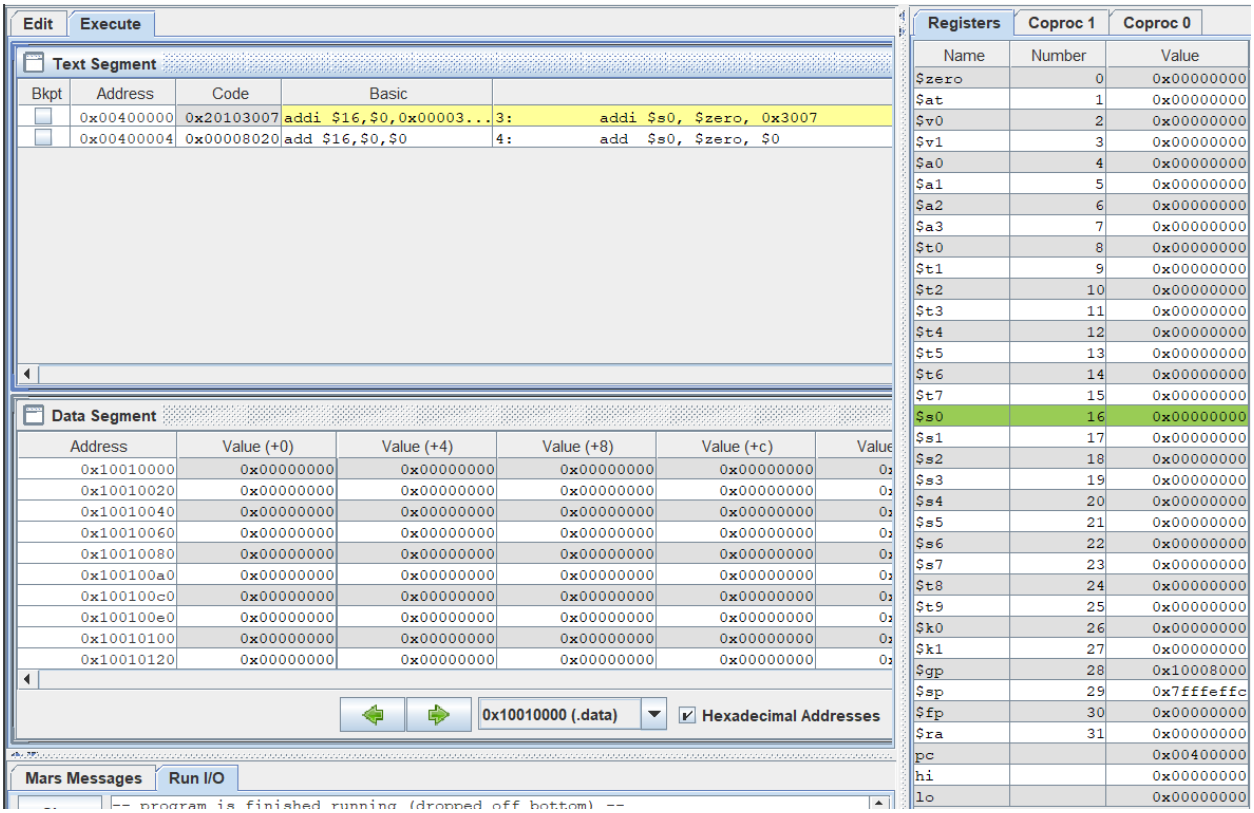
Báo cáo thực hành Kiến trúc máy tính

Assignment 1

```
#Laboratory Exercise 2, Assigment 1
.text
        addi $s0, $zero, 0x3007         # $s0 = 0 + 0x3007 = 0x3007; I-type
        add  $s0, $zero, $0             # $s0 = 0 + 0 = 0; R-type
```



Edit | Execute

Text Segment

Bkpt	Address	Code	Basic	
	0x00400000	0x20103007	addi $16,$0,0x00003...	3: addi $s0, $zero, 0x3007
	0x00400004	0x00008020	add $16,$0,$0	4: add $s0, $zero, $0

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value
0x10010000	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x10010020	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x100100c0	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x100100e0	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x10010100	0x00000000	0x00000000	0x00000000	0x00000000	0x
0x10010120	0x00000000	0x00000000	0x00000000	0x00000000	0x

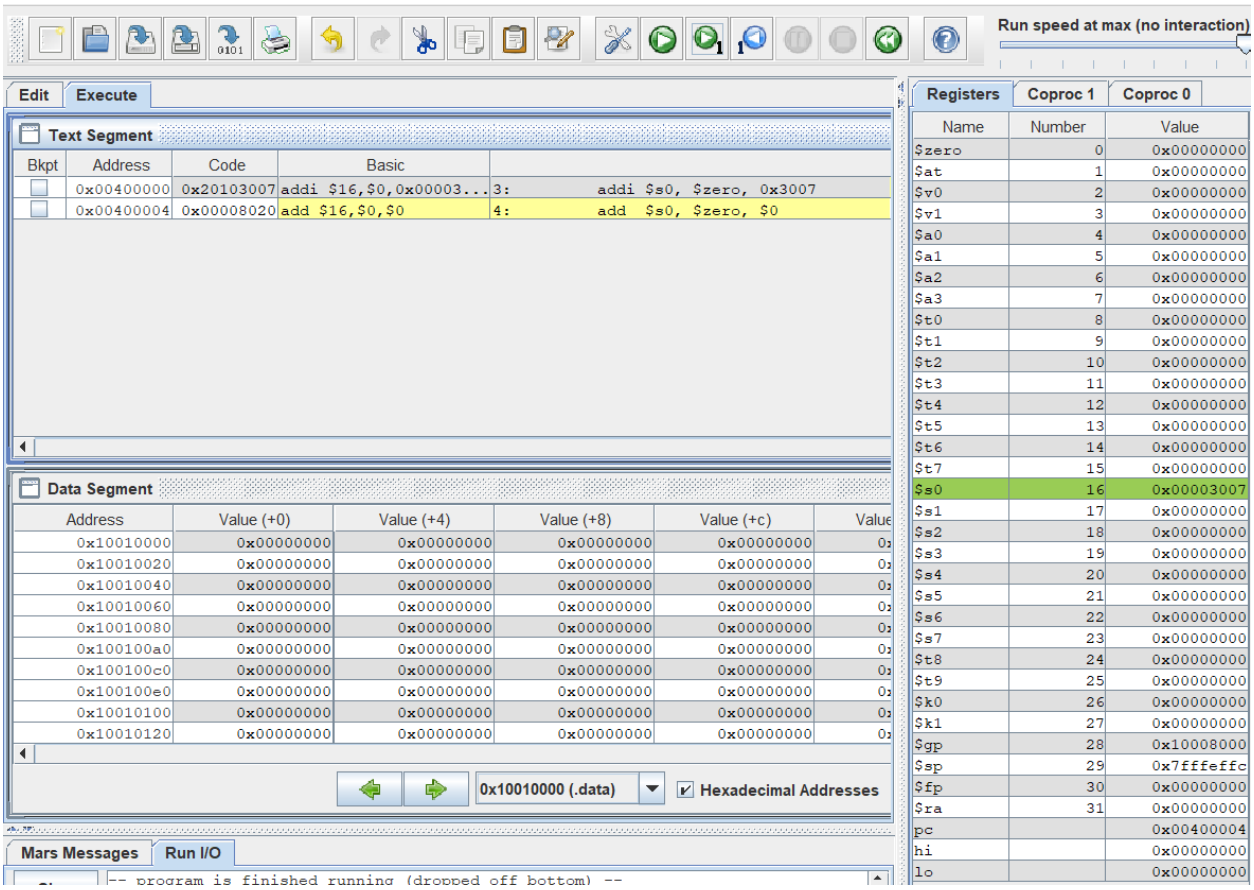
0x10010000 (.data) Hexadecimal Addresses

Mars Messages | Run I/O

-- program is finished running (dropped off bottom) --

Registers | Coproc 1 | Coproc 0

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
$s0	16	0x00000000
$s1	17	0x00000000
$s2	18	0x00000000
$s3	19	0x00000000
$s4	20	0x00000000
$s5	21	0x00000000
$s6	22	0x00000000
$s7	23	0x00000000
$t8	24	0x00000000
$t9	25	0x00000000
$k0	26	0x00000000
$k1	27	0x00000000
$gp	28	0x10008000
$sp	29	0x7fffeffc
$fp	30	0x00000000
$ra	31	0x00000000
pc		0x00400000
hi		0x00000000
lo		0x00000000



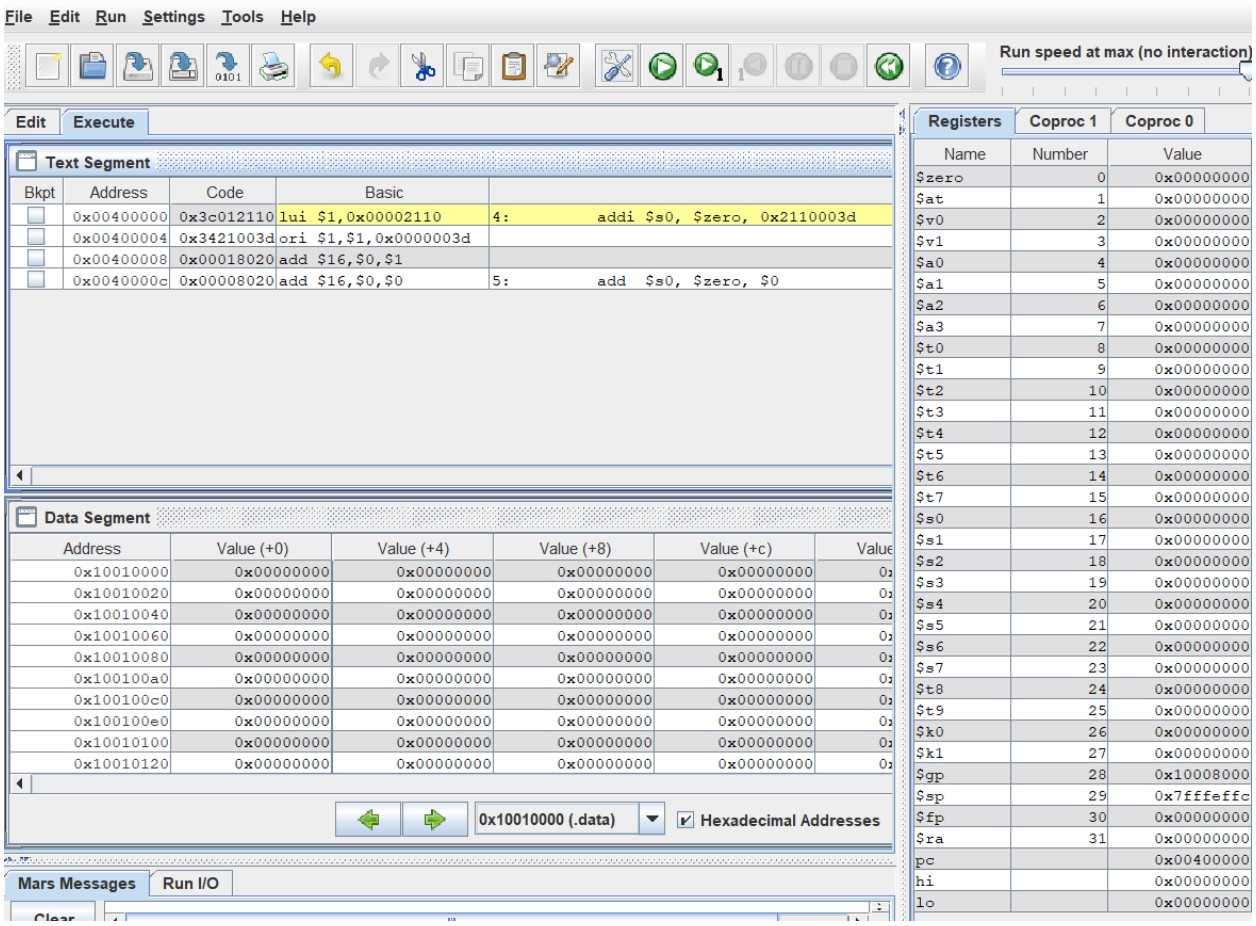
Nhận xét:

1. Trước khi thực hiện câu lệnh addi, giá trị thanh ghi $s0 là 0x00000, sau khi thực hiện câu lệnh addi giá trị thanh ghi $s0 là 0x0003007.
2. Sau khi thực hiện lệnh add: giá trị của $s0 = 0x0000 0000, giá trị pc thay đổi từ 0x0040004 thành 0x0040008.

So sánh mã máy với khuôn lệnh:

Khuôn lệnh khi được biên dịch sẽ biến tên địa chỉ thanh ghi tương ứng với giá trị ở cột Number trên Register: $s0 -> $16 , còn lại giá trị tạm thời và hằng số vẫn được giữ nguyên như ban đầu.

