef30000	lw \$18,0x00000000(\$...)	10: lw \$t2, 0(\$t9)
	0x00400018	0x0251402a	lwt \$8,\$18,\$17	14: slt \$t0, \$t2, \$t1
	0x00400019	0x15000003	lne \$8,\$0,0x00000003	15: bne \$t0, \$zero, else
	0x00400020	0x21290001	add \$9,\$9,\$0	16: addi \$t1, \$t1, 1
	0x00400024	0x200e0001	addi \$11,\$0,0x00000000	17: addi \$t3, \$zero, 1
	0x00400028	0x0910000d	0x04000034	18: j endif
	0x0040002d	0x214fffff	addi \$10,\$10,0xffff...	21: addi \$t2, \$t2, -1

**Data Segment**

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100e0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages** Run I/O

Reset: reset completed.

**Registers** **Coproc 1** **Coproc 0**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000001
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000002
\$t10	18	0x00000001
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00000000
\$t17	25	0x00000004
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x00000000
\$sp	29	0xfffffeff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x0400002c
hi		0x00000000
lo		0x00000000

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File Edit Run Settings Tools Help

Run speed at max (no interaction)

**Edit Execute**

**Text Segment**

Bkpt	Address	Code	Basic	Source
	0x00400004	0x43100000	ori \$24,\$1,0x00000000	7: la \$t0, J
	0x00400005	0x43100000	ori \$24,\$1,0x00000000	8: la \$t9, J
	0x00400006	0x3c011001	lui \$1,\$0x00001001	
	0x00400007	0x43100004	ori \$25,\$1,0x00000004	
	0x00400010	0xbef10000	lw \$17,0x00000000(\$...)	9: lw \$t1, 0(\$t8)
	0x00400014	0xbef30000	lw \$18,0x00000000(\$...)	10: lw \$t2, 0(\$t9)
	0x00400018	0x0251402a	lwt \$8,\$18,\$17	14: slt \$t0, \$t2, \$t1
	0x00400019	0x15000003	lne \$8,\$0,0x00000003	15: bne \$t0, \$zero, else
	0x00400020	0x21290001	add \$9,\$9,\$0	16: addi \$t1, \$t1, 1
	0x00400024	0x200e0001	addi \$11,\$0,0x00000000	17: addi \$t3, \$zero, 1
	0x00400028	0x0910000d	0x04000034	18: j endif
	0x0040002d	0x214fffff	addi \$10,\$10,0xffff...	21: addi \$t2, \$t2, -1
	0x00400030	0x01685820	add \$11,\$11,\$11	22: addi \$t3, \$t3, \$t3

**Data Segment**

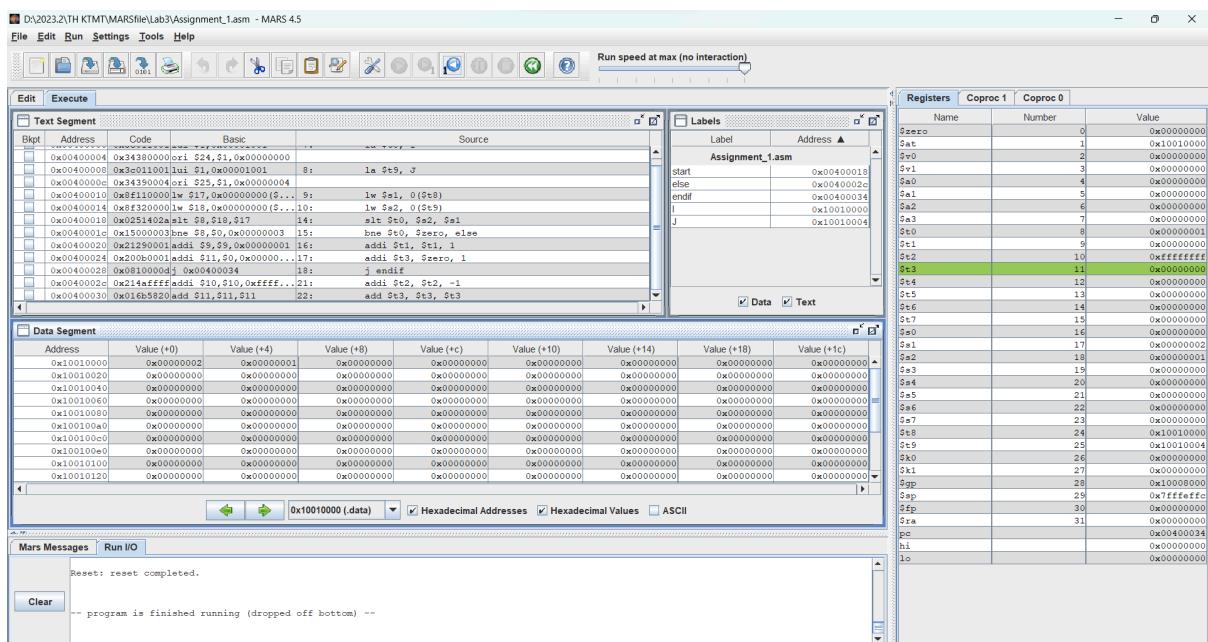
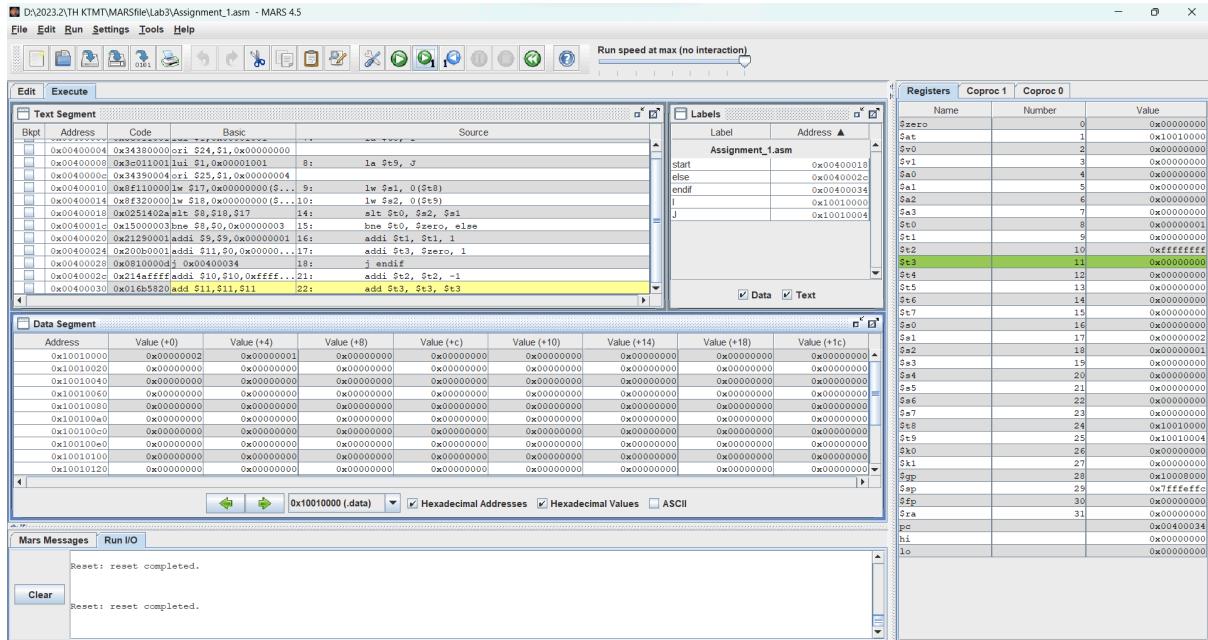
Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x00000002	0x00000001	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

**Mars Messages** Run I/O

Reset: reset completed.

**Registers** **Coproc 1** **Coproc 0**

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x00000000
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000001
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$t8	16	0x00000000
\$t9	17	0x00000002
\$t10	18	0x00000001
\$t11	19	0x00000000
\$t12	20	0x00000000
\$t13	21	0x00000000
\$t14	22	0x00000000
\$t15	23	0x00000000
\$t16	24	0x00000000
\$t17	25	0x00000004
\$t18	26	0x00000000
\$t19	27	0x00000000
\$gp	28	0x00000000
\$sp	29	0xfffffeff
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x04000020
hi		0x00000000
lo		0x00000000



- Khởi tạo chương trình với  $i = 2$  và  $j = 1$ .
- Lệnh `slt` so sánh  $i$  với  $j$  và  $j < i$  thì trả về 1, còn lại trả về 0 vào thanh ghi `$t0`.
- Lệnh `bne` nhận giá trị thanh ghi `$t0` và so sánh với 0 (thanh ghi zero), đúng thì chạy sang nhánh `else` (được dán nhãn `else:`) sai thì bỏ qua chạy tuần tự tiếp.
- Chương trình chạy trả về giá trị đúng.