Sửa lại lệnh lui như bên dưới. Chuyện gì xảy ra sau đó. Hãy giải thích addi $s0, $zero, 0x2110003d

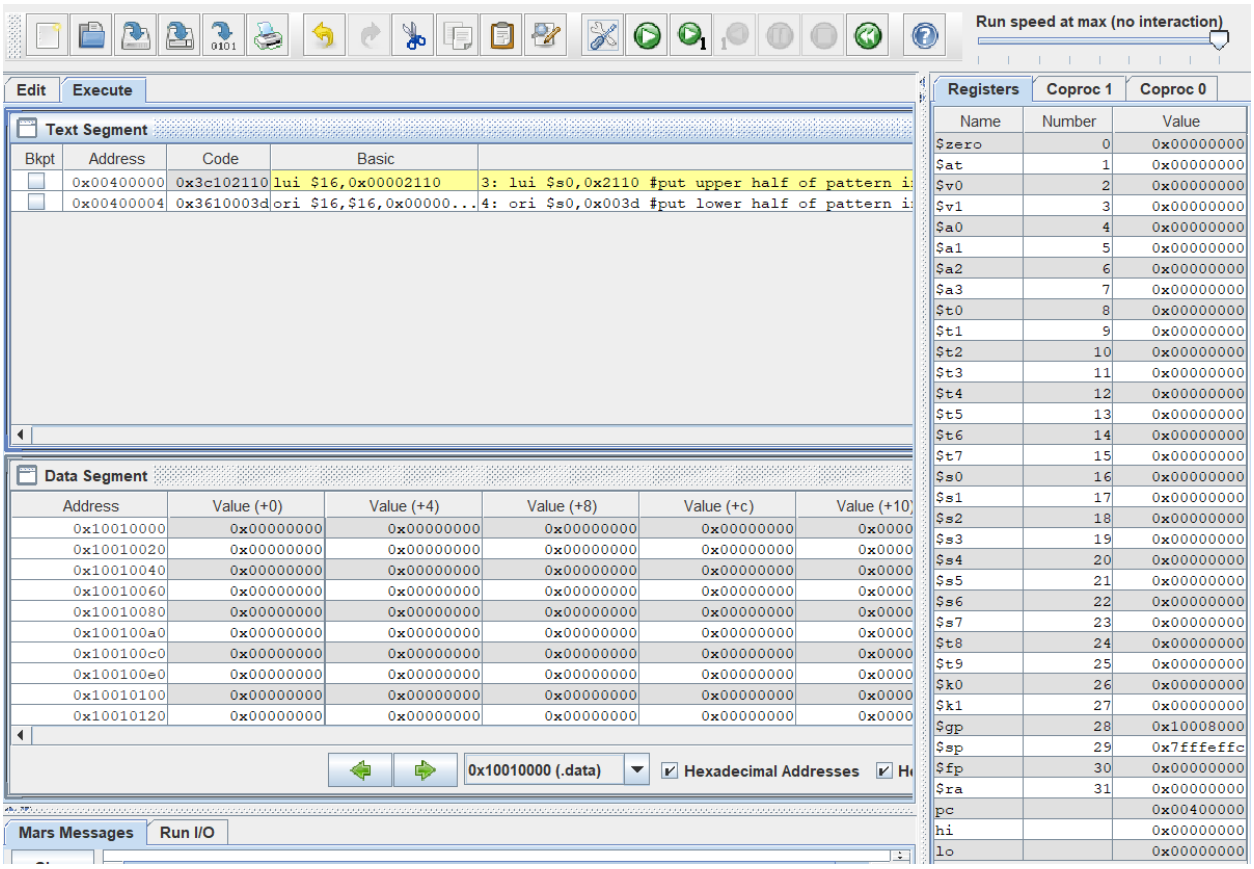


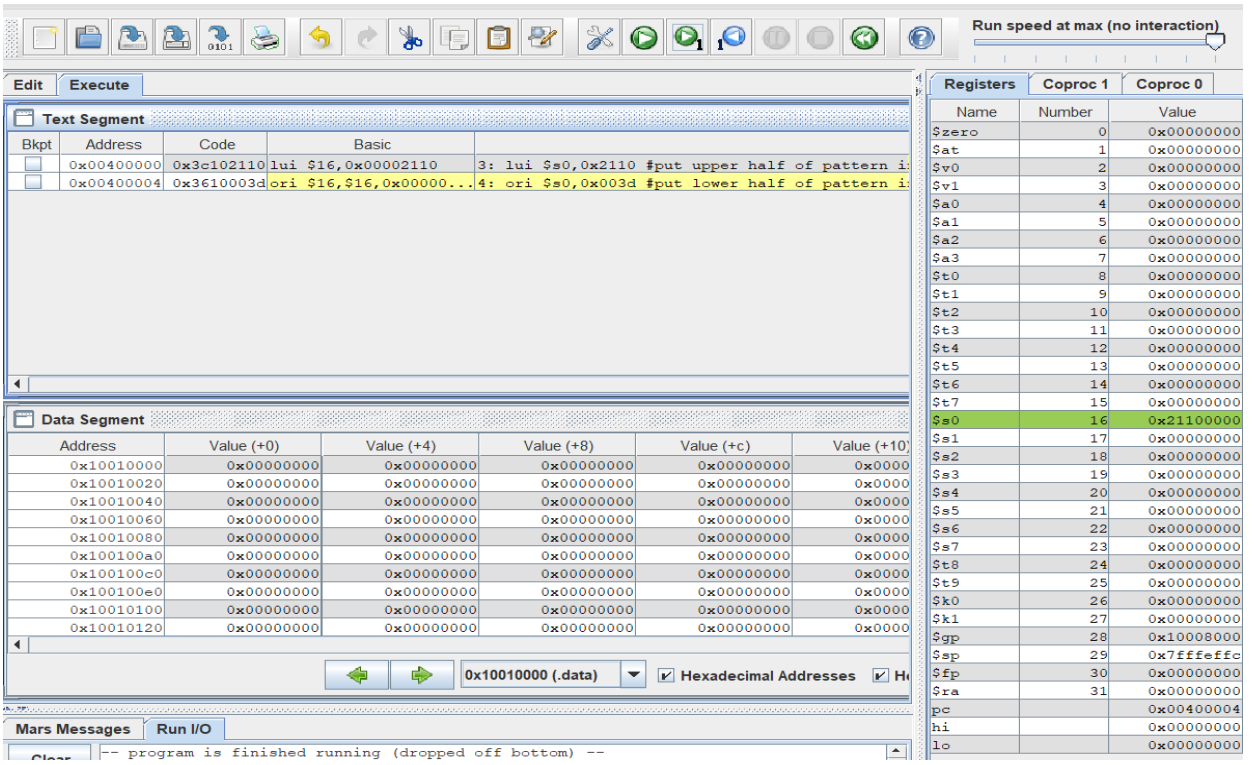
Giải thích: Khi gán giá trị vượt quá 16 bit thì nó nạp vào theo 2 bước

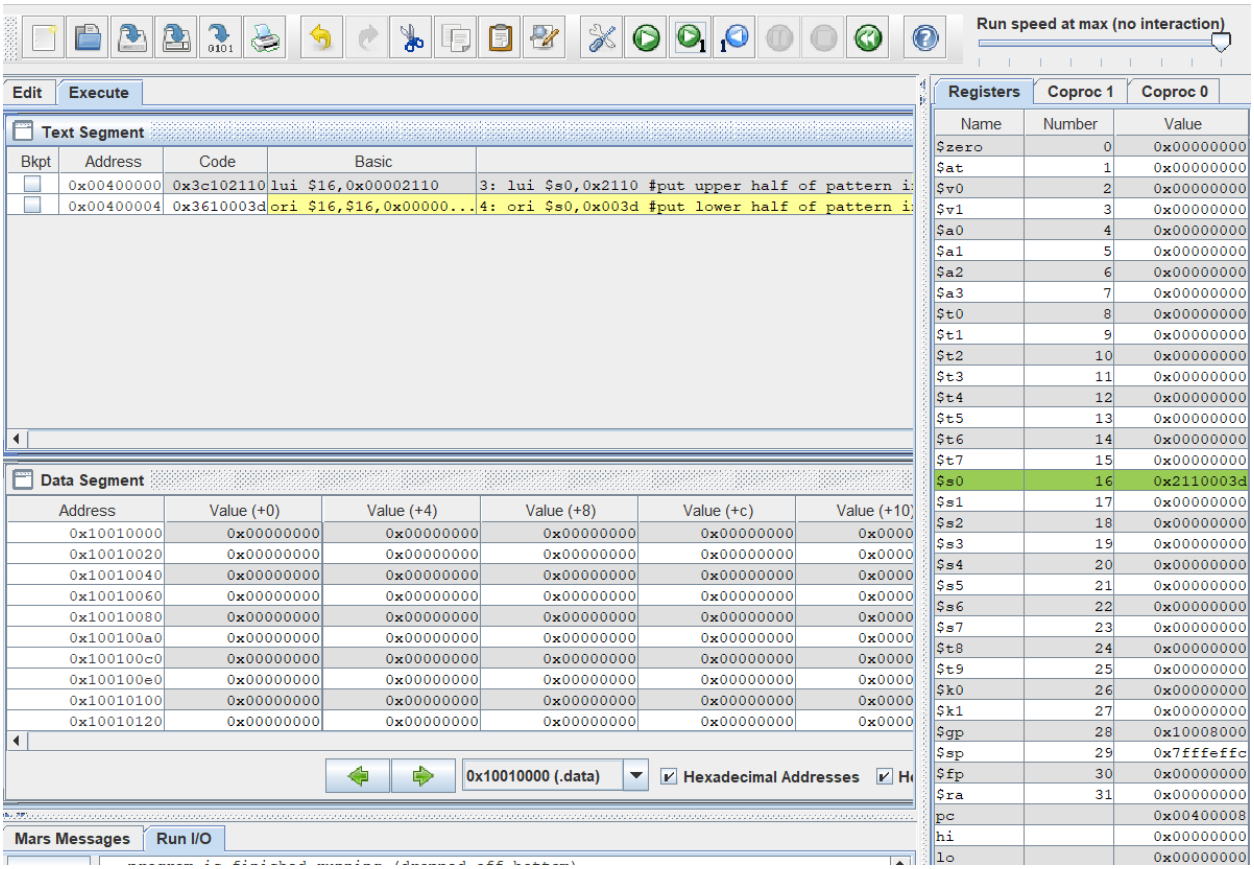
Bước 1: Nạp 16 bit cao vào một thanh ghi sử dụng toán tử lui(Load upper immediate)

Bước 2: Nạp 16 bit thấp sử dụng toán tử ori(Or immediate). Gán giá trị vượt quá 16bit

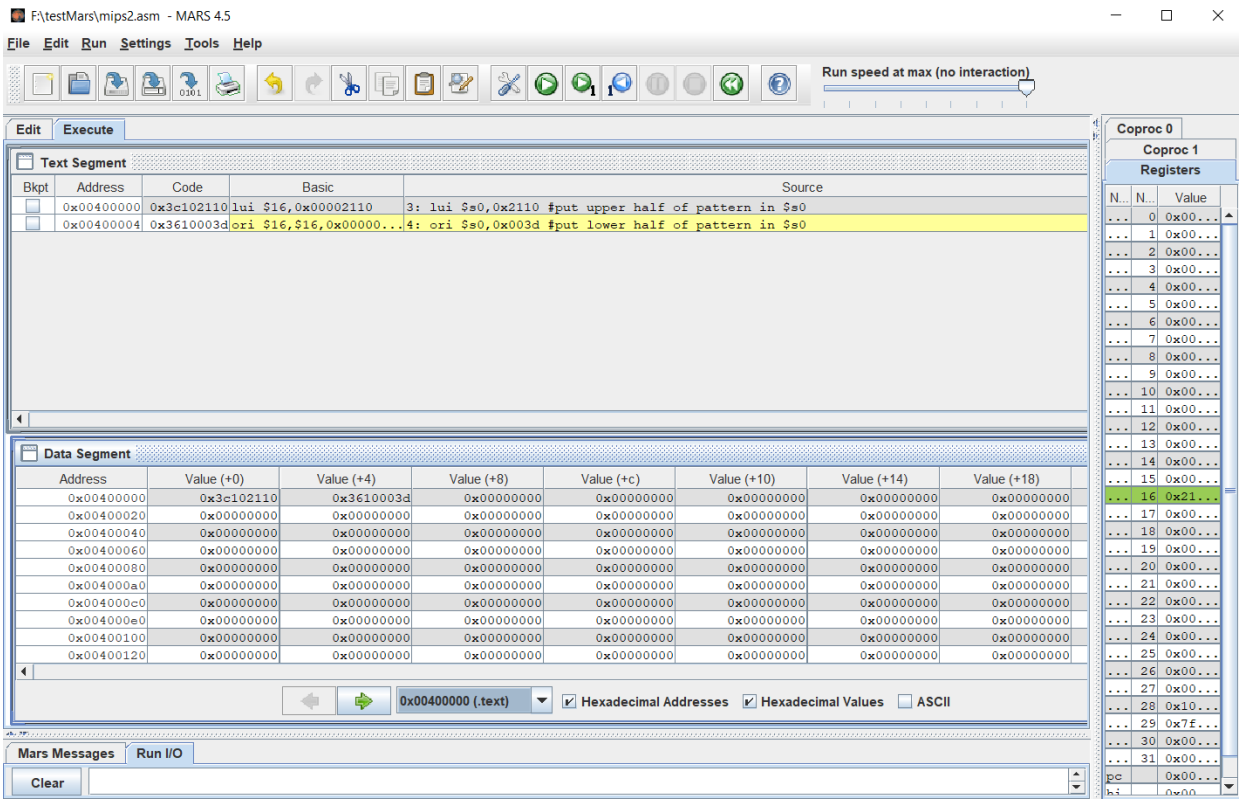
Assignment 2: Lệnh gán số 32 bit


Run speed at max (no interaction)
Edit
Execute
Text Segment
Bkpt
Address
Code
Basic
0x00400000 0x3c102110 lui $16,0x00002110 3: lui $s0,0x2110 #put upper half of pattern i
0x00400004 0x3610003d ori $16,$16,0x00000... 4: ori $s0,0x003d #put lower half of pattern i
Data Segment
Address
Value (+0)
Value (+4)
Value (+8)
Value (+c)
Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010000 (.data)
Hexadecimal Addresses
Mars Messages
Run I/O
Registers
Coproc 1
Coproc 0
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
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400000
hi 0x00000000
lo 0x00000000


Run speed at max (no interaction)
Edit
Execute
Text Segment
Bkpt
Address
Code
Basic
0x00400000 0x3c102110 lui $16,0x00002110 3: lui $s0,0x2110 #put upper half of pattern i
0x00400004 0x3610003d ori $16,$16,0x00000... 4: ori $s0,0x003d #put lower half of pattern i
Data Segment
Address
Value (+0)
Value (+4)
Value (+8)
Value (+c)
Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010000 (.data)
Hexadecimal Addresses
Mars Messages
Run I/O
-- program is finished running (dropped off bottom) --
Registers
Coproc 1
Coproc 0
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
$s0 16 0x21100000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400004
hi 0x00000000
lo 0x00000000

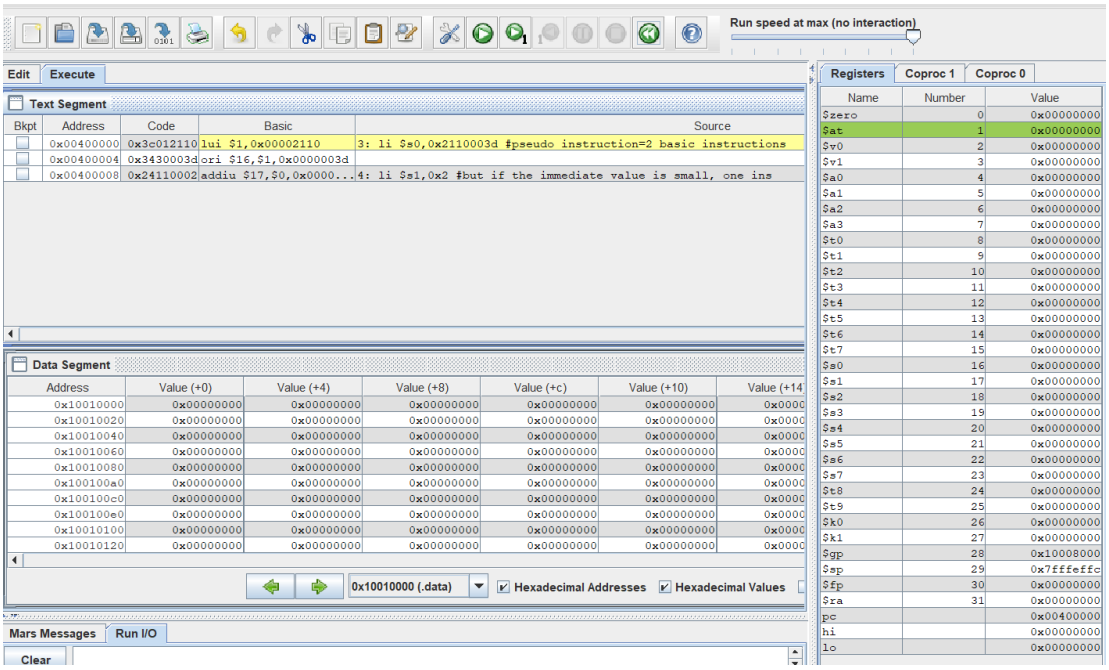

Run speed at max (no interaction)
Edit
Execute
Text Segment
Bkpt
Address
Code
Basic
0x00400000
0x3c102110
lui $16,0x00002110
3: lui $s0,0x2110 #put upper half of pattern i
0x00400004
0x3610003d
ori $16,$16,0x00000...
4: ori $s0,0x003d #put lower half of pattern i
Data Segment
Address
Value (+0)
Value (+4)
Value (+8)
Value (+c)
Value (+10)
0x10010000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x00000000
0x0000
0x10010000 (.data)
Hexadecimal Addresses
Mars Messages
Run I/O
Registers
Coproc 1
Coproc 0
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
$s0 16 0x2110003d
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400008
hi 0x00000000
lo 0x00000000

Hộp Combo



Cột code có giá trị trùng với hàng đầu tiên ở Data segment

Assigment 3: Lệnh gán (giả lệnh)

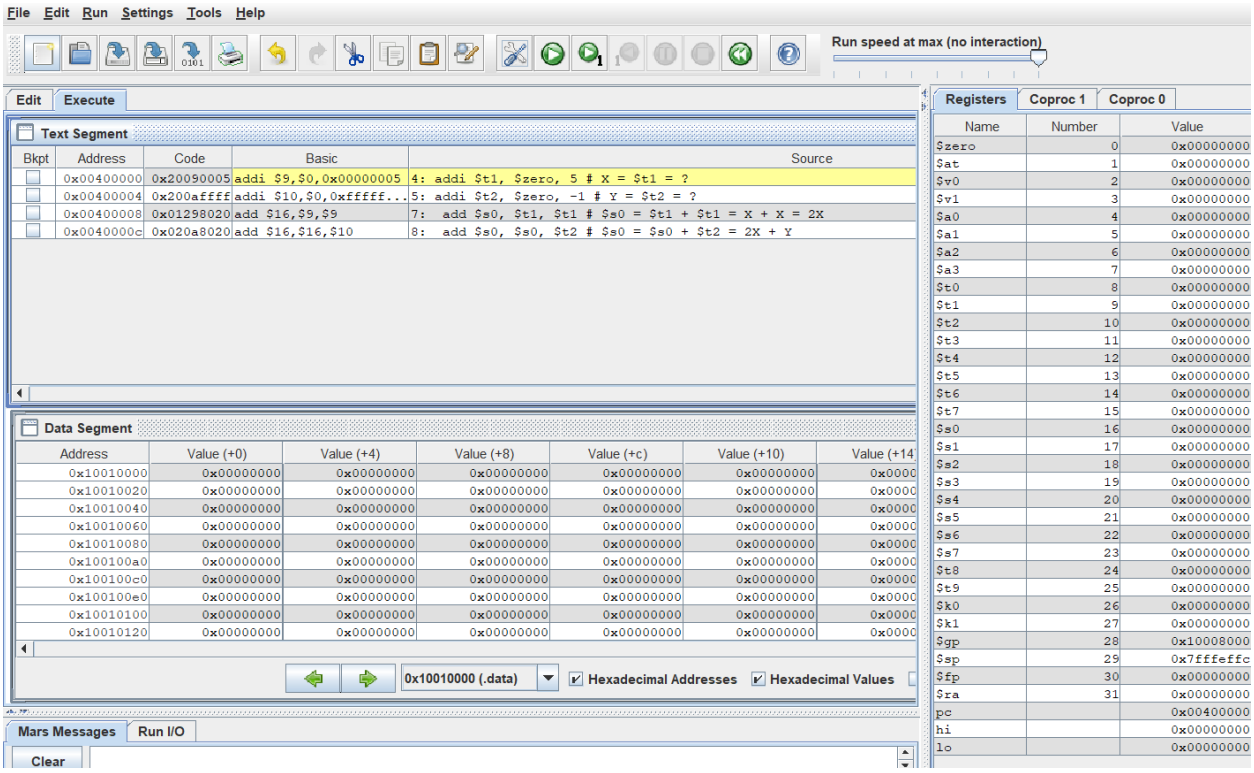


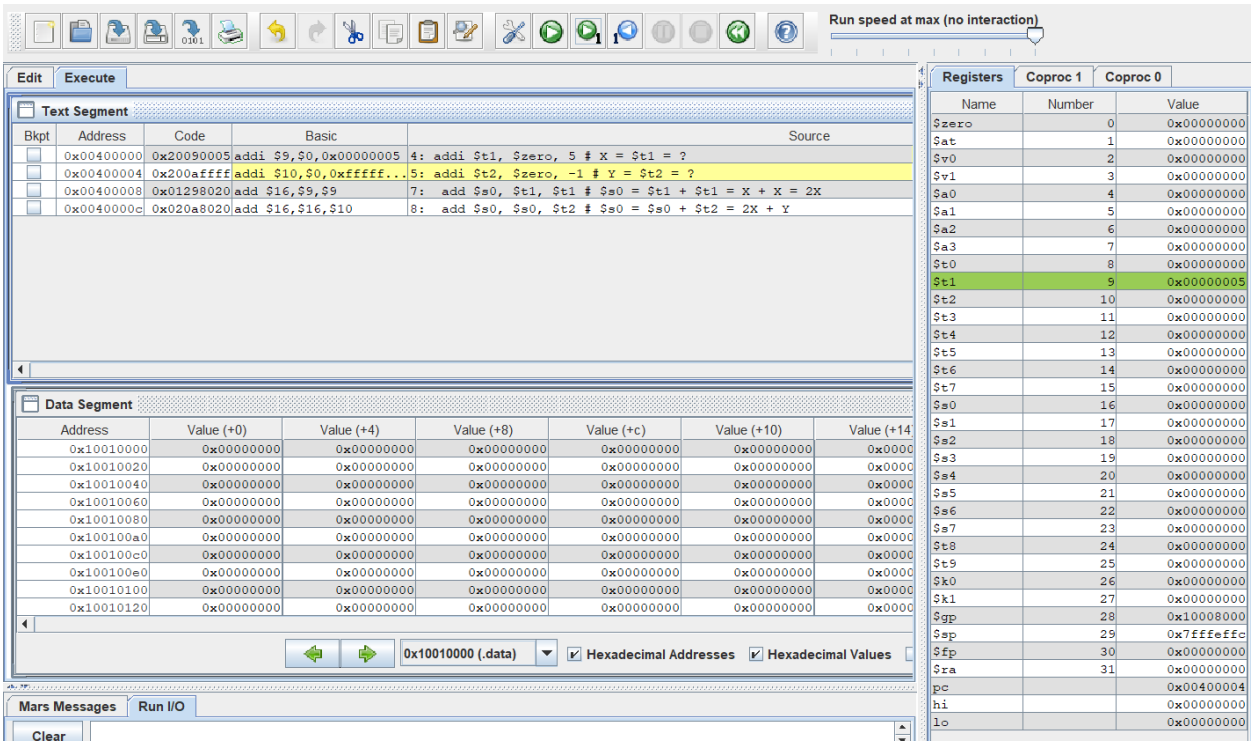
Giải thích:

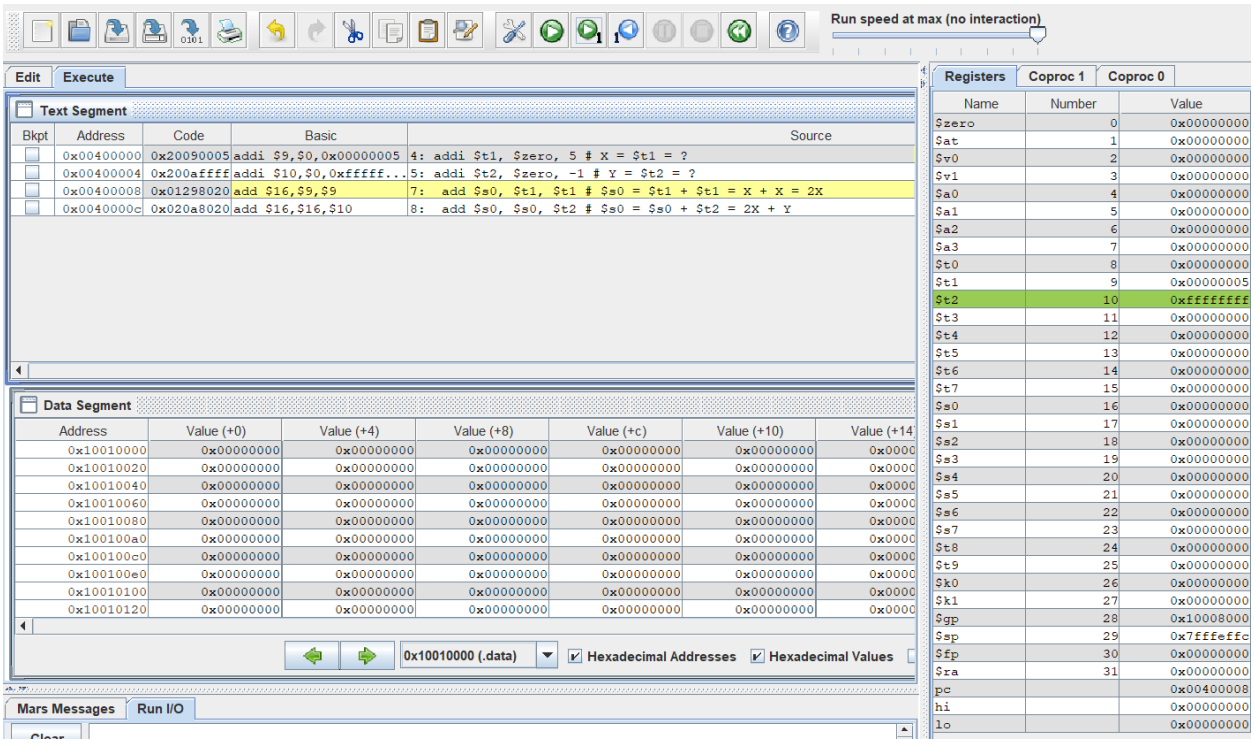
Lệnh li của MÍP chỉ có tham số 16 bít nên được tách thành 2 lệnh.thanh ghi $at trung gian để ghi 16 bit cao đầu tiên bằng lui, 16 bit thấp sẽ được ghi vào tiếp theo bằng lệnh ori vào thanh ghi $s0.

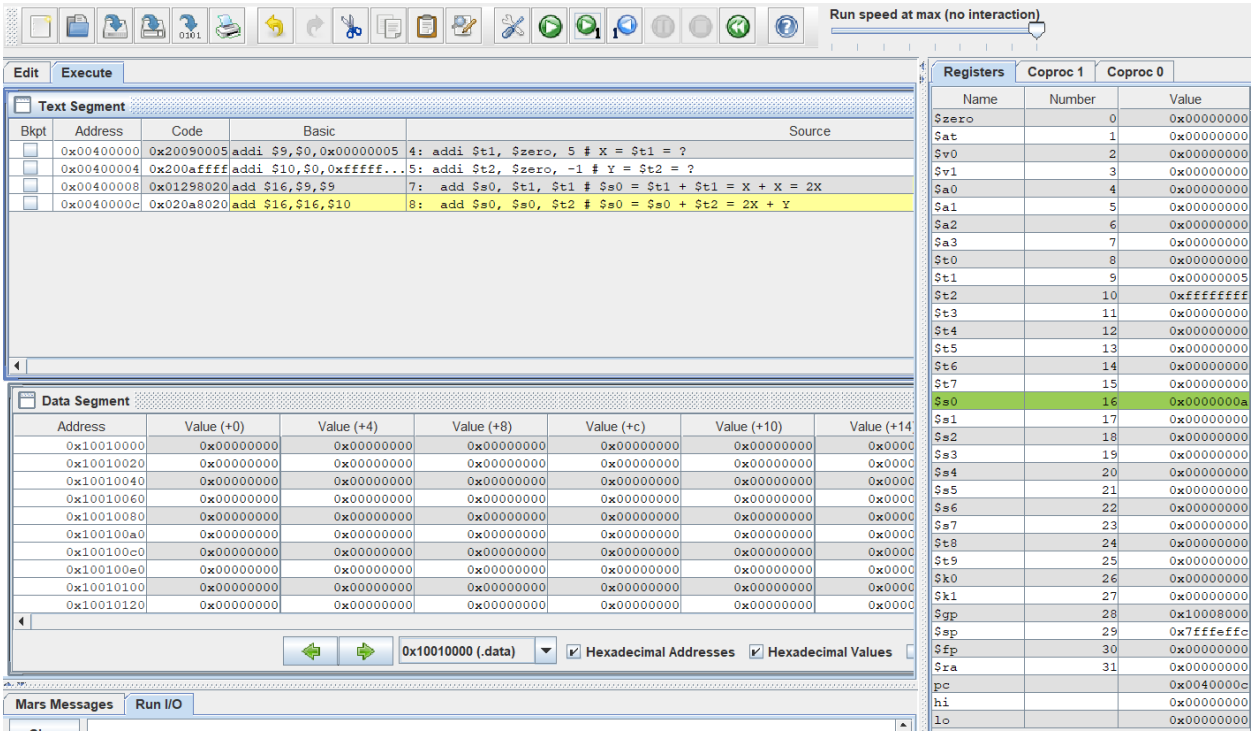
Lệnh li thứ 2 có tham số nhỏ hơn 16 bít nên không cần tách.