## Assignment 2

Code:

#Laboratory 3, Home Assignment 2

```
.data
n: .word 3
step: .word 1
A: .word 1,9,5 #Load array
```

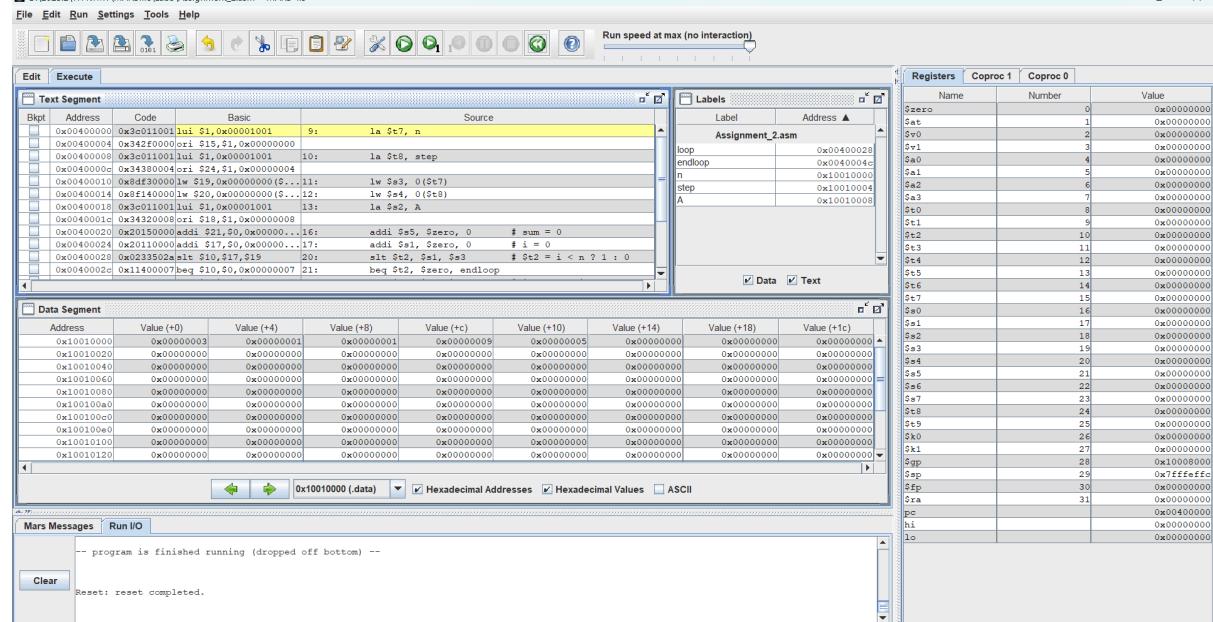
```
.text
#Load n, step, starting address A[i]
la $t7, n
la $t8, step
lw $s3, 0($t7)
lw $s4, 0($t8)
la $s2, A
```

```
addi $s5, $zero, 0      # sum = 0
addi $s1, $zero, 0      # i = 0

loop:
slt $t2, $s1, $s3      # $t2 = i < n ? 1 : 0
beq $t2, $zero, endloop
add $t1, $s1, $s1      # $t1 = 2 * $s1
add $t1, $t1, $t1      # $t1 = 4 * $s1 - 4 byte word
add $t1, $t1, $s2      # $t1 store the address of A[i]
lw $t0, 0($t1)          # load value of A[i] in $t0
add $s5, $s5, $t0       # sum = sum + A[i]
add $s1, $s1, $s4       # i = i + step
j loop                  # goto loop
```

endloop:

Result:



The screenshot shows the MARS 4.5 assembly editor interface. The top menu bar includes File, Edit, Run, Settings, Tools, and Help. The main window has several toolbars at the top. The left side features the Text Segment and Data Segment panes. The Text Segment pane displays assembly code with labels, addresses, and source code. The Data Segment pane shows memory starting at address 0x10010000. The right side features the Registers pane, which lists registers Szero through lo with their current values.

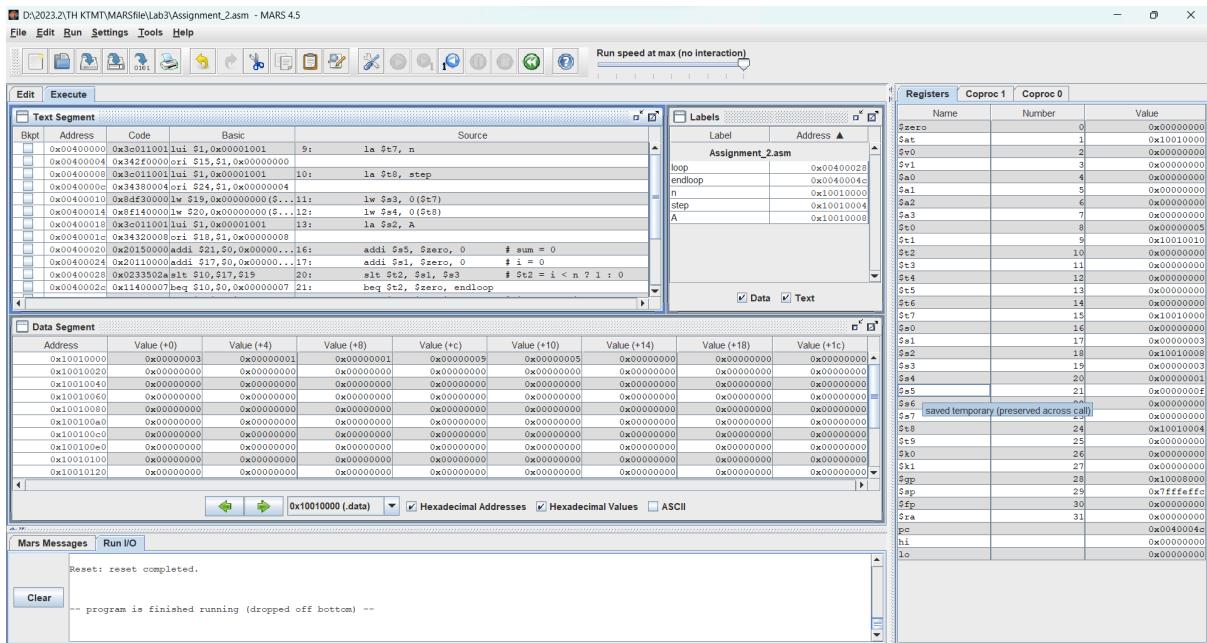
Registers	Coproc 1	Coproc 0
Szero	0	0x00000000
S\$1	1	0x10010000
S\$2	2	0x00000000
S\$3	3	0x00000000
S\$4	4	0x00000000
S\$5	5	0x00000000
S\$6	6	0x00000000
S\$7	7	0x00000000
S\$8	8	0x00000000
S\$9	9	0x00000000
S\$10	10	0x00000000
S\$11	11	0x00000000
S\$12	12	0x00000000
S\$13	13	0x00000000
S\$14	14	0x00000000
S\$15	15	0x10010000
S\$16	16	0x00000000
S\$17	17	0x00000000
S\$18	18	0x00000000
S\$3	19	0x00000000
S\$20	20	0x00000000
S\$21	21	0x00000000
S\$22	22	0x00000000
S\$23	23	0x00000000
S\$24	24	0x10010000
S\$25	25	0x00000000
S\$26	26	0x00000000
S\$27	27	0x00000000
S\$28	28	0x00000000
S\$29	29	0xffffffff
S\$30	30	0x00000000
Sra	31	0x00000000
ps		0x00040021
hi		0x00000000
lo		0x00000000

- Khởi tạo array A với 3 giá trị 1, 9, 5 lần lượt
  - Lệnh la \$s2, A : Lưu địa chỉ đầu array A vào thanh ghi \$t2

The screenshot shows the Mars 4.5 assembly editor interface. The top menu bar includes File, Edit, Run, Settings, Tools, and Help. The main window is divided into several panes:

- Text Segment**: Shows assembly code from address 0x00040000 to 0x0004003B. The code includes instructions like ori, lw, addi, sll, slt, and add. A yellow box highlights the loop section starting at address 0x00040020.
- Data Segment**: Shows memory starting at address 0x00010000 with values ranging from 0x00000000 to 0x00000003.
- Registers**: Displays registers Szero through S17, all initialized to 0x00000000.
- Coproc 0**: Shows Coproc 0 registers Number 0 through 31, also initialized to 0x00000000.
- Coproc 1**: Shows Coproc 1 registers Name 0 through 31, also initialized to 0x00000000.
- Mars Messages**: Displays the message "program is finished running (dropped off bottom)".
- Run I/O**: Shows the current run state as "0x10010000 (data)".