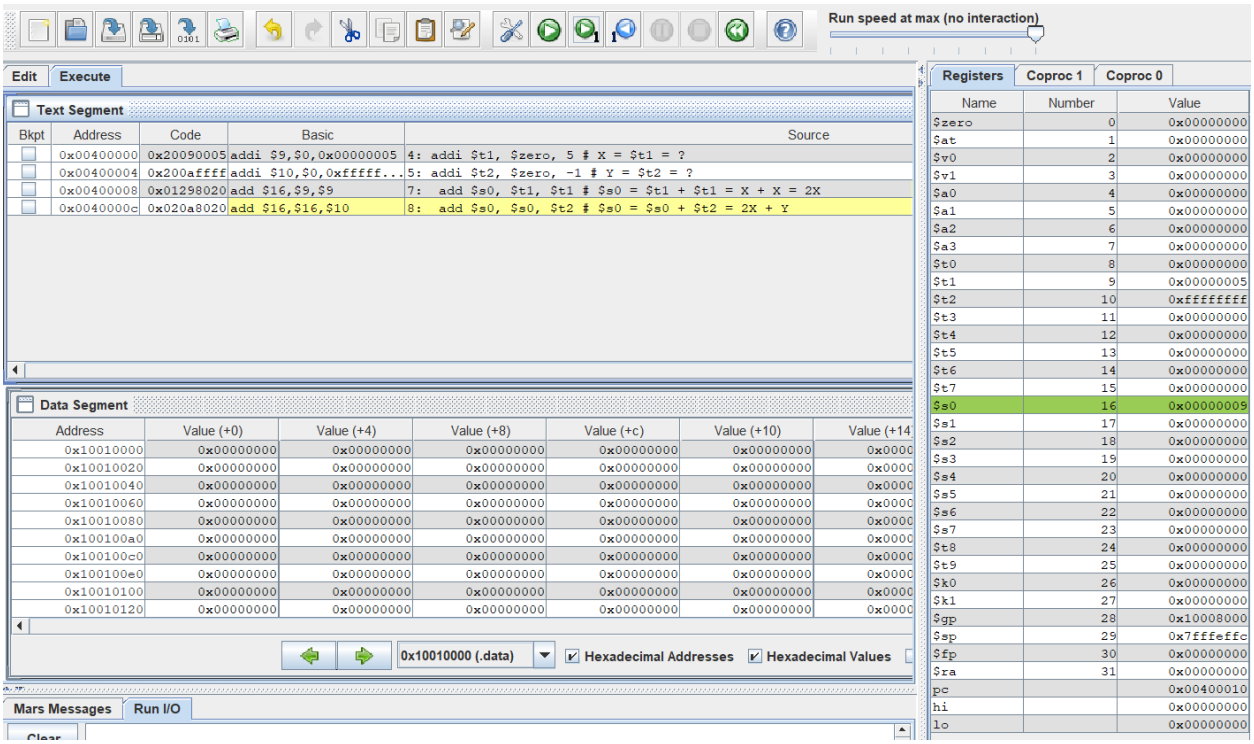
Assignment 4: Tính biểu thức 2x + y= ?






Run speed at max (no interaction)
Edit
Execute
Text Segment
Bkpt
Address
Code
Basic
Source
0x00400000 0x20090005 addi $9,$0,0x00000005 4: addi $t1, $zero, 5 # X = $t1 = ?
0x00400004 0x200afffe addi $10,$0,0xfffffe... 5: addi $t2, $zero, -1 # Y = $t2 = ?
0x00400008 0x01298020 add $16,$9,$9 7: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X + X = 2X
0x0040000c 0x020a8020 add $16,$16,$10 8: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2X + Y
Data Segment
Address
Value (+0)
Value (+4)
Value (+8)
Value (+c)
Value (+10)
Value (+14
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010000 (.data)
Hexadecimal Addresses
Hexadecimal Values
Mars Messages
Run I/O
Registers
Coproc 1
Coproc 0
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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400008
hi 0x00000000
lo 0x00000000


Run speed at max (no interaction)
Edit
Execute
Text Segment
Bkpt
Address
Code
Basic
Source
0x00400000 0x20090005 addi $9,$0,0x00000005 4: addi $t1, $zero, 5 # X = $t1 = ?
0x00400004 0x200afffe addi $10,$0,0xfffffe... 5: addi $t2, $zero, -1 # Y = $t2 = ?
0x00400008 0x01298020 add $16,$9,$9 7: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X + X = 2X
0x0040000c 0x020a8020 add $16,$16,$10 8: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2X + Y
Data Segment
Address
Value (+0)
Value (+4)
Value (+8)
Value (+c)
Value (+10)
Value (+14
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x0000
0x10010000 (.data)
Hexadecimal Addresses
Hexadecimal Values
Mars Messages
Run I/O
Registers
Coproc 1
Coproc 0
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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x0000000a
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x0040000c
hi 0x00000000
lo 0x00000000

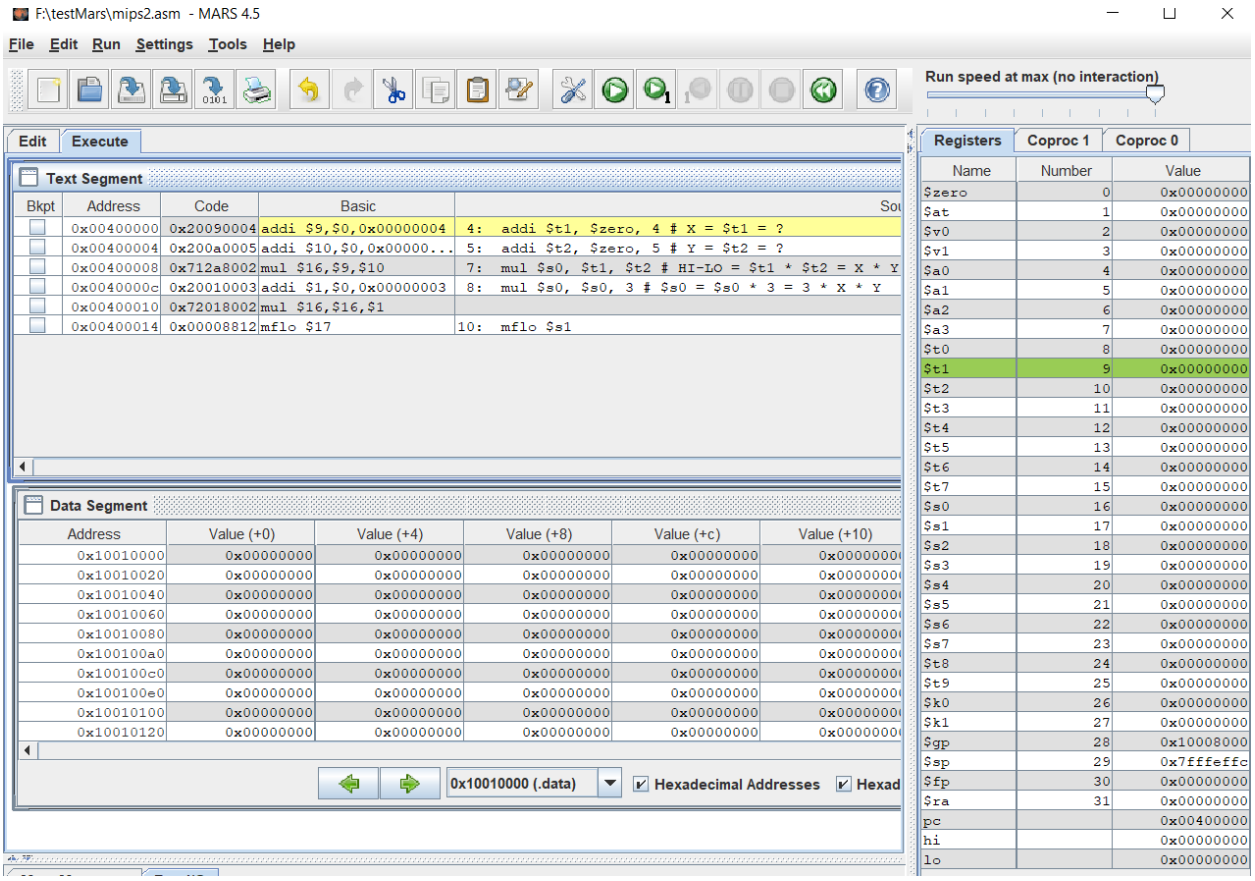


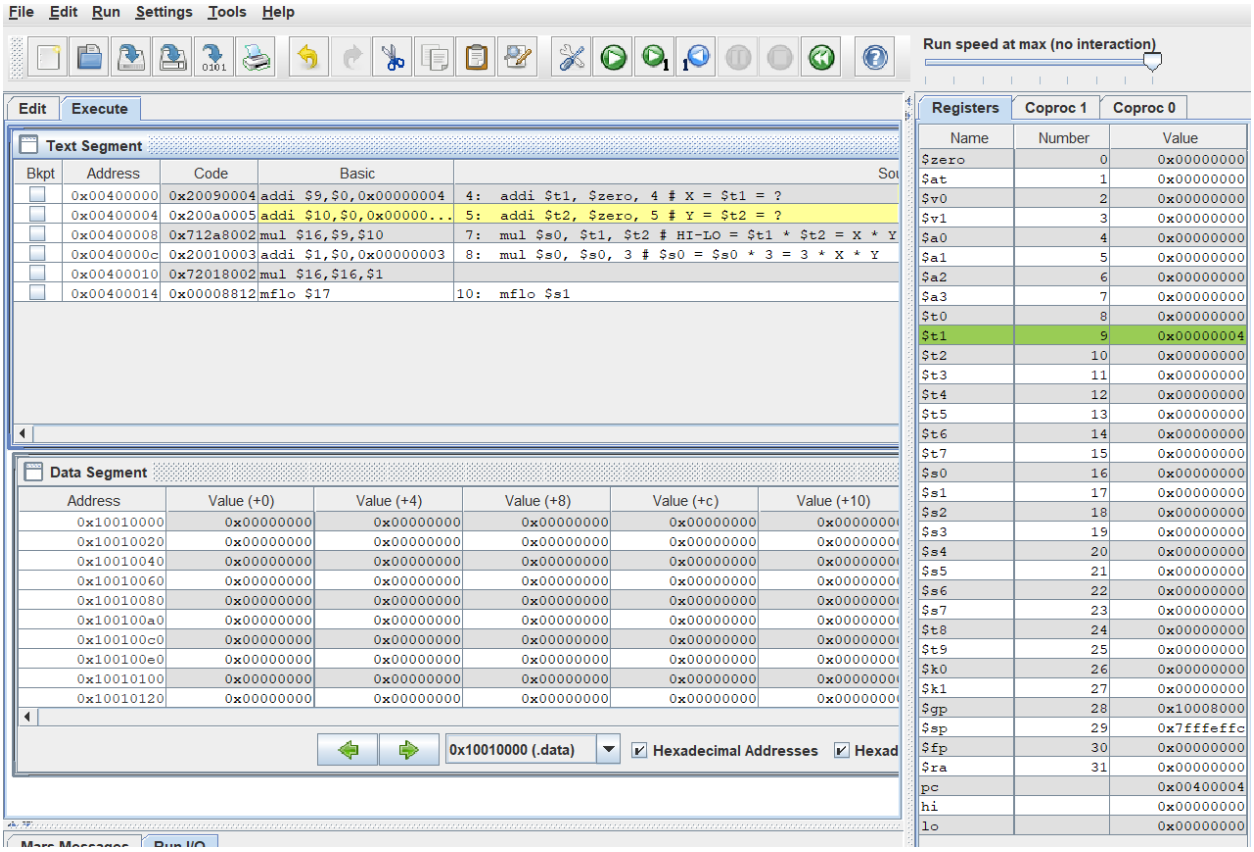
Sau khi kết thúc chương trình , kết quả = 9 Kết quả đúng.

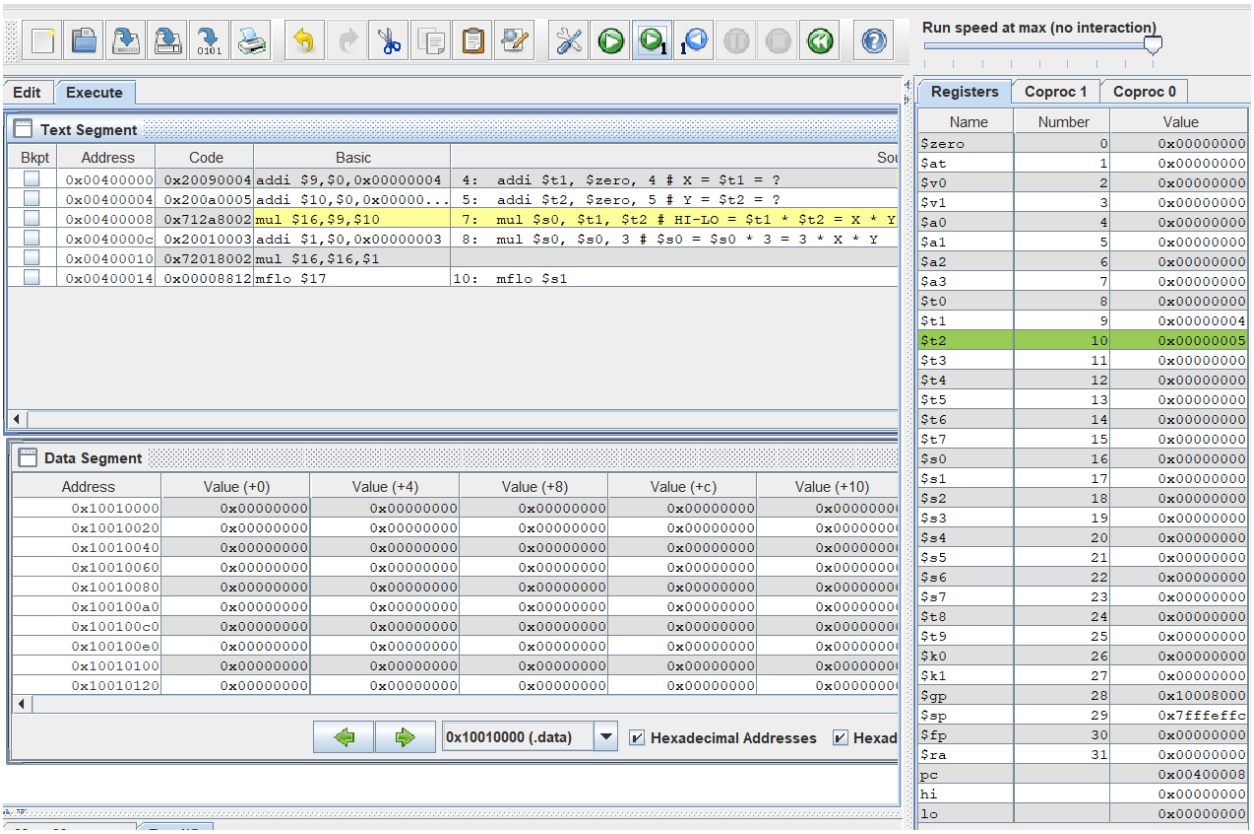
Sau kiểm tra, lệnh addi có phù hợp với khuôn mẫu lệnh I, lệnh add phù hợp với khuôn mẫu lệnh R.

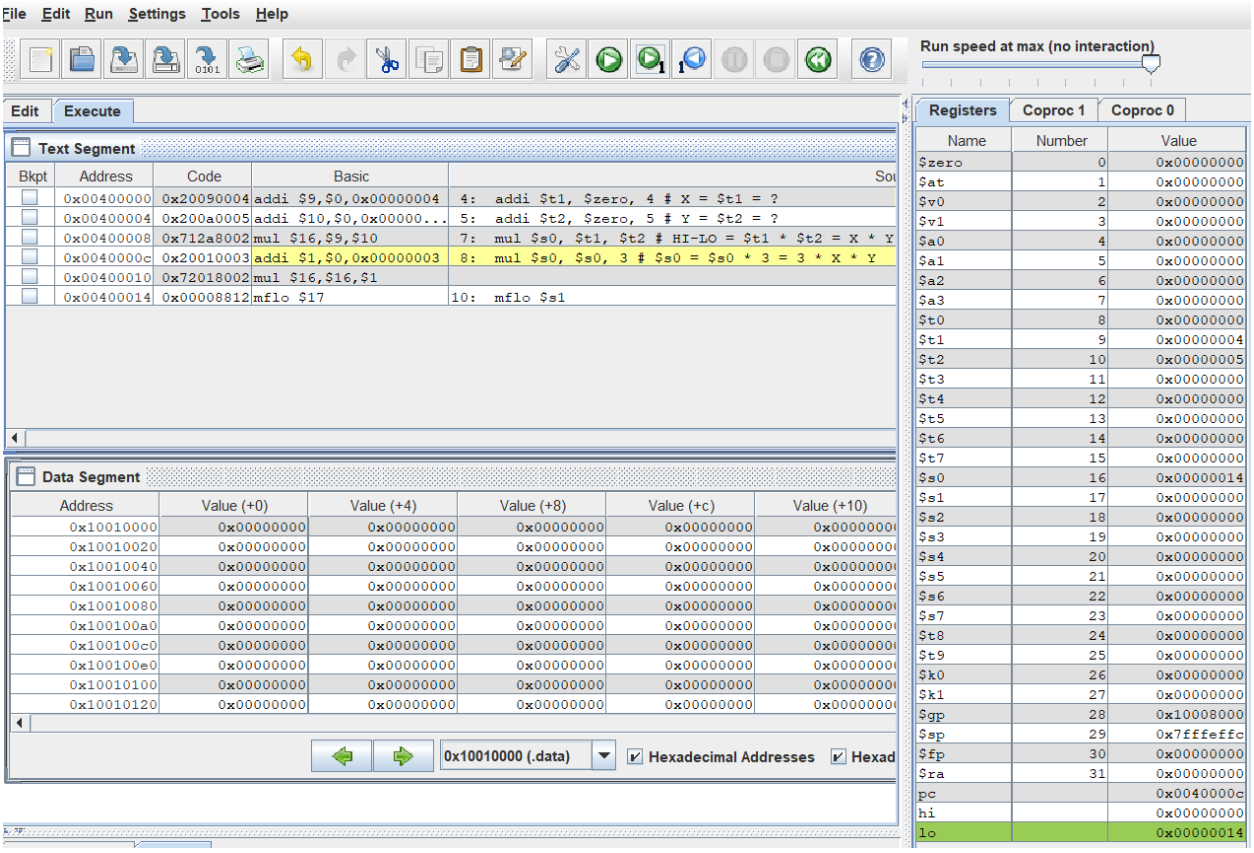
Assignment 5: Phép nhân

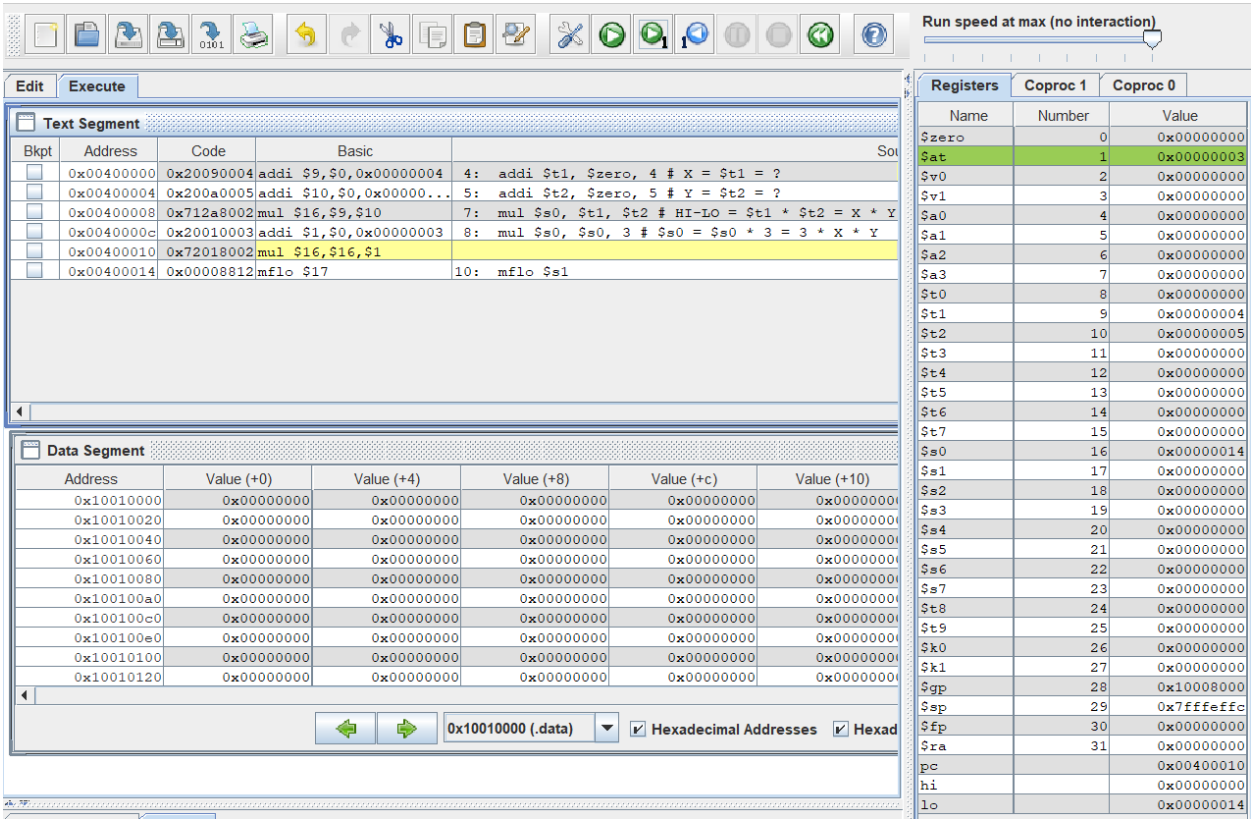
Chạy và debug

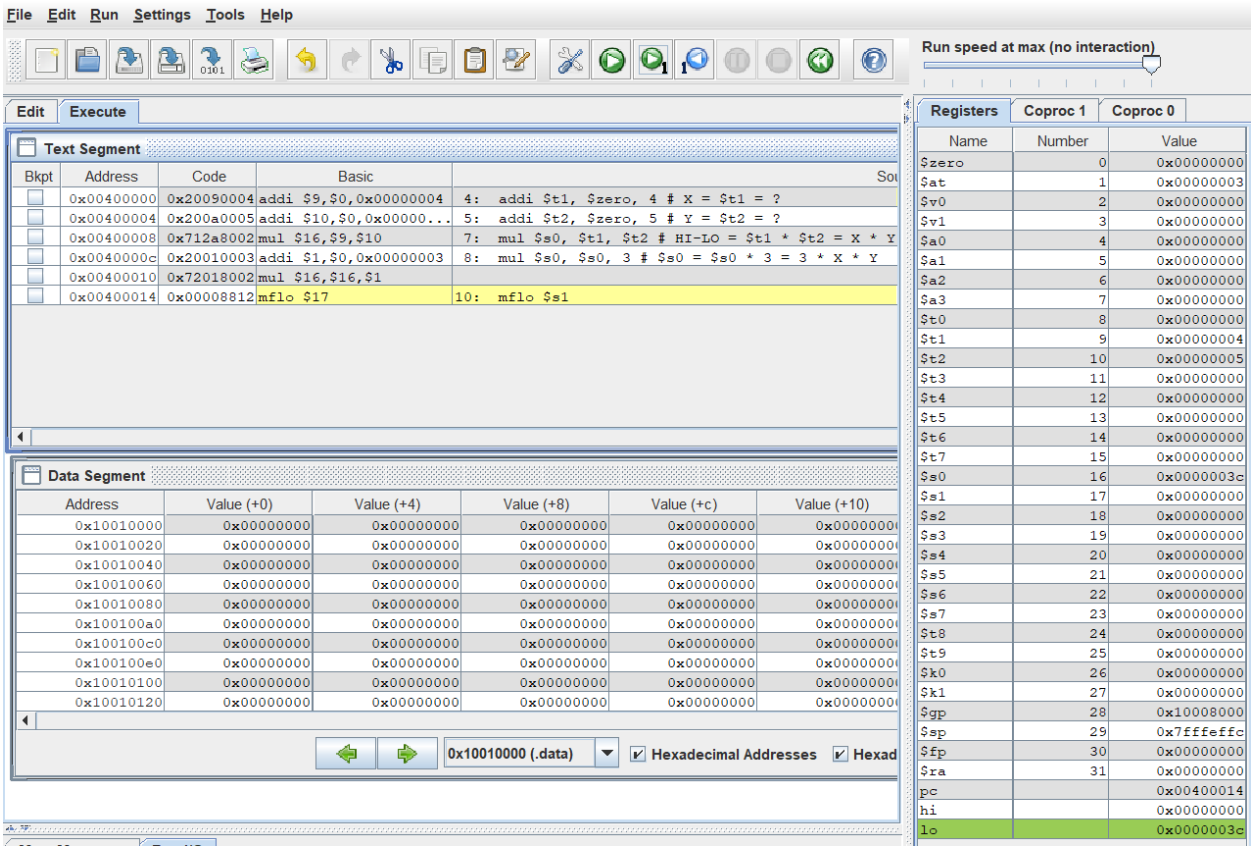


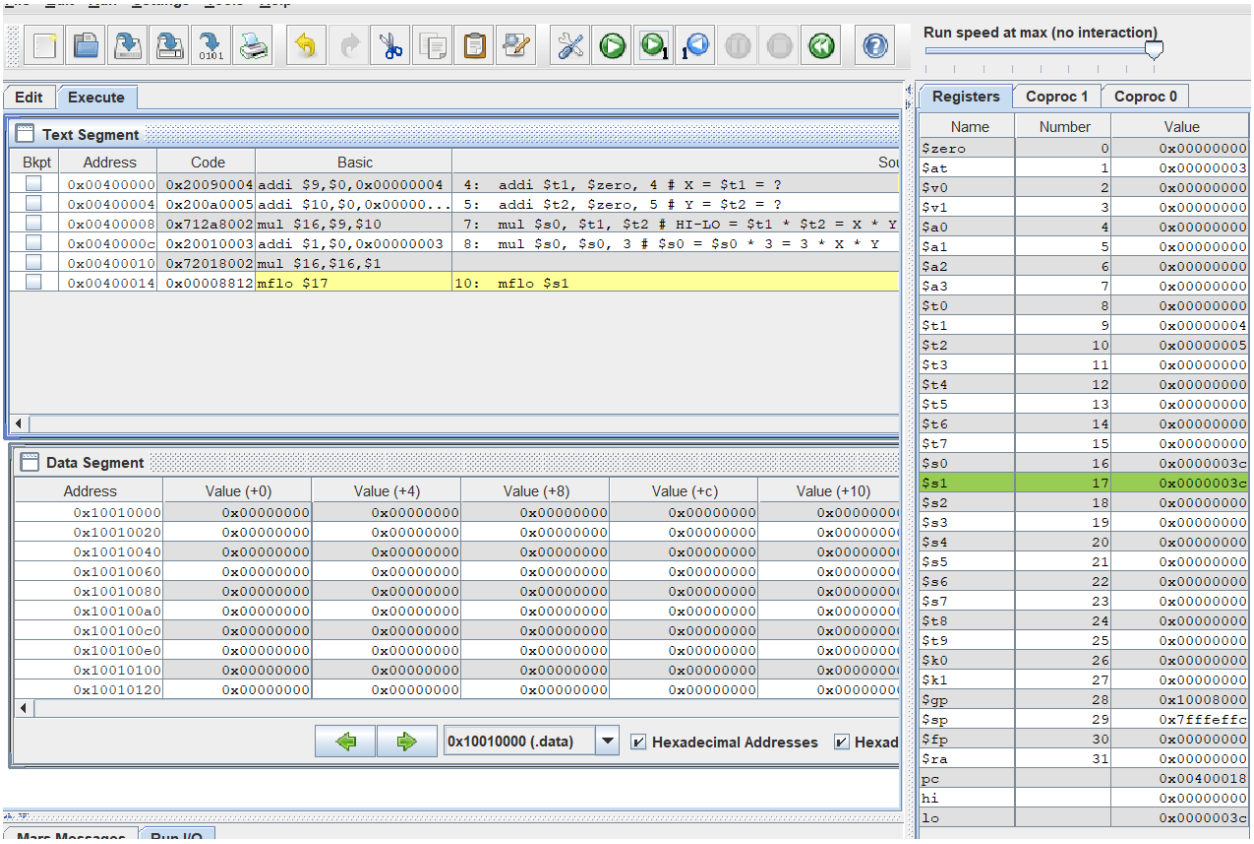

File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic
0x00400000 0x20090004 addi $9,$0,0x00000004 4: addi $t1, $zero, 4 # X = $t1 = ?
0x00400004 0x200a0005 addi $10,$0,0x00000... 5: addi $t2, $zero, 5 # Y = $t2 = ?
0x00400008 0x712a8002 mul $16,$9,$10 7: mul $s0, $t1, $t2 # HI-LO = $t1 * $t2 = X * Y
0x0040000c 0x20010003 addi $1,$0,0x00000003 8: mul $s0, $s0, 3 # $s0 = $s0 * 3 = 3 * X * Y
0x00400010 0x72018002 mul $16,$16,$1
0x00400014 0x00008812 mflo $17 10: mflo $s1
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010000 (.data)
Hexadecimal Addresses
Hexad
Registers Coproc 1 Coproc 0
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 0x00000004
$t2 10 0x00000000
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400004
hi 0x00000000
lo 0x00000000


Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic
0x00400000 0x20090004 addi $9,$0,0x00000004 4: addi $t1, $zero, 4 # X = $t1 = ?
0x00400004 0x200a0005 addi $10,$0,0x00000... 5: addi $t2, $zero, 5 # Y = $t2 = ?
0x00400008 0x712a8002 mul $16,$9,$10 7: mul $s0, $t1, $t2 # HI-LO = $t1 * $t2 = X * Y
0x0040000c 0x20010003 addi $1,$0,0x00000003 8: mul $s0, $s0, 3 # $s0 = $s0 * 3 = 3 * X * Y
0x00400010 0x72018002 mul $16,$16,$1
0x00400014 0x00008812 mflo $17 10: mflo $s1
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010000 (.data)
Hexadecimal Addresses
Hexad
Registers Coproc 1 Coproc 0
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 0x00000004
$t2 10 0x00000005
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400008
hi 0x00000000
lo 0x00000000


File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic
0x00400000 0x20090004 addi $9,$0,0x00000004 4: addi $t1, $zero, 4 # X = $t1 = ?
0x00400004 0x200a0005 addi $10,$0,0x00000... 5: addi $t2, $zero, 5 # Y = $t2 = ?
0x00400008 0x712a8002 mul $16,$9,$10 7: mul $s0, $t1, $t2 # HI-LO = $t1 * $t2 = X * Y
0x0040000c 0x20010003 addi $1,$0,0x00000003 8: mul $s0, $s0, 3 # $s0 = $s0 * 3 = 3 * X * Y
0x00400010 0x72018002 mul $16,$16,$1
0x00400014 0x00008812 mflo $17 10: mflo $s1
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000
0x10010000 (.data)
Hexadecimal Addresses
Hexad
Registers Coproc 1 Coproc 0
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 0x00000004
$t2 10 0x00000005
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000014
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x0040000c
hi 0x00000000
lo 0x00000014


Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic
0x00400000 0x20090004 addi $9,$0,0x00000004 4: addi $t1, $zero, 4 # X = $t1 = ?
0x00400004 0x200a0005 addi $10,$0,0x00000... 5: addi $t2, $zero, 5 # Y = $t2 = ?
0x00400008 0x712a8002 mul $16,$9,$10 7: mul $s0, $t1, $t2 # HI-LO = $t1 * $t2 = X * Y
0x0040000c 0x20010003 addi $1,$0,0x00000003 8: mul $s0, $s0, 3 # $s0 = $s0 * 3 = 3 * X * Y
0x00400010 0x72018002 mul $16,$16,$1
0x00400014 0x00008812 mflo $17 10: mflo $s1
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000
0x10010000 (.data)
Hexadecimal Addresses
Hexad
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0x00000000
$at 1 0x00000003
$v0 2 0x00000000
$v1 3 0x00000000
$a0 4 0x00000000
$a1 5 0x00000000
$a2 6 0x00000000
$a3 7 0x00000000
$t0 8 0x00000000
$t1 9 0x00000004
$t2 10 0x00000005
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000014
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400010
hi 0x00000000
lo 0x00000014

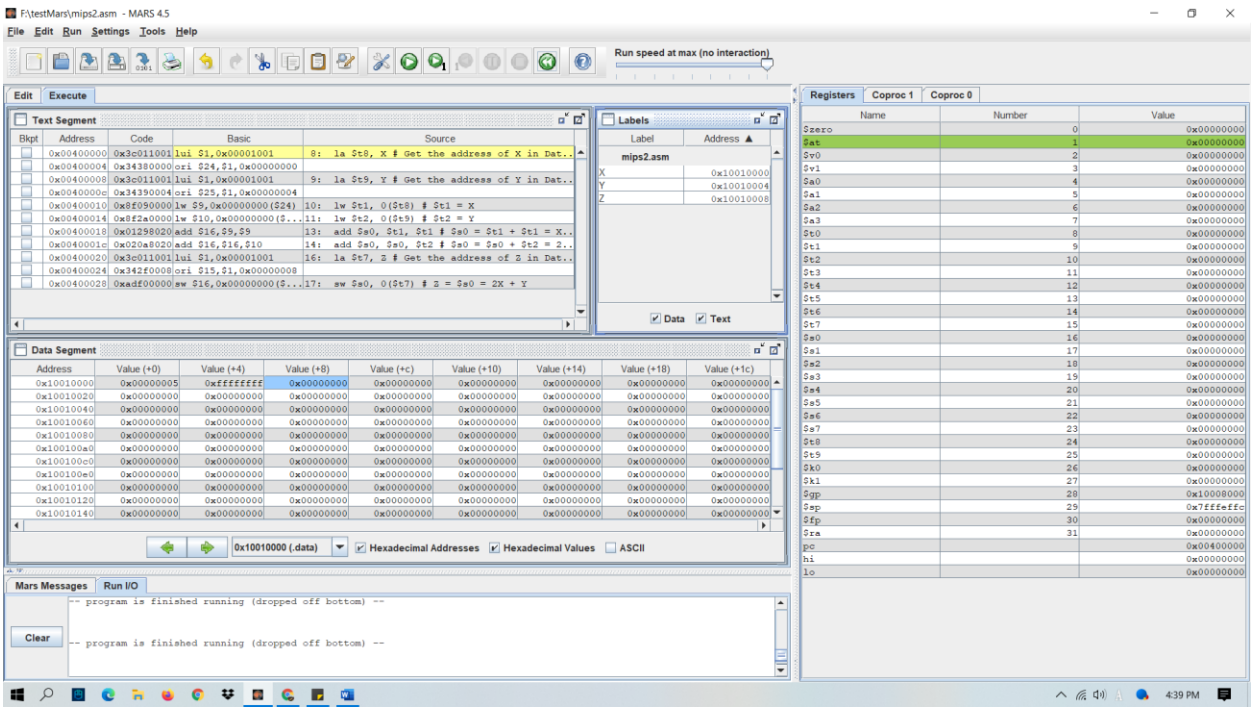

File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic
0x00400000 0x20090004 addi $9,$0,0x00000004 4: addi $t1, $zero, 4 # X = $t1 = ?
0x00400004 0x200a0005 addi $10,$0,0x00000... 5: addi $t2, $zero, 5 # Y = $t2 = ?
0x00400008 0x712a8002 mul $16,$9,$10 7: mul $s0, $t1, $t2 # HI-LO = $t1 * $t2 = X * Y
0x0040000c 0x20010003 addi $1,$0,0x00000003 8: mul $s0, $s0, 3 # $s0 = $s0 * 3 = 3 * X * Y
0x00400010 0x72018002 mul $16,$16,$1
0x00400014 0x00008812 mflo $17 10: mflo $s1
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000
0x10010000 (.data)
Hexadecimal Addresses
Hexad
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0x00000000
$at 1 0x00000003
$v0 2 0x00000000
$v1 3 0x00000000
$a0 4 0x00000000
$a1 5 0x00000000
$a2 6 0x00000000
$a3 7 0x00000000
$t0 8 0x00000000
$t1 9 0x00000004
$t2 10 0x00000005
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x0000003c
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400014
hi 0x00000000
lo 0x0000003c

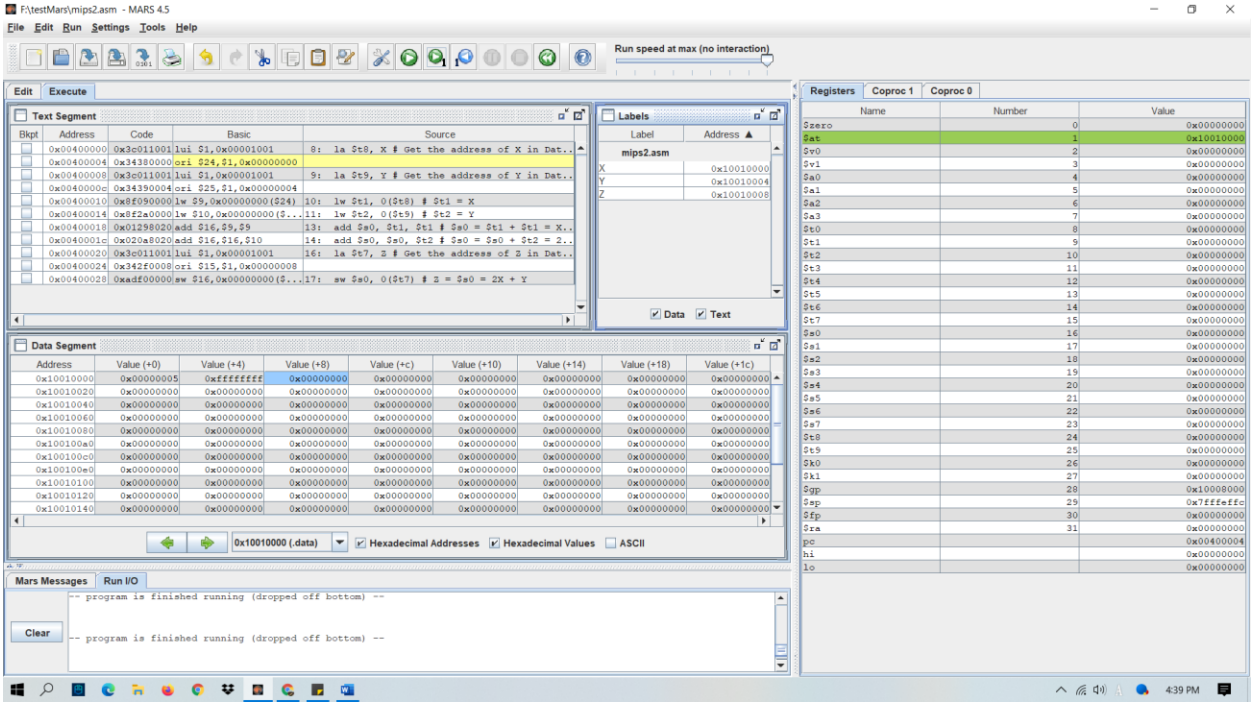

Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic
0x00400000 0x20090004 addi $9,$0,0x00000004 4: addi $t1, $zero, 4 # X = $t1 = ?
0x00400004 0x200a0005 addi $10,$0,0x00000... 5: addi $t2, $zero, 5 # Y = $t2 = ?
0x00400008 0x712a8002 mul $16,$9,$10 7: mul $s0, $t1, $t2 # HI-LO = $t1 * $t2 = X * Y
0x0040000c 0x20010003 addi $1,$0,0x00000003 8: mul $s0, $s0, 3 # $s0 = $s0 * 3 = 3 * X * Y
0x00400010 0x72018002 mul $16,$16,$1
0x00400014 0x00008812 mflo $17 10: mflo $s1
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10)
0x10010000 0x00000000 0x00000000 0x00000000 0x00000000
0x10010020 0x00000000 0x00000000 0x00000000 0x00000000
0x10010040 0x00000000 0x00000000 0x00000000 0x00000000
0x10010060 0x00000000 0x00000000 0x00000000 0x00000000
0x10010080 0x00000000 0x00000000 0x00000000 0x00000000
0x100100a0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100c0 0x00000000 0x00000000 0x00000000 0x00000000
0x100100e0 0x00000000 0x00000000 0x00000000 0x00000000
0x10010100 0x00000000 0x00000000 0x00000000 0x00000000
0x10010120 0x00000000 0x00000000 0x00000000 0x00000000
0x10010000 (.data)
Hexadecimal Addresses
Hexad
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0x00000000
$at 1 0x00000003
$v0 2 0x00000000
$v1 3 0x00000000
$a0 4 0x00000000
$a1 5 0x00000000
$a2 6 0x00000000
$a3 7 0x00000000
$t0 8 0x00000000
$t1 9 0x00000004
$t2 10 0x00000005
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x0000003c
$s1 17 0x0000003c
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400018
hi 0x00000000
lo 0x0000003c

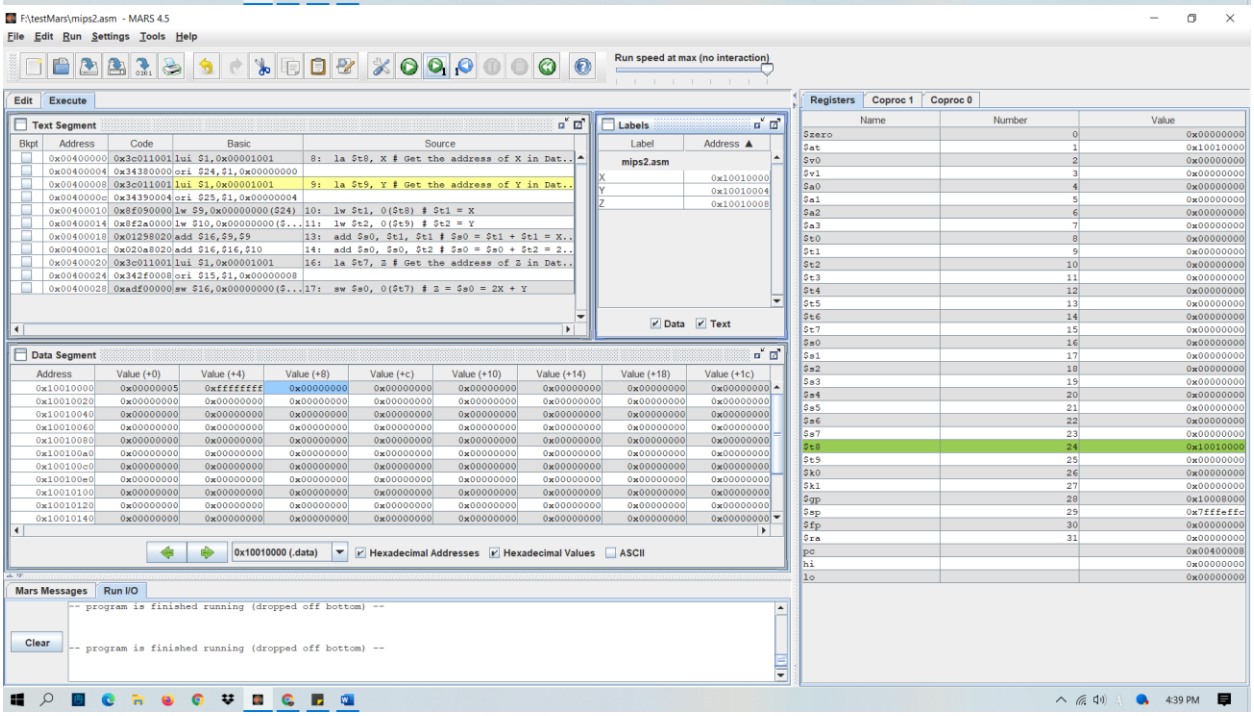
Lệnh mul $s0, $s0, 3 bị tách thành 2 lệnh addi $1, $0 , 0x0000 0003, mul $16, $16, $1