- Lệnh slt \$t2, \$s1, \$s3 so sánh giá trị thanh ghi s1 và s3 tương ứng với i và n. Trả về giá trị 1 nếu đúng  $i < n$  và 0 cho còn lại.
  - Lệnh beq \$t2, \$zero, endloop : so sánh giá trị thanh ghi t2 với giá trị 0 nếu đúng thì dừng vòng lặp loop ( rẽ nhánh về nhãn endloop ở cuối ), sai thì tiếp tục chạy trong vòng loop.
  - Lệnh j loop : thực hiện jump về nhãn loop có tác dụng lặp lại vòng nếu chưa thỏa mãn điều kiện dừng vòng lặp.
  - Thanh ghi t1 và s1 có tác dụng lưu địa chỉ mảng và bước nhảy vòng lặp, lần lượt nhảy 4 byte tương ứng với 4 byte của từng giá trị word.



# Assignment 3

**Code:**

## #Laboratory Exercise 3, Home Assignment 3

.data

test: .word 1

.text

#Load a b

```
addi $s2, $zero, 2  
addi $s3, $zero, 3
```

```
la $s0, test #load the address of test variable  
lw $s1, 0($s0) #load the value of test to register $t1  
li $t0, 0 #load value for test case  
li $t1, 1  
li $t2, 2  
beq $s1, $t0, case_0  
beq $s1, $t1, case_1  
beq $s1, $t2, case_2
```

i default

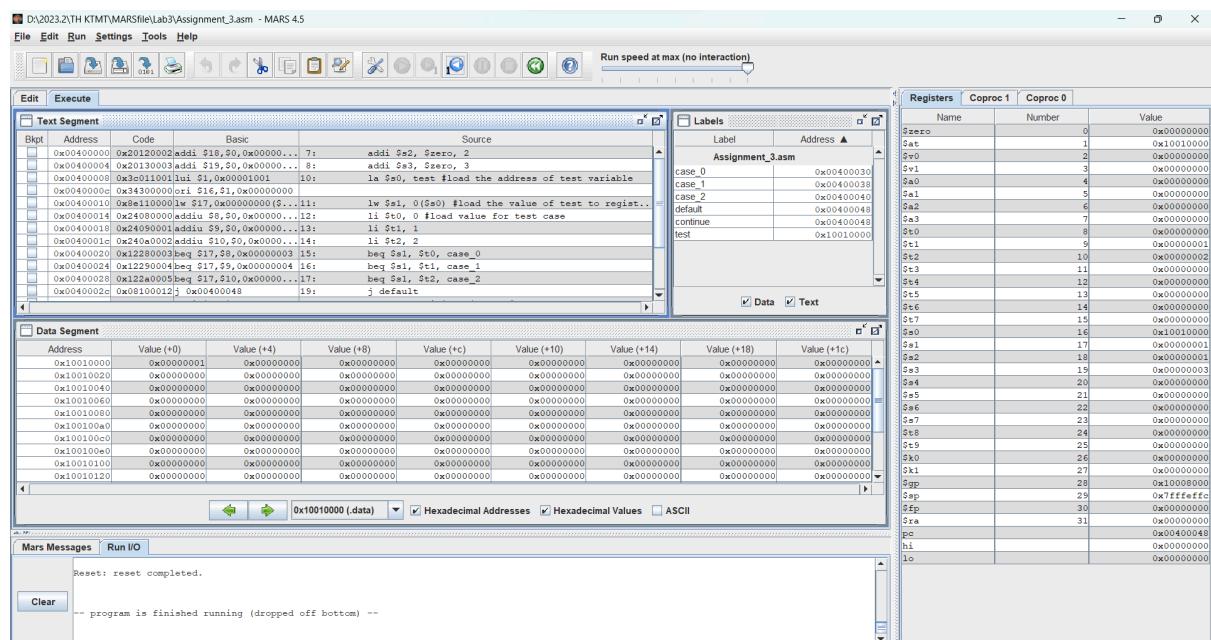
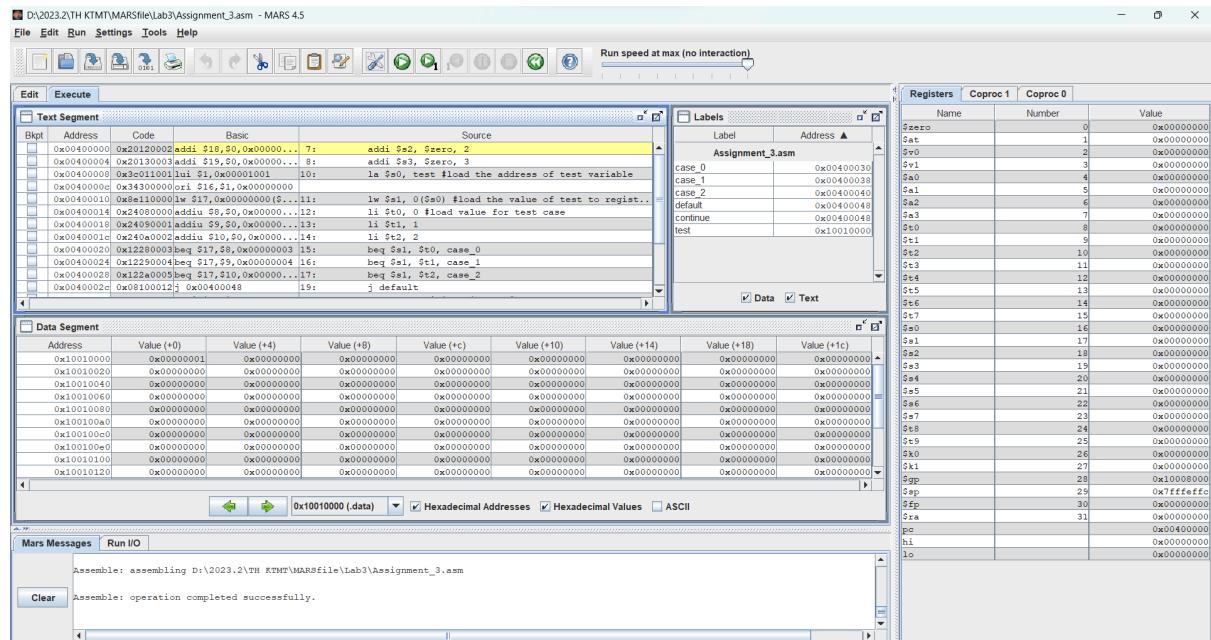
case\_0: addi \$s2, \$s2, 1 #a=a+1  
j continue

case\_1: sub \$s2, \$s2, \$t1 #a=a-1  
j continue

case\_2: add \$s3, \$s3, \$s3 #b=2\*b  
j continue

default:  
continue:

Result:



- Chương trình chạy đúng theo cấu trúc switch case.
- Lệnh beq thực hiện so sánh và rẽ nhánh sang nhãn dán
- Lệnh j : thực hiện jump nhảy không điều kiện tới nhãn dãn sẵn

# Assignment 4

Code:

a)

#Lab Ex 3, Assignment 4

.data

I: .word 2

J: .word 1

.text

#Load i and j

la \$t8, I

la \$t9, J

lw \$s1, 0(\$t8)

lw \$s2, 0(\$t9)

start:

slt \$t0, \$s1, \$s2 # I < J

beq \$t0, \$zero, else

addi \$t1, \$t1, 1 # x = x + 1

addi \$t3, \$zero, 1 # z = 1

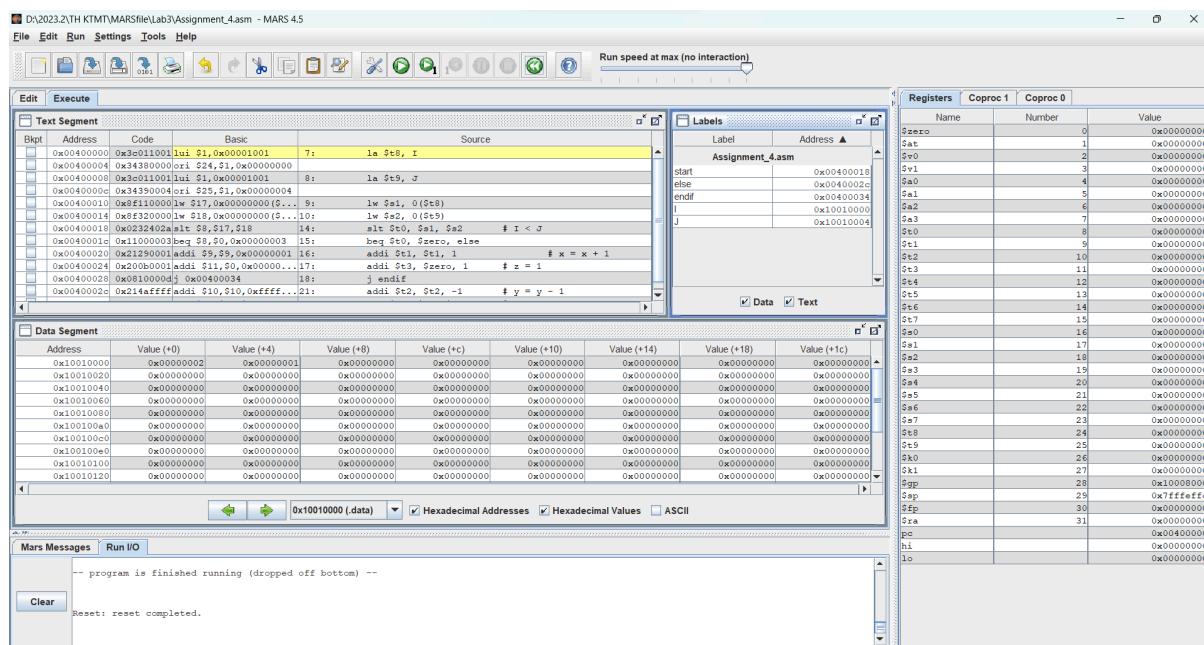
j endif

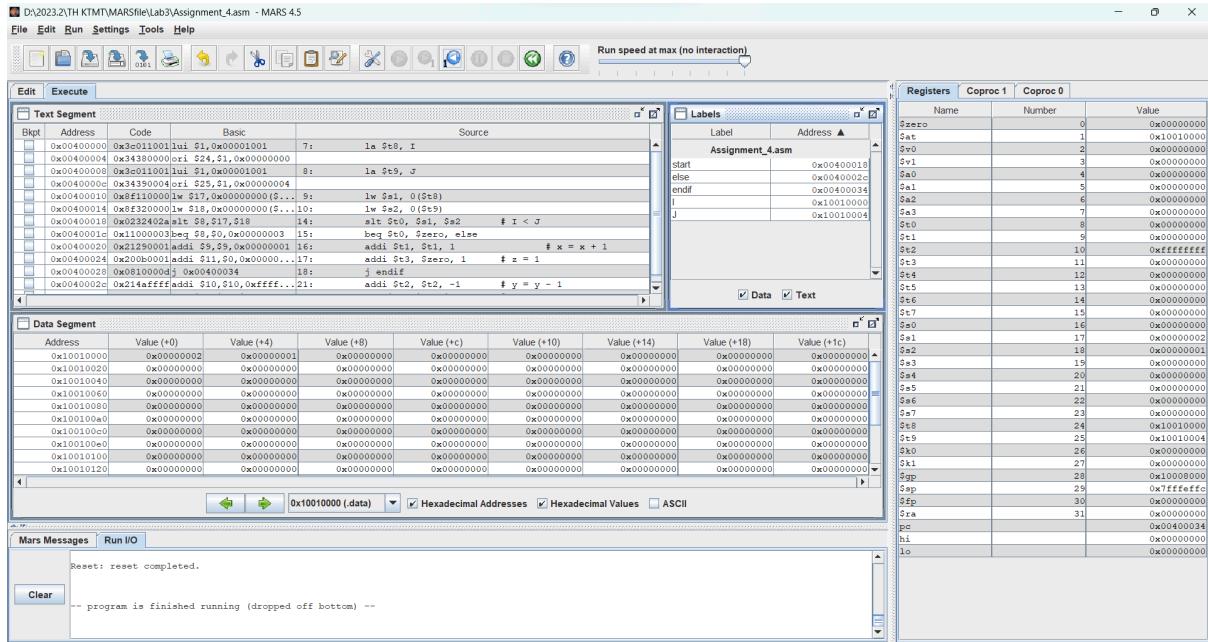
else:

addi \$t2, \$t2, -1 # y = y - 1

add \$t3, \$t3, \$t3 # z = 2\*z

endif:





b)

### #Lab Ex 3, Assignment 4

.data

I: .word 3

J: .word 14

.text

#Load i and j

la \$t8, I

la \$t9, J

lw \$s1, 0(\$t8)

lw \$s2, 0(\$t9)

start:

slt \$t0, \$s1, \$s2

bne \$t0, \$zero, else # I >= J

addi \$t1, \$t1, 1 # x = x + 1

addi \$t3, \$zero, 1 # z = 1

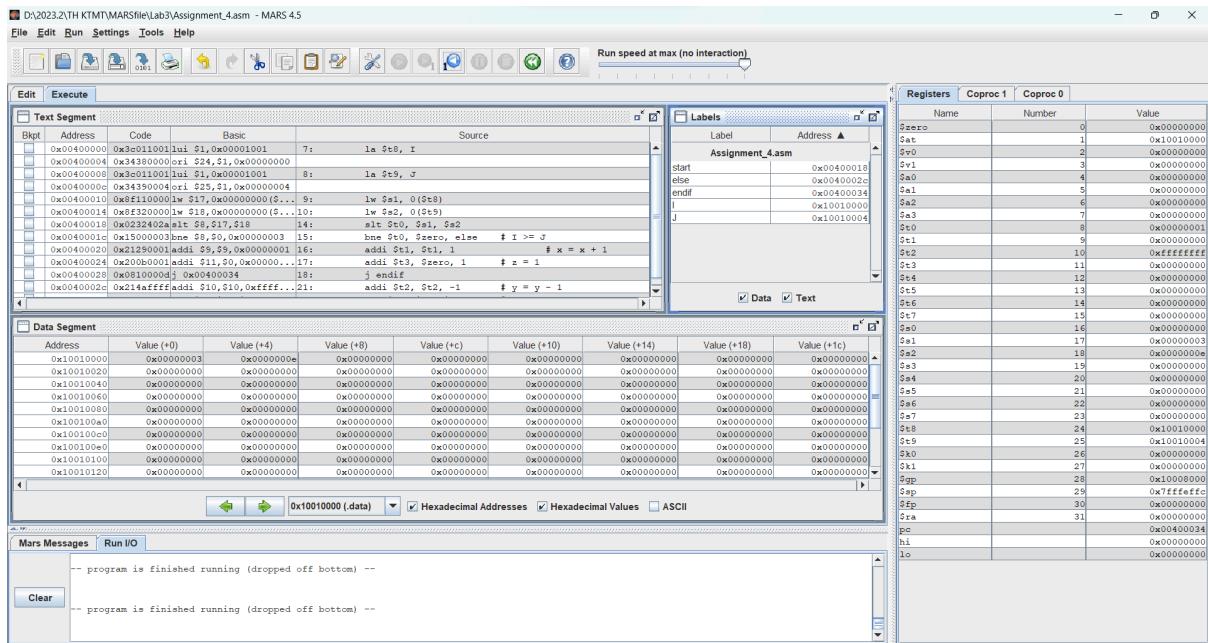
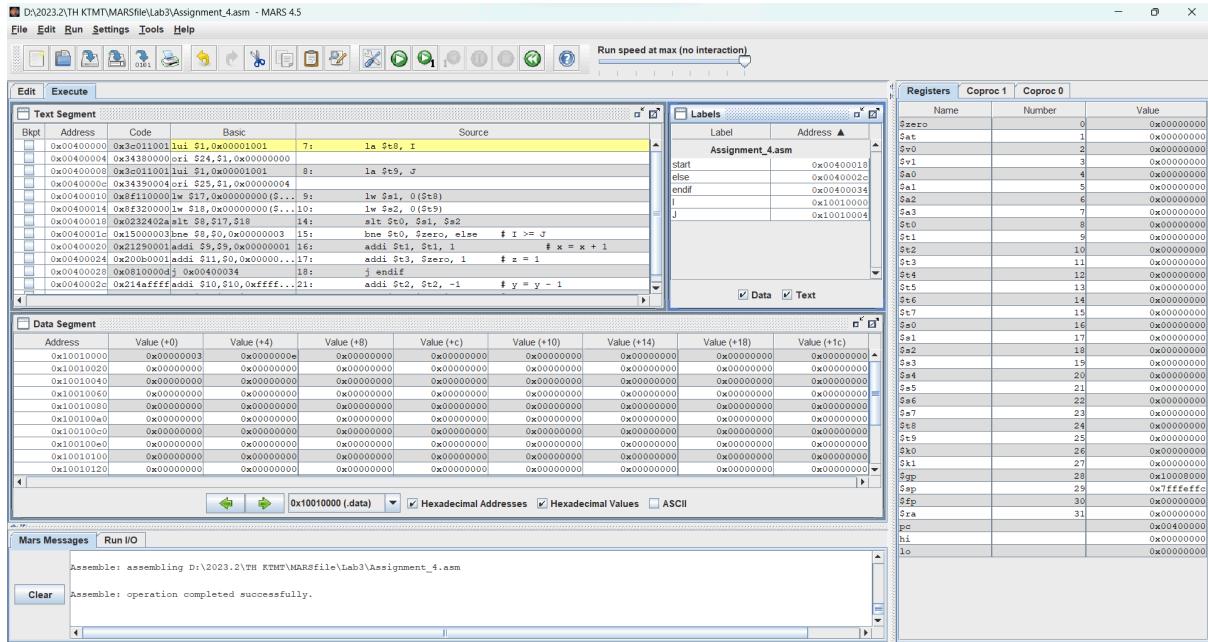
j endif

else:

addi \$t2, \$t2, -1 # y = y - 1

add \$t3, \$t3, \$t3 # z = 2\*z

endif:



c)  
**#Lab Ex 3, Assignment 4**

.data

I: .word -3

J: .word -14

.text

#Load i and j

la \$t8, I

la \$t9, J

lw \$s1, 0(\$t8)

lw \$s2, 0(\$t9)

```

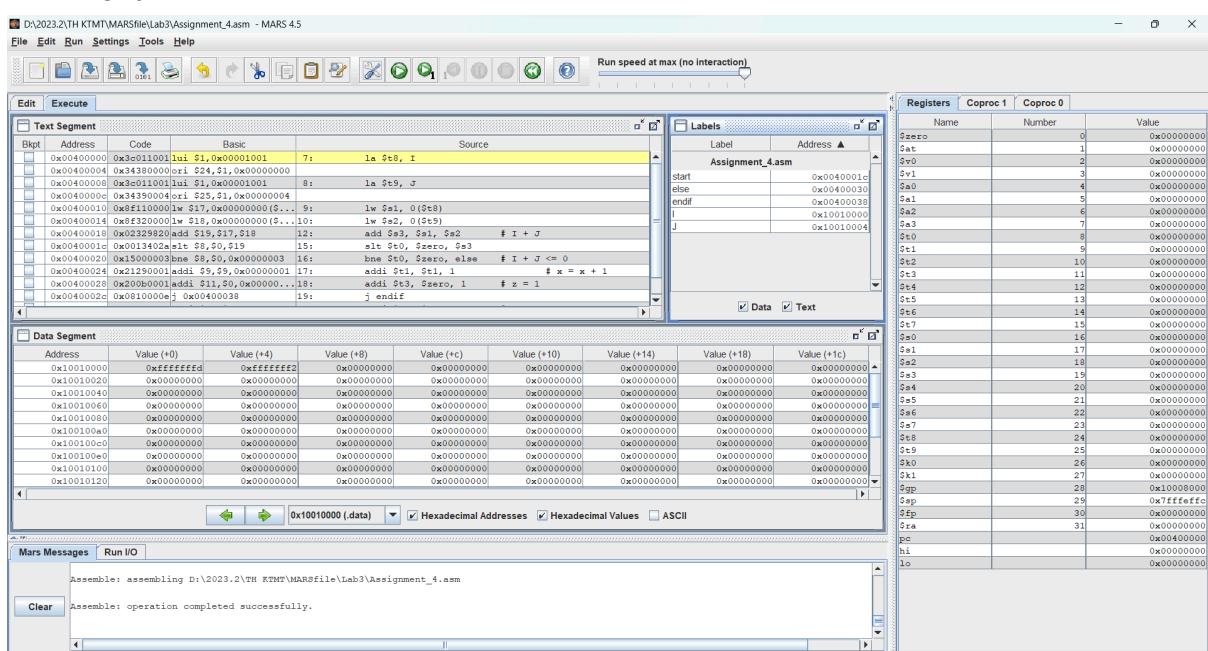
add $s3, $s1, $s2      # I + J

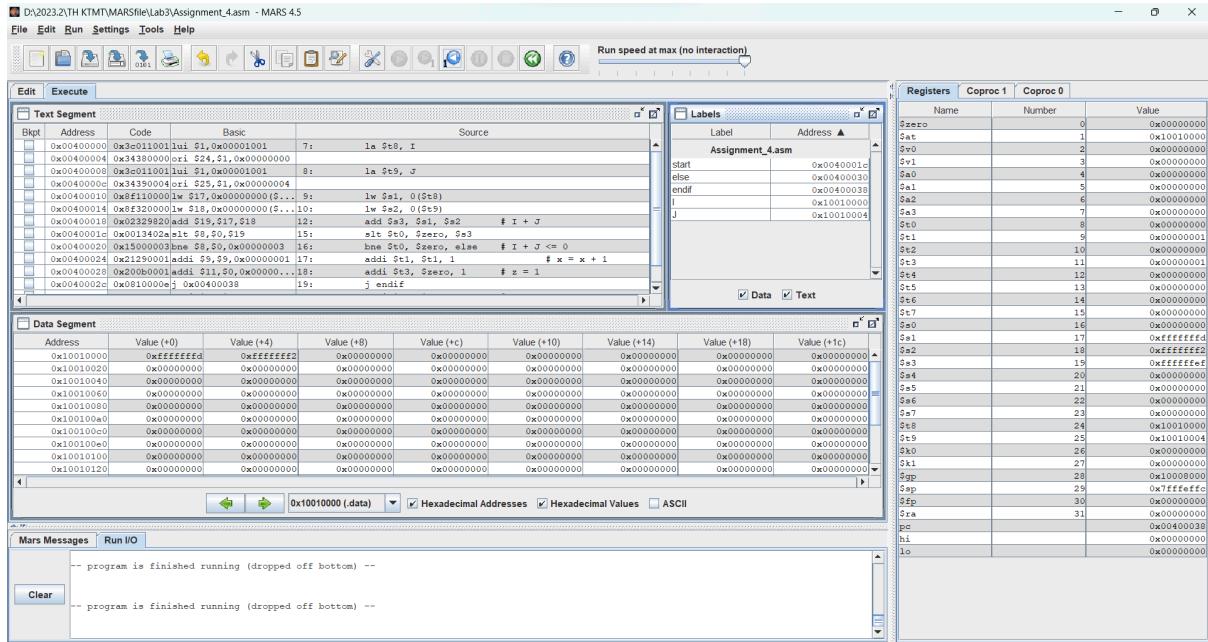
start:
    slt $t0, $zero, $s3
    bne $t0, $zero, else  # I + J <= 0
    addi $t1, $t1, 1          # x = x + 1
    addi $t3, $zero, 1      # z = 1
    j endif

else:
    addi $t2, $t2, -1     # y = y - 1
    add $t3, $t3, $t3      # z = 2*z

endif:

```





d)

### #Lab Ex 3, Assignment 4

.data

```
I: .word -3
J: .word 14
M: .word 1
N: .word 13
```

.text

#Load i and j, m, n

la \$t6, M

la \$t7, N

la \$t8, I

la \$t9, J

lw \$s1, 0(\$t8)

lw \$s2, 0(\$t9)

lw \$s4, 0(\$t6)

lw \$s5, 0(\$t7)

```
add $s3, $s1, $s2      # I + J
add $s6, $s4, $s5      # M + N
```

start:

slt \$t0, \$s6, \$s3

beq \$t0, \$zero, else # I + J <= 0

addi \$t1, \$t1, 1 # x = x + 1

addi \$t3, \$zero, 1 # z = 1

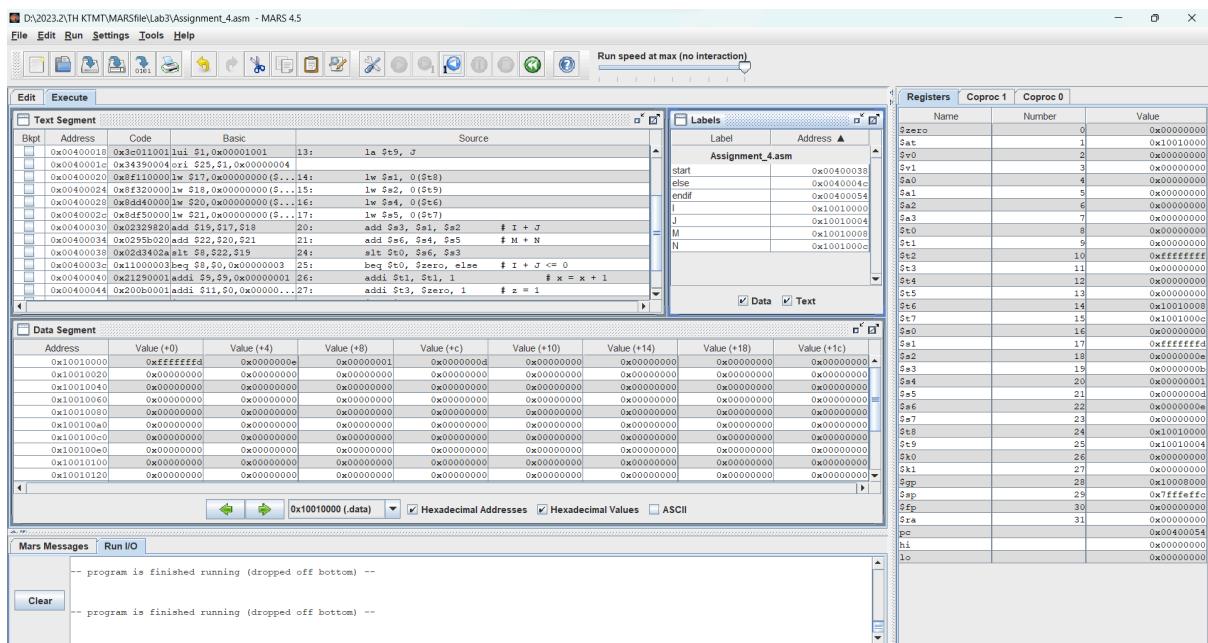
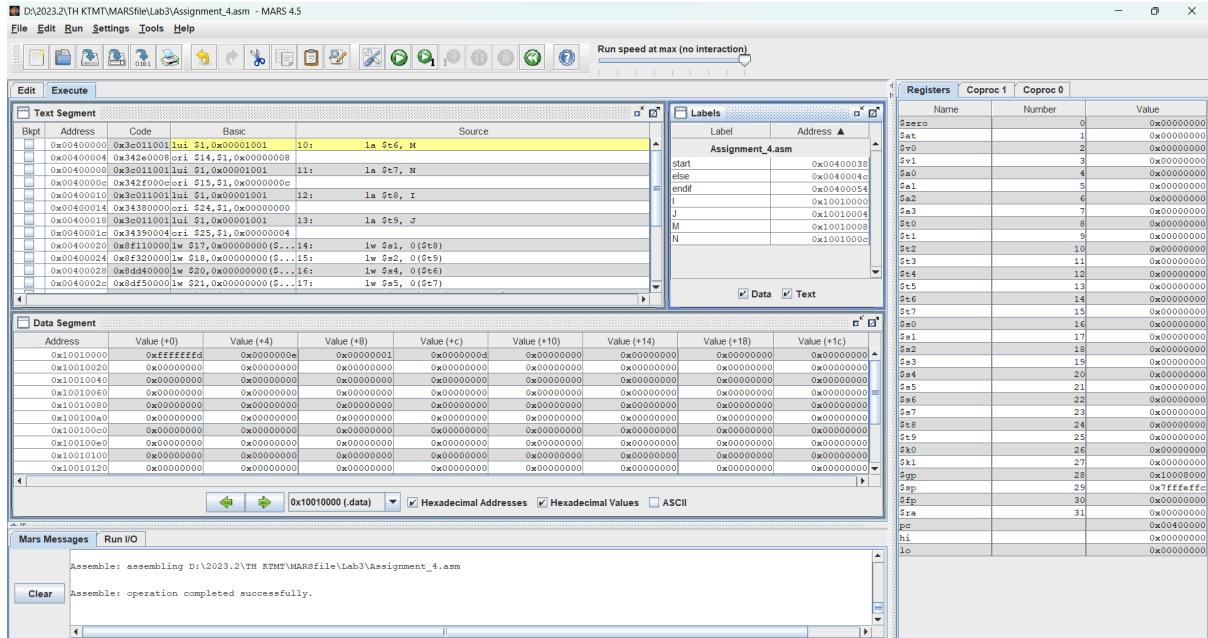
j endif

```

else:
    addi $t2, $t2, -1      # y = y - 1
    add $t3, $t3, $t3      # z = 2*z

```

endif:



## Assignment 5

Code:

a)

#Laboratory 3, Home Assignment 5

.data

n: .word 3

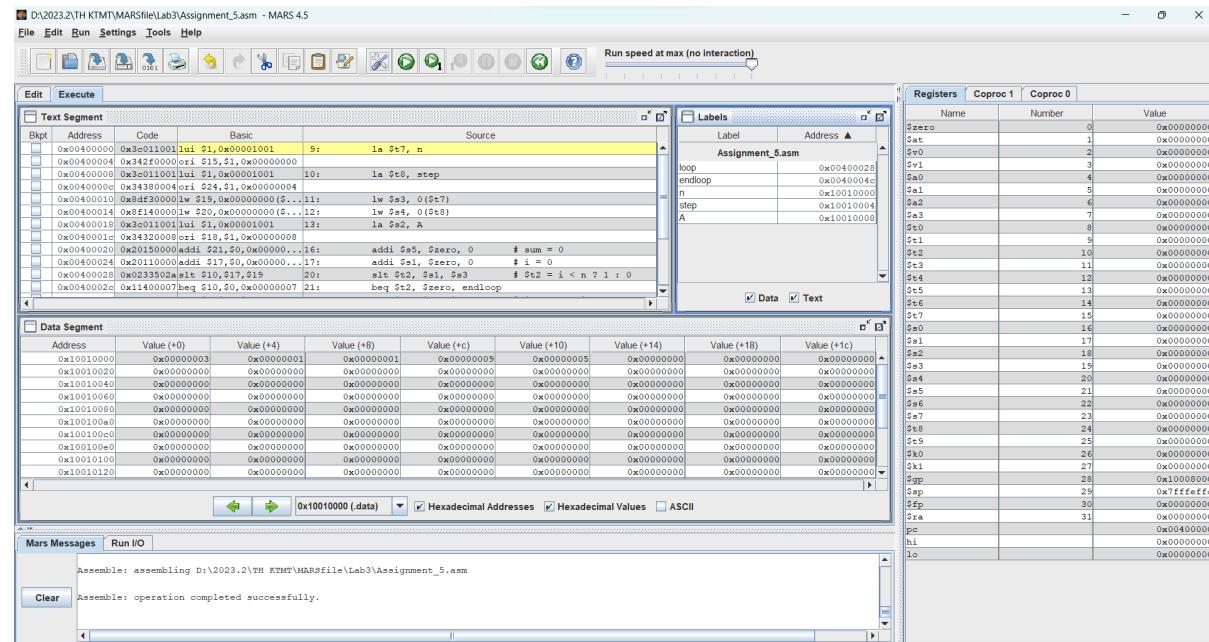
step: .word 1  
A: .word 1,9,5 #Load array

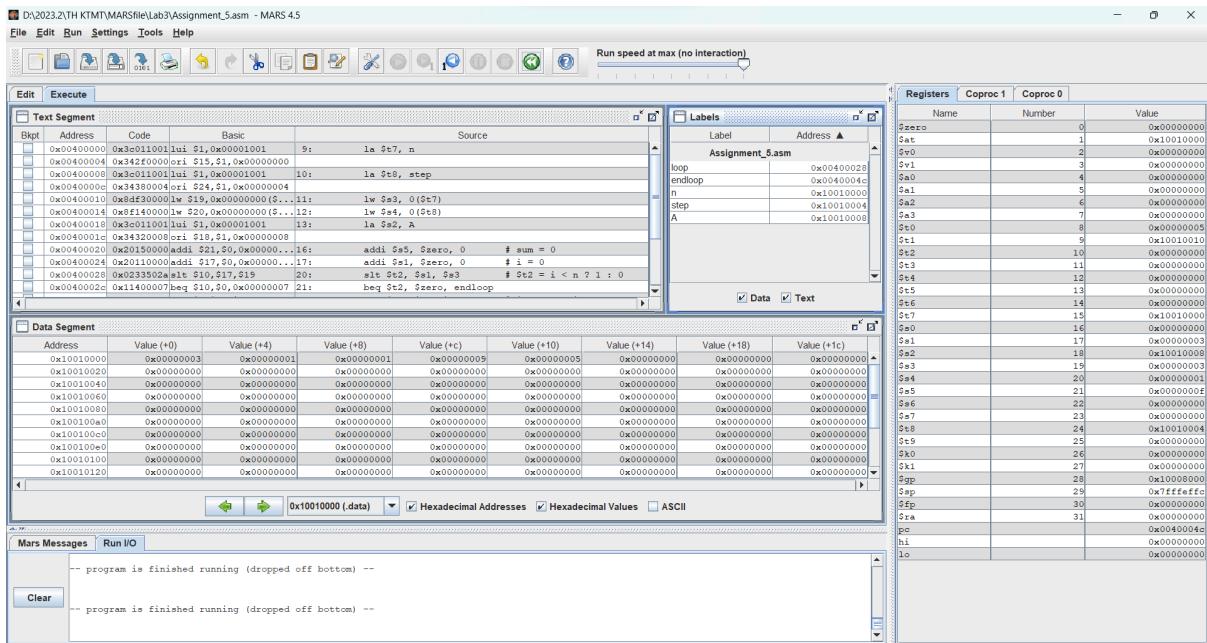
```
.text
#Load n, step, starting address A[i]
la $t7, n
la $t8, step
lw $s3, 0($t7)
lw $s4, 0($t8)
la $s2, A
```

```
addi $s5, $zero, 0      # sum = 0
addi $s1, $zero, 0      # i = 0
```

```
loop:
slt $t2, $s1, $s3      # $t2 = i < n ? 1 : 0
beq $t2, $zero, endloop
add $t1, $s1, $s1      # $t1 = 2 * $s1
add $t1, $t1, $t1      # $t1 = 4 * $s1 - 4 byte word
add $t1, $t1, $s2      # $t1 store the address of A[i]
lw $t0, 0($t1)          # load value of A[i] in $t0
add $s5, $s5, $t0       # sum = sum + A[i]
add $s1, $s1, $s4       # i = i + step
j loop                 # goto loop
```

endloop:





b)

## #Laboratory 3, Home Assignment 5

.data

```
n: .word 3  
step: .word 1  
A: .word 1,9,5 #Load array
```

.text

```
#Load n, step, starting address A[i]  
la $t7, n  
la $t8, step  
lw $s3, 0($t7)  
lw $s4, 0($t8)  
la $s2, A
```