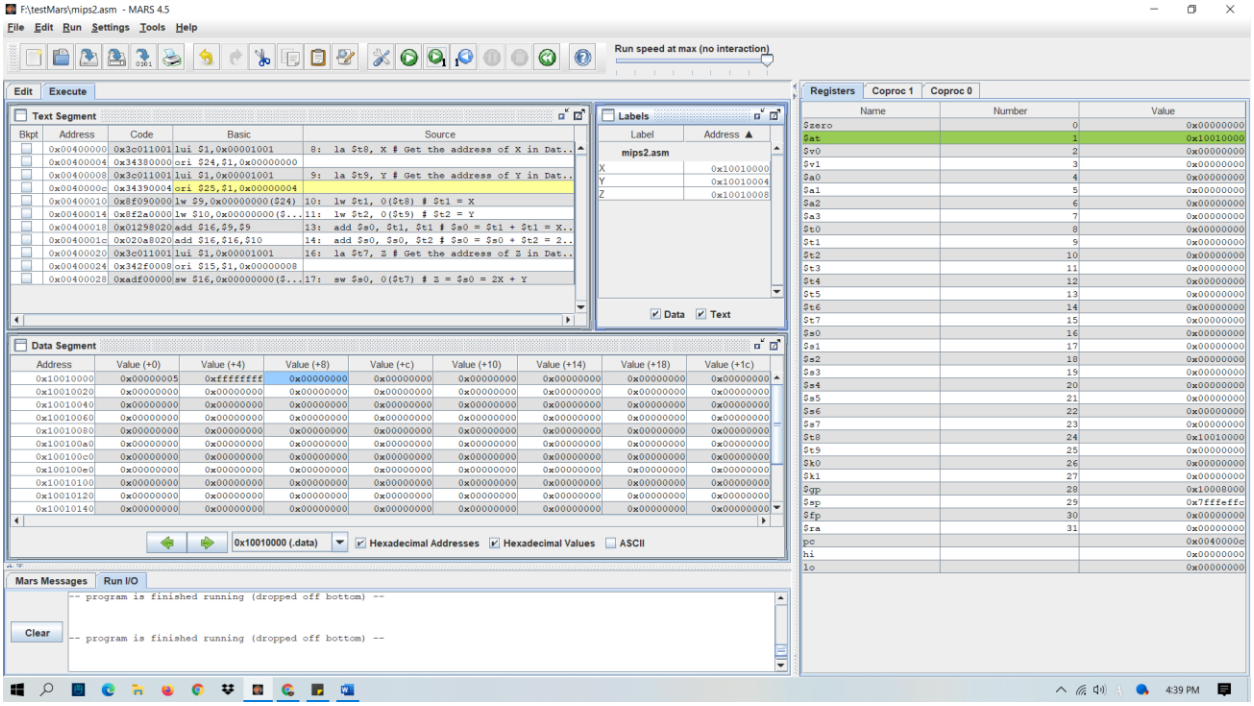
Lệnh addi lưu 3 vào thanh ghi at. Sau đó lệnh mul mới tính tích của at và $s0. Sau lệnh thanh lo $s0 sẽ có giá trị 60. Lệnh cuối cùng thay đổi giá trị $s1 = $s0

Assignment 6: Tạo biến và truy cập biến




F:\testMars\mips2.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 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x00000000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400004
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.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 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x00000000
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400008
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.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 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020 0x10010040 0x10010060 0x10010080 0x100100a0 0x100100c0 0x100100e0 0x10010100 0x10010120 0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
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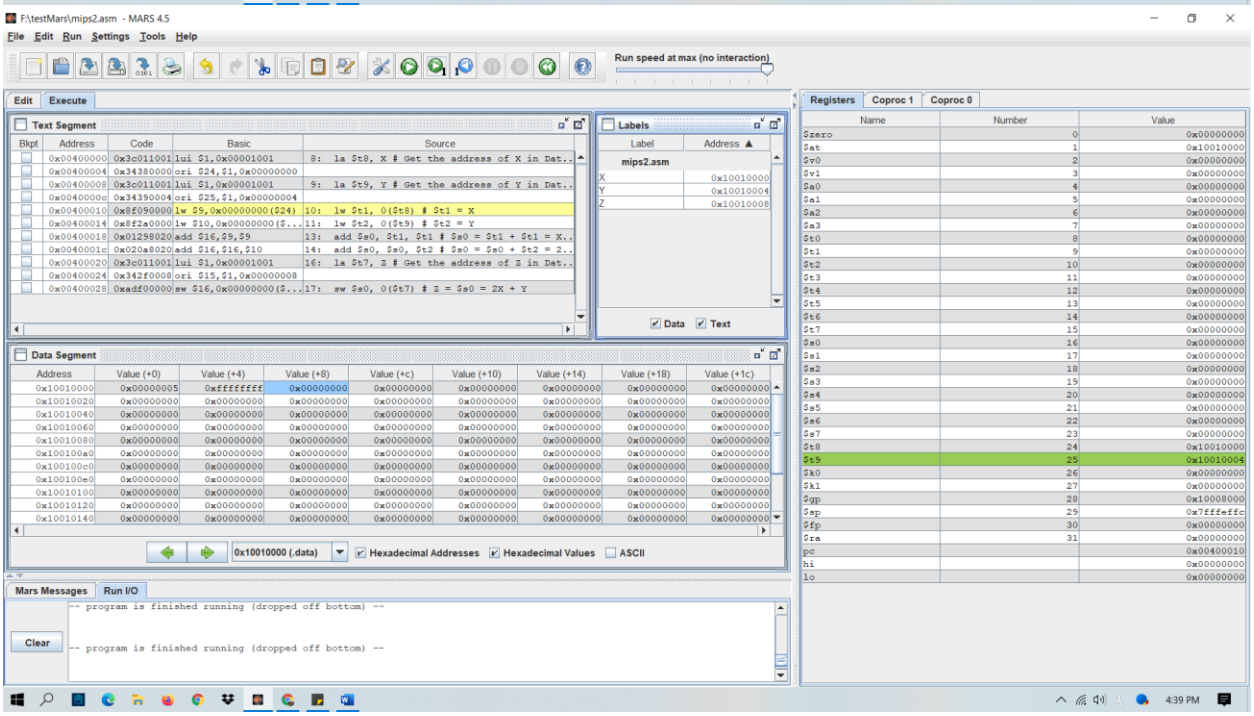
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x0040000c
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.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 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020 0x10010040 0x10010060 0x10010080 0x100100a0 0x100100c0 0x100100e0 0x10010100 0x10010120 0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0x00000000
$at 1 0x10010000
$v0 2 0x00000000
$v1 3 0x00000000
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$a2 6 0x00000000
$a3 7 0x00000000
$t0 8 0x00000000
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$t3 11 0x00000000
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$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
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$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
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$s6 22 0x00000000
$s7 23 0x00000000
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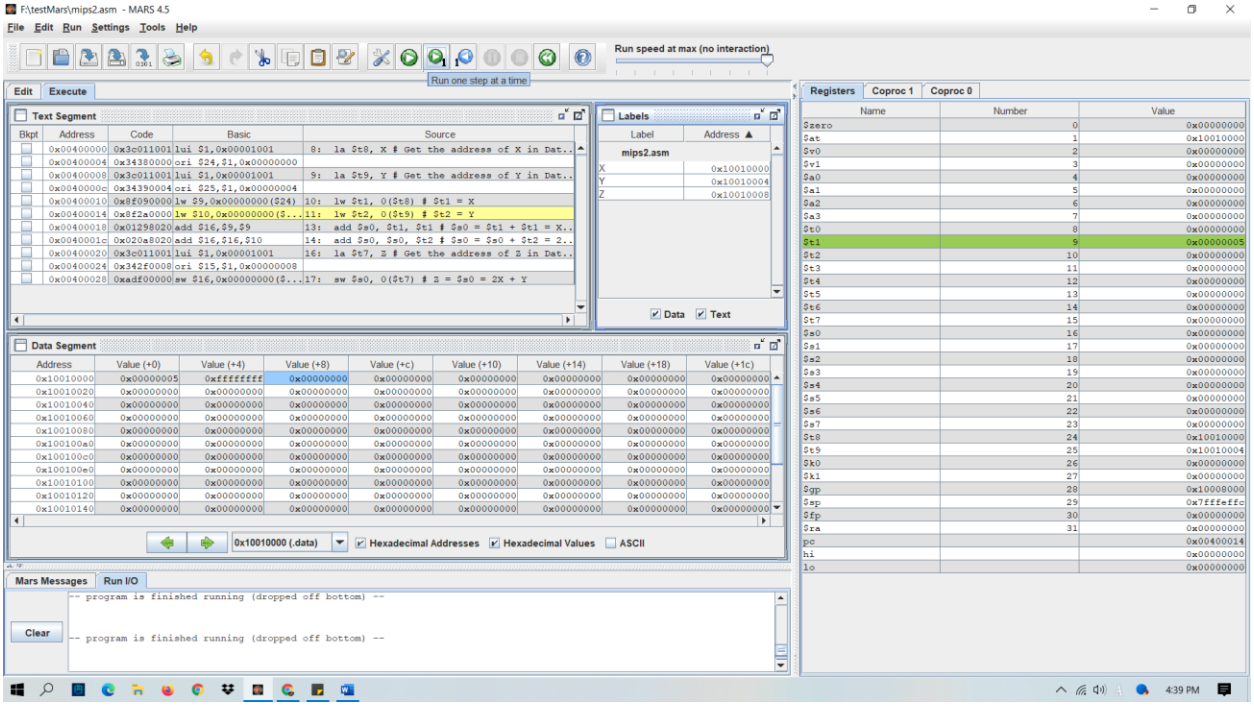
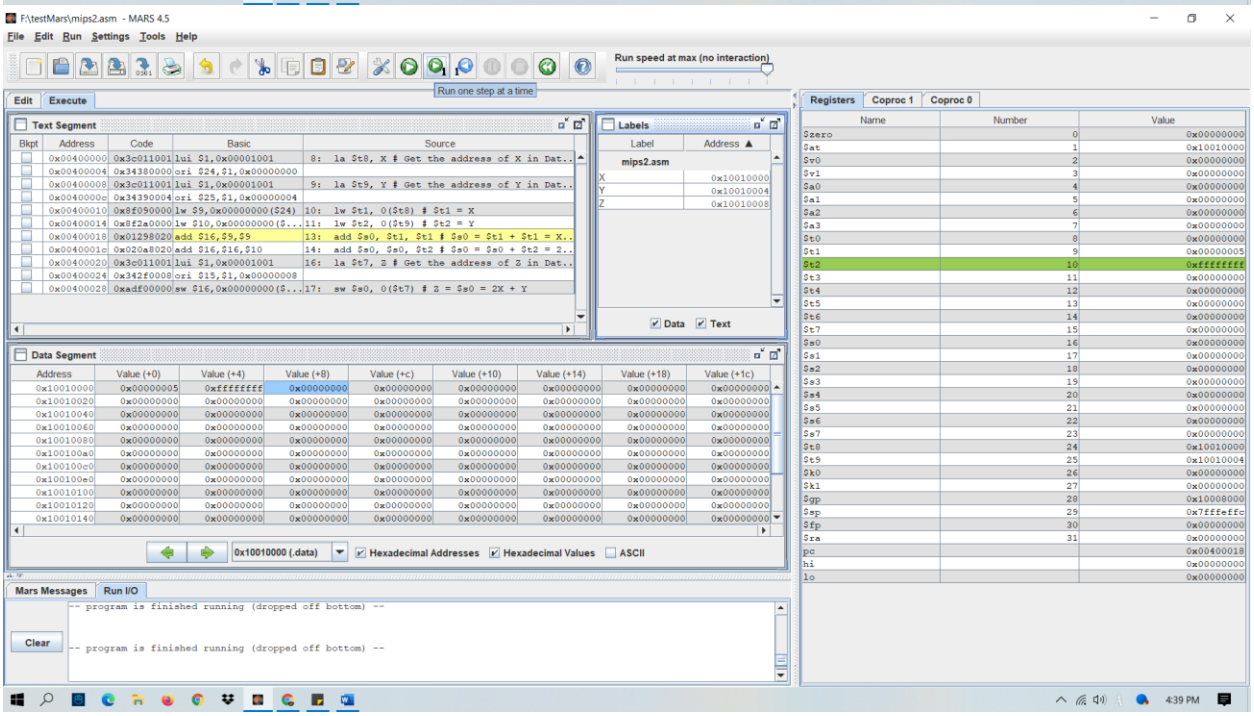
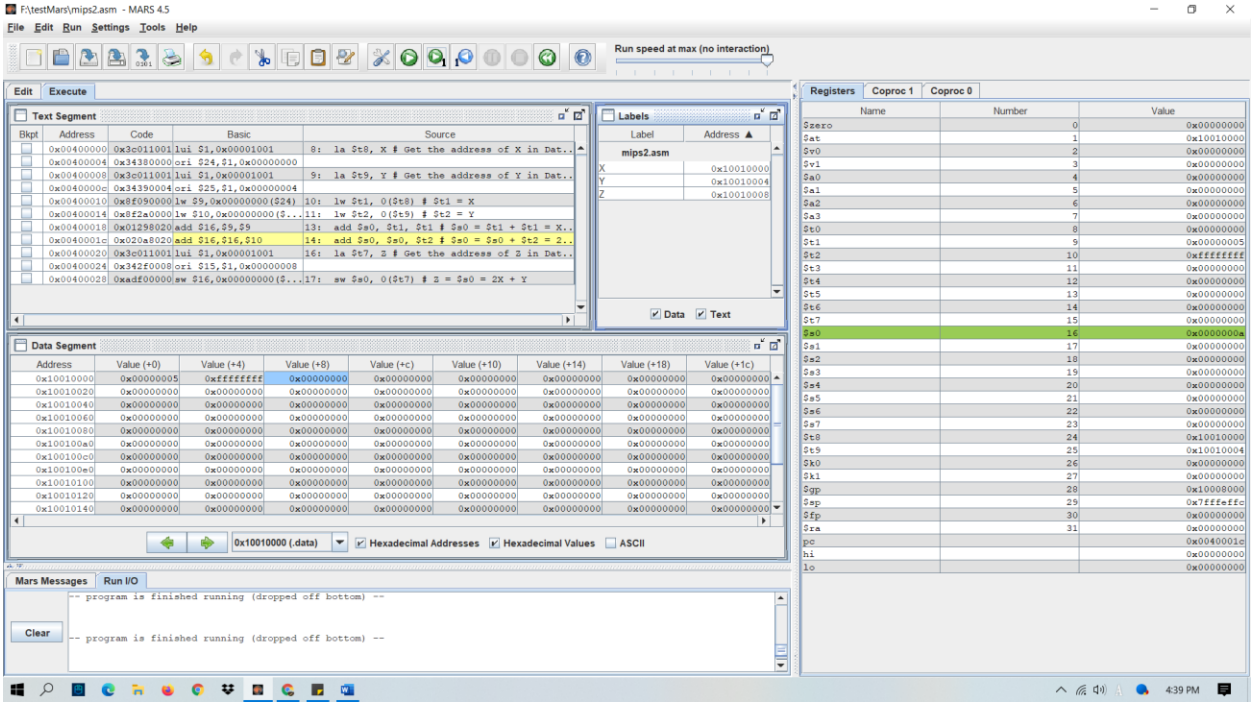
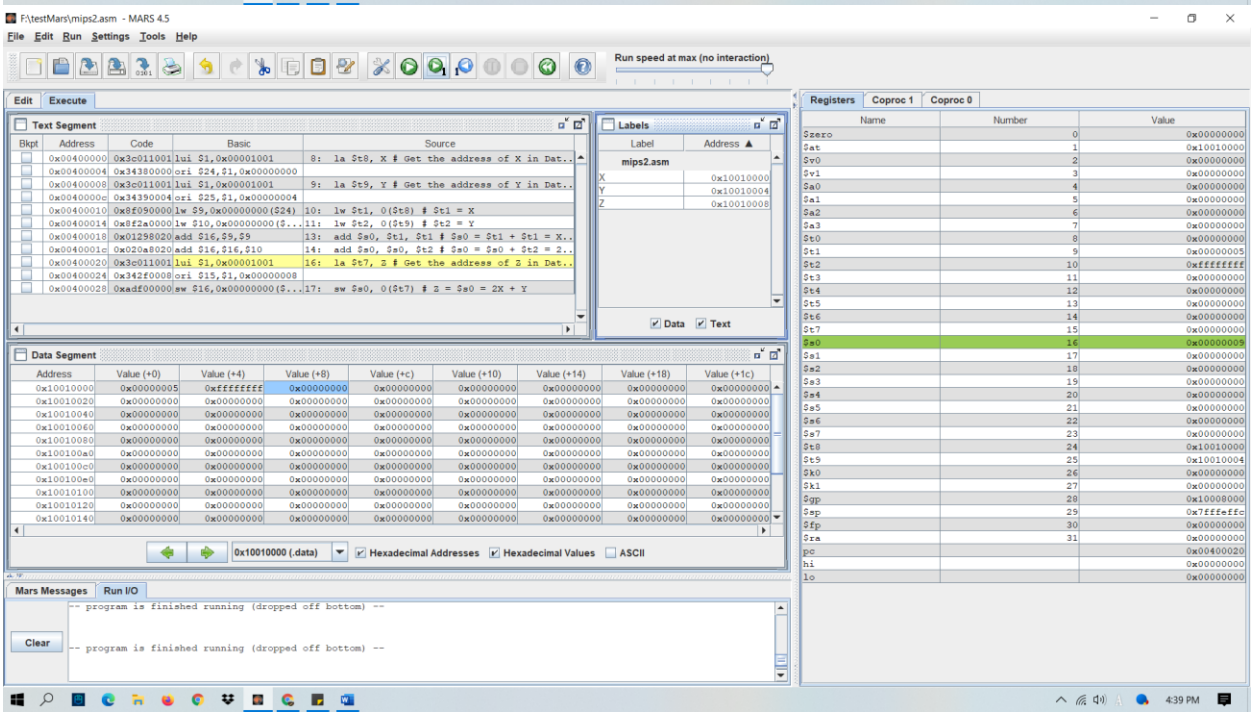
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400010
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Run one step at a time
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400000 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010140 0x00000000
0x10010000 (.data)
Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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 0x00000005
$t2 10 0x00000000
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400014
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Run one step at a time
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400000 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010140 0x00000000
0x10010000 (.data)
Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000000
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400018
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.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 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x0000000a
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x0040001c
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.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 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
Registers Coproc 1 Coproc 0
Name Number Value
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$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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x0000000f
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
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$sp 29 0x7fffeffc
$fp 30 0x00000000
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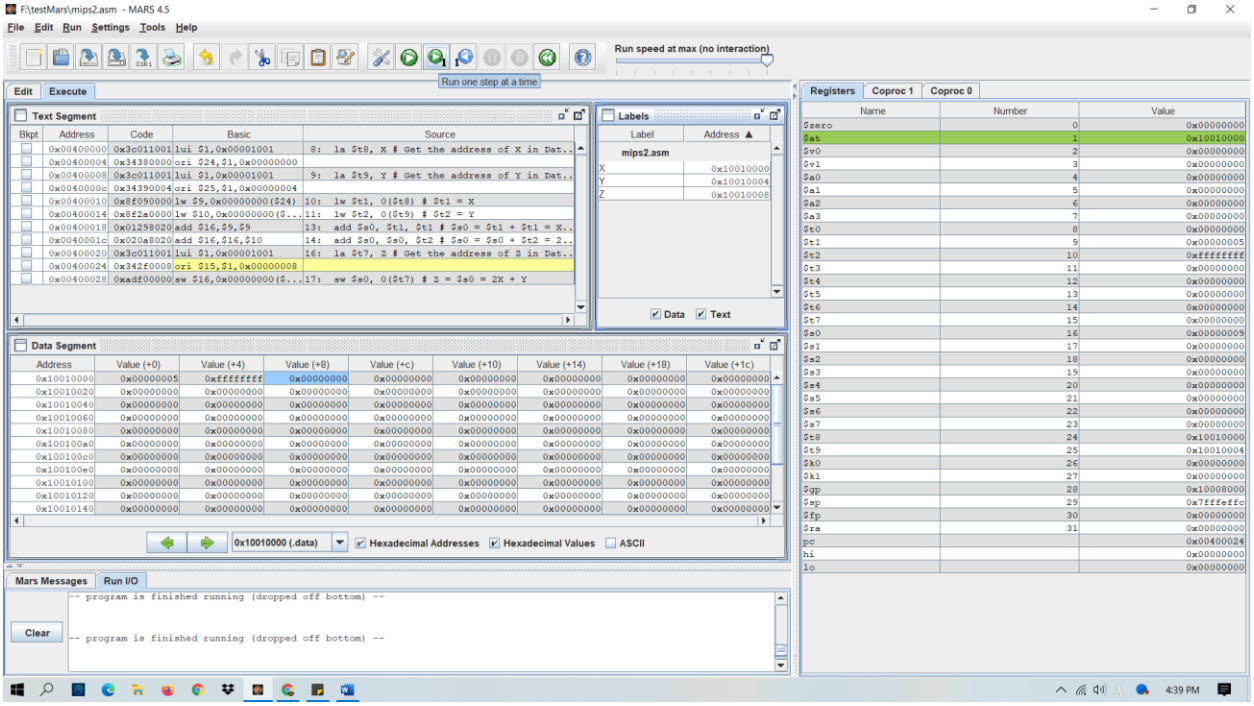
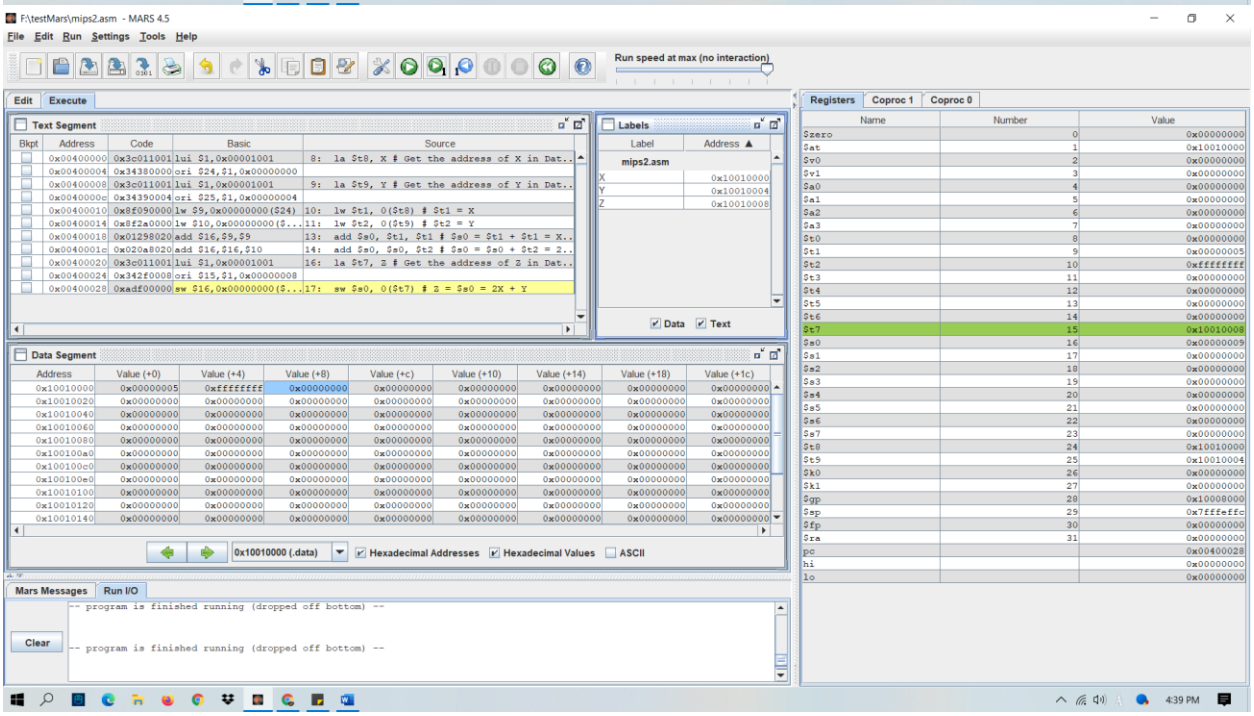
pc 0x00400020
hi 0x00000000
lo 0x00000000
4:39 PM