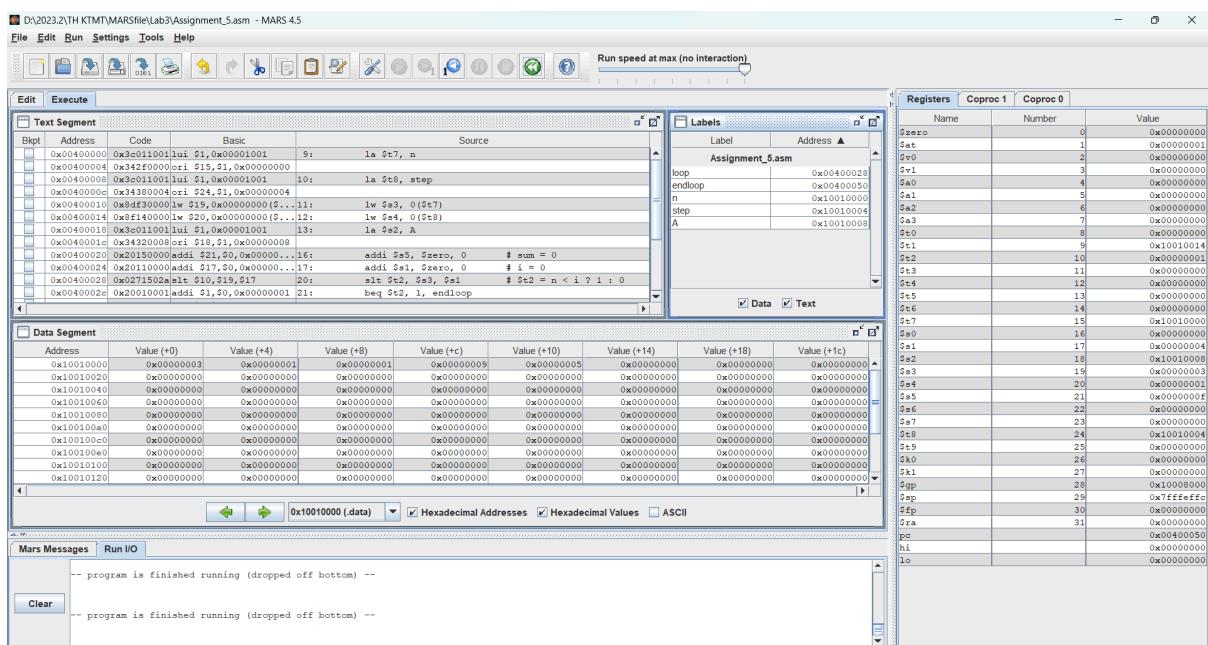
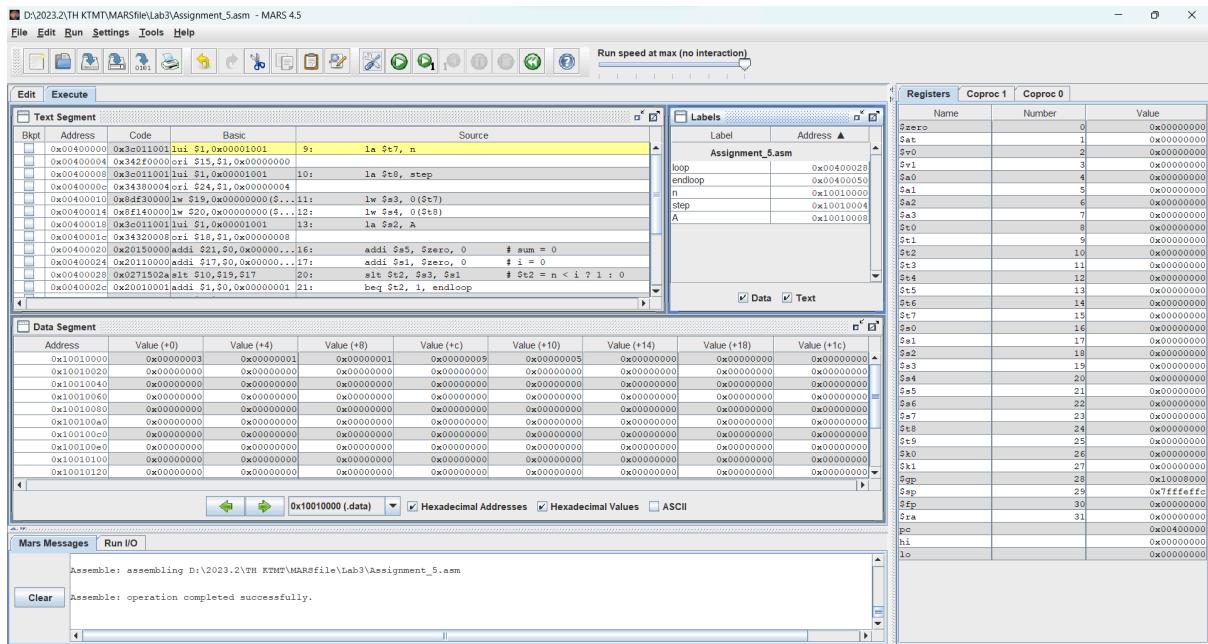
```

addi $s5, $zero, 0      # sum = 0
addi $s1, $zero, 0      # i = 0

loop:
slt $t2, $s3, $s1      # $t2 = n < i ? 1 : 0
beq $t2, 1, endloop
# i <= n -> TRUE
add $t1, $s1, $s1      # $t1 = 2 * $s1
add $t1, $t1, $t1      # $t1 = 4 * $s1 - 4 byte word
add $t1, $t1, $s2      # $t1 store the address of A[i]
lw $t0, 0($t1)          # load value of A[i] in $t0
add $s5, $s5, $t0      # sum = sum + A[i]
add $s1, $s1, $s4      # i = i + step
j loop                  # goto loop

```

endloop:



c)

#Laboratory 3, Home Assignment 5

.data

n: .word 5

step: .word 1

A: .word 1,9,5,10,-100 #Load array

.text

#Load n, step, starting address A[i]

la \$t7, n

la \$t8, step

```

lw $s3, 0($t7)
lw $s4, 0($t8)
la $s2, A

```

```

addi $s5, $zero, 0      # sum = 0
addi $s1, $zero, 0      # i = 0

```

loop:

```

slt $t2, $s1, $s3      # $t2 = i < n ? 1 : 0
beq $t2, $zero, endloop
# SUM >= 0
slt $t3, $s5, $zero
beq $t3, 1, endloop

```

```

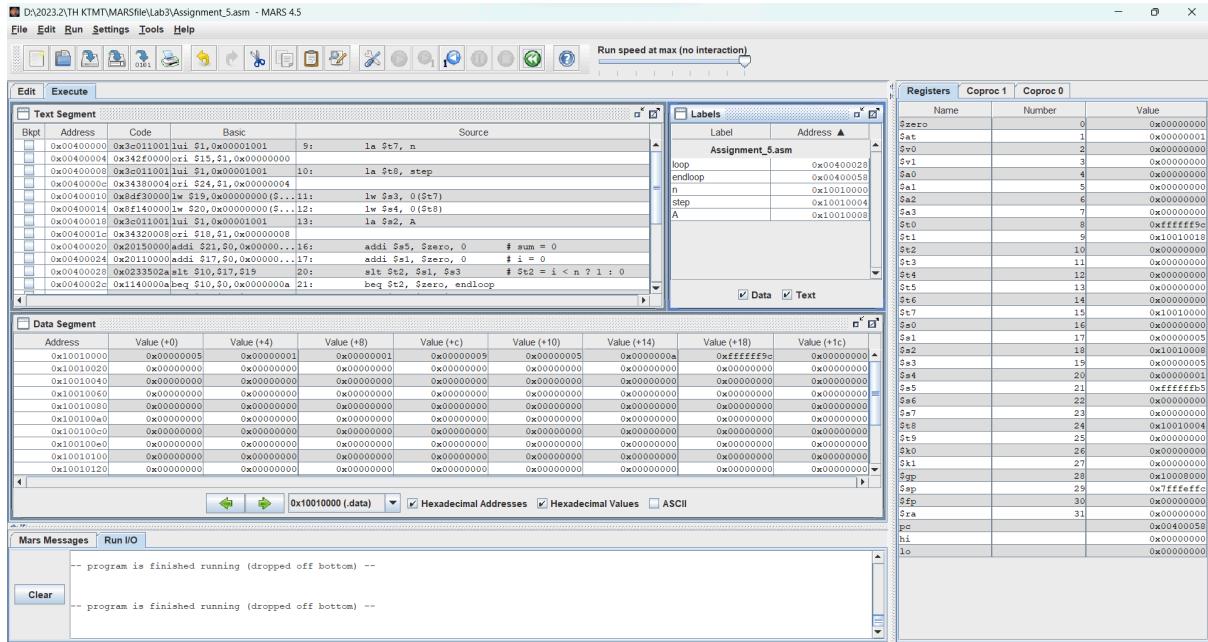
add $t1, $s1, $s1      # $t1 = 2 * $s1
add $t1, $t1, $t1      # $t1 = 4 * $s1 - 4 byte word
add $t1, $t1, $s2      # $t1 store the address of A[i]
lw $t0, 0($t1)          # load value of A[i] in $t0
add $s5, $s5, $t0       # sum = sum + A[i]
add $s1, $s1, $s4       # i = i + step
j loop                 # goto loop

```

endloop:

The screenshot shows the MARS 4.5 assembly editor interface with the following sections visible:

- Text Segment:** Displays assembly instructions in columns for Blkt, Address, Code, Basic, and Source.
- Labels:** Shows labels from the assembly code, such as `loop`, `endloop`, `n`, `step`, `A`, and various memory locations.
- Registers:** Shows the state of registers from 0 to 31, all initialized to zero.
- Data Segment:** Displays memory starting at address 0x10010000 with values for each byte.
- Mars Messages:** Shows assembly completion messages.



d)

### #Laboratory 3, Home Assignment 5

.data

```
n: .word 3
step: .word 1
A: .word 1,0,9 #Load array
```

.text

#Load n, step, starting address A[i]

```
la $t7, n
la $t8, step
lw $s3, 0($t7)
lw $s4, 0($t8)
la $s2, A
```

```
addi $s5, $zero, 0      # sum = 0
addi $s1, $zero, 0      # i = 0
```

loop:

```
slt $t2, $s1, $s3      # $t2 = i < n ? 1 : 0
beq $t2, $zero, endloop
add $t1, $s1, $s1      # $t1 = 2 * $s1
add $t1, $t1, $t1      # $t1 = 4 * $s1 - 4 byte word
add $t1, $t1, $s2      # $t1 store the address of A[i]
lw $t0, 0($t1)          # load value of A[i] in $t0
# A[i] == 0
beq $t0, 0, endloop
```

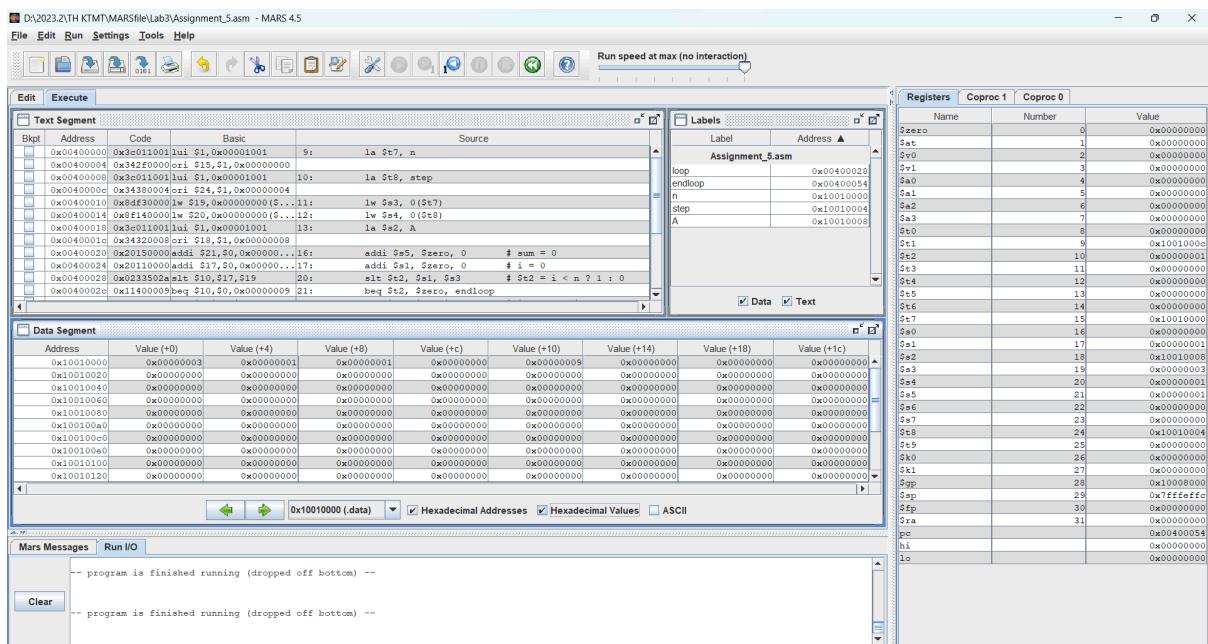
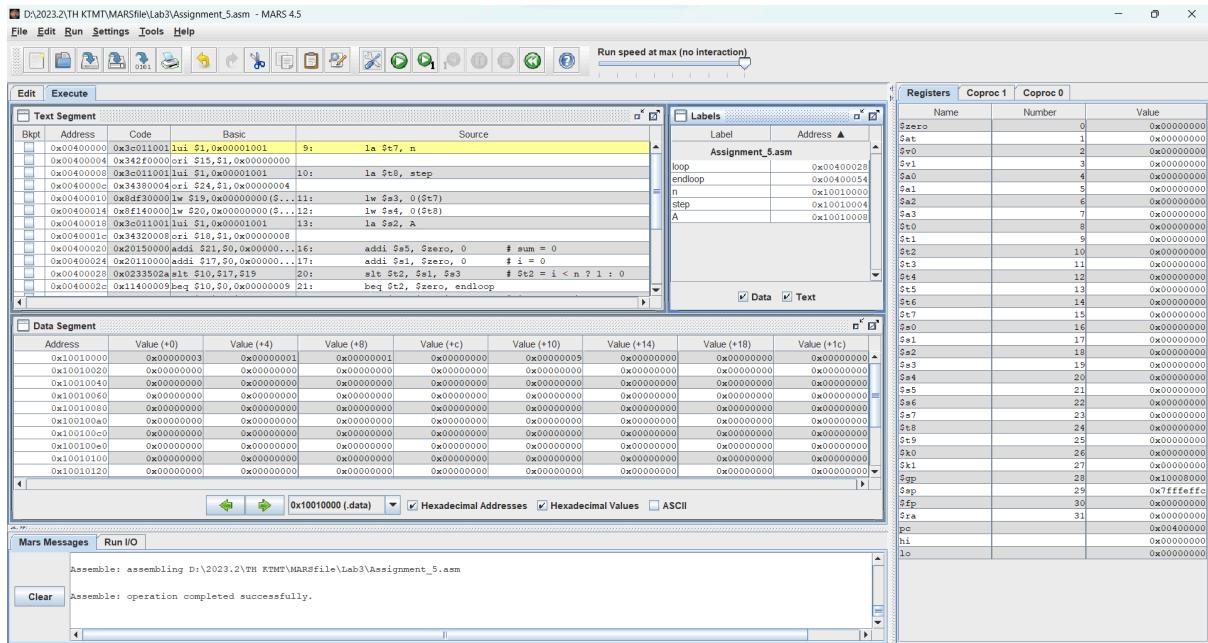
```

add $s5, $s5, $t0      # sum = sum + A[i]
add $s1, $s1, $s4      # i = i + step
j loop                 # goto loop

```

endloop:

- Chương trình gặp  $A[i] == 0$  thì dừng



## Assignment 6

Code:

#Laboratory 3, Home Assignment 2

.data

```

n: .word 7
step: .word 1
A: .word 9, 1, 22, 10, 11, 22, 1      #Load array

.text
#Load n, step, starting address A[i]
la $t7, n
la $t8, step
lw $s3, 0($t7)
lw $s4, 0($t8)
la $s2, A

addi $s5, $zero, 0      # sum = 0
addi $s1, $zero, 0      # i = 0
lw $t3, 0($s2)          # SET MAX = t3

loop:
slt $t2, $s1, $s3      # $t2 = i < n ? 1 : 0
beq $t2, $zero, endloop
add $t1, $s1, $s1      # $t1 = 2 * $s1
add $t1, $t1, $t1      # $t1 = 4 * $s1 - 4 byte word
add $t1, $t1, $s2      # $t1 store the address of A[i]
lw $t0, 0($t1)          # load value of A[i] in $t0
#FIND MAX
slt $t4, $t3, $t0
bne $t4, 1, CONTINUE
addi $t3, $t0, 0
CONTINUE:

add $s1, $s1, $s4      # i = i + step
j loop                  # goto loop

endloop:

```

Result:

- Lệnh slt \$t4, \$t3, \$t0 thực hiện so sánh giá trị thanh ghi t3 < t0. Trả về 1 nếu đúng , 0 nếu sai vào thanh ghi t4.
  - Lệnh bne \$t4, 1, CONTINUE thực hiện so sánh giá trị thanh ghi t4 với 1. Rẽ nhánh sang nhãn CONTINUE nếu t4 != 1 để thực hiện tiếp vòng lặp quét giá trị trong mảng A, nếu t4 = 1 thì thực hiện cập nhật giá trị MAX mới.