F:\testMars\mips2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Run one step at a time
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400000 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x00000000
$s0 16 0x00000009
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400024
hi 0x00000000
lo 0x00000000
4:39 PM

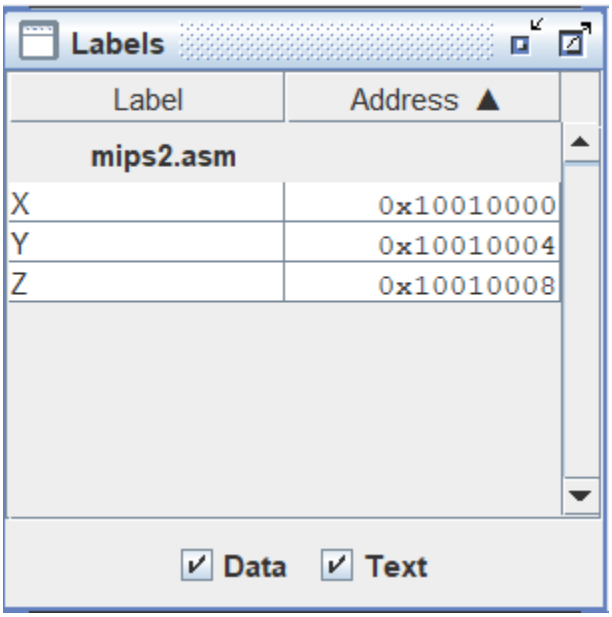

F:\testMars\mips2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400000 0x3c011001 lui $1,0x00001001 8: la $t8, X # Get the address of X in Dat..
0x00400004 0x34380000 ori $24,$1,0x00000000
0x00400008 0x3c011001 lui $1,0x00001001 9: la $t9, Y # Get the address of Y in Dat..
0x0040000c 0x34390004 ori $25,$1,0x00000004
0x00400010 0x8f090000 lw $9,0x00000000($24) 10: lw $t1, 0($t8) # $t1 = X
0x00400014 0x8f2a0000 lw $10,0x00000000($... 11: lw $t2, 0($t9) # $t2 = Y
0x00400018 0x01298020 add $16,$9,$9 13: add $s0, $t1, $t1 # $s0 = $t1 + $t1 = X..
0x0040001c 0x020a8020 add $16,$16,$10 14: add $s0, $s0, $t2 # $s0 = $s0 + $t2 = 2..
0x00400020 0x3c011001 lui $1,0x00001001 16: la $t7, Z # Get the address of Z in Dat..
0x00400024 0x342f0008 ori $15,$1,0x00000008
0x00400028 0xadf00000 sw $16,0x00000000($... 17: sw $s0, 0($t7) # Z = $s0 = 2X + Y
Labels
Label Address
mips2.asm
X 0x10010000
Y 0x10010004
Z 0x10010008
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 0x00000005 0xffffffff 0x00000000
0x10010020
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
-- program is finished running (dropped off bottom) --
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 0x00000005
$t2 10 0xffffffff
$t3 11 0x00000000
$t4 12 0x00000000
$t5 13 0x00000000
$t6 14 0x00000000
$t7 15 0x10010008
$s0 16 0x00000009
$s1 17 0x00000000
$s2 18 0x00000000
$s3 19 0x00000000
$s4 20 0x00000000
$s5 21 0x00000000
$s6 22 0x00000000
$s7 23 0x00000000
$t8 24 0x10010000
$t9 25 0x10010004
$k0 26 0x00000000
$k1 27 0x00000000
$gp 28 0x10008000
$sp 29 0x7fffeffc
$fp 30 0x00000000
$ra 31 0x00000000
pc 0x00400028
hi 0x00000000
lo 0x00000000
4:39 PM

Lệnh la được tách thành 2 lệnh lui và ori để load địa chỉ của biến x vì địa chỉ biến x là 32 bits.

Giá trị

X	0x00000005
Y	0xffffffff
Z	0x00000000 (không khởi tạo giá trị)

Bảng label



Lệnh lw: load giá trị kiểu word từ thanh ghi $t8, $t9 vào thanh ghi $t1, $t2

Lệnh sw: store giá trị kiểu word từ thanh ghi $s0 vào thanh ghi $t7

Lệnh lb: load giá trị kiểu byte vào một thanh ghi

Lệnh sb: store giá trị low-order 8 bits vào một thanh ghi