ĐẠI HỌC BÁCH KHOA HÀ NỘI

TRƯỜNG CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

****

BÁO CÁO

Bài tập thực hành tuần 5

Học phần: Thực hành kiến trúc máy tính

Giảng viên hướng dẫn: Lê Bá Vui

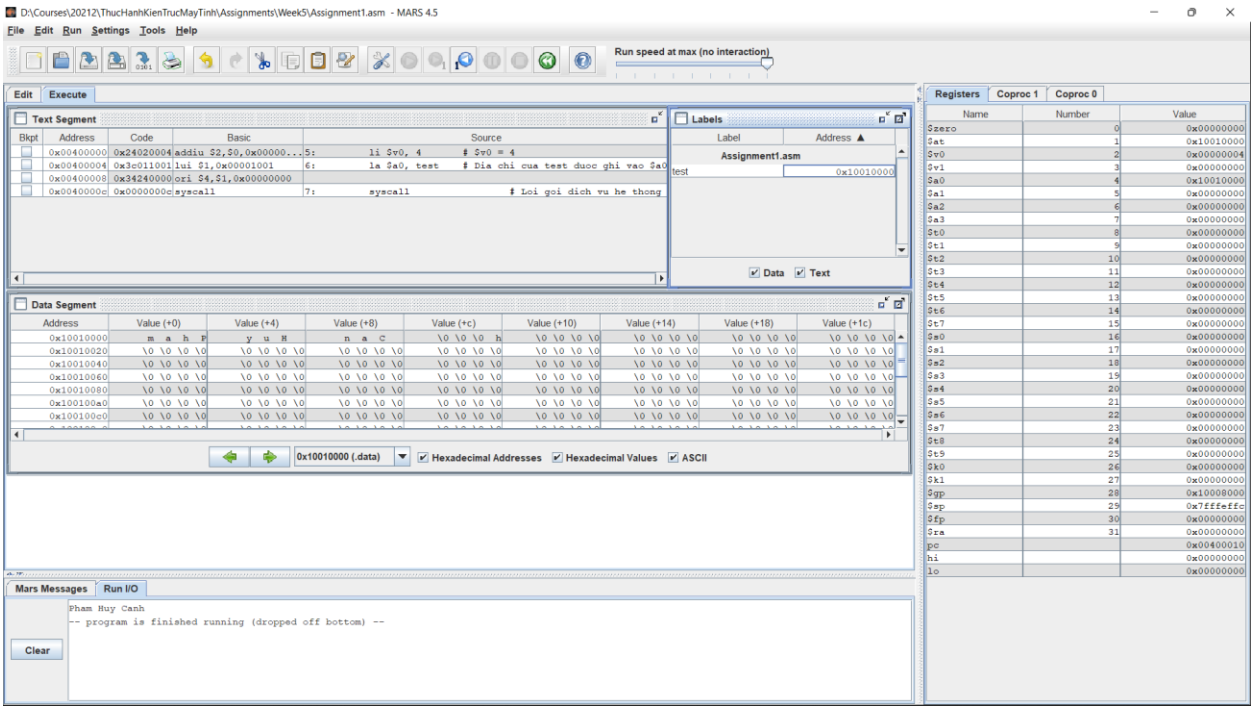
Sinh viên thực hiện: Phạm Huy Cảnh - 20194490

Mã lớp: 130938

Hà Nội, tháng 4 năm 2022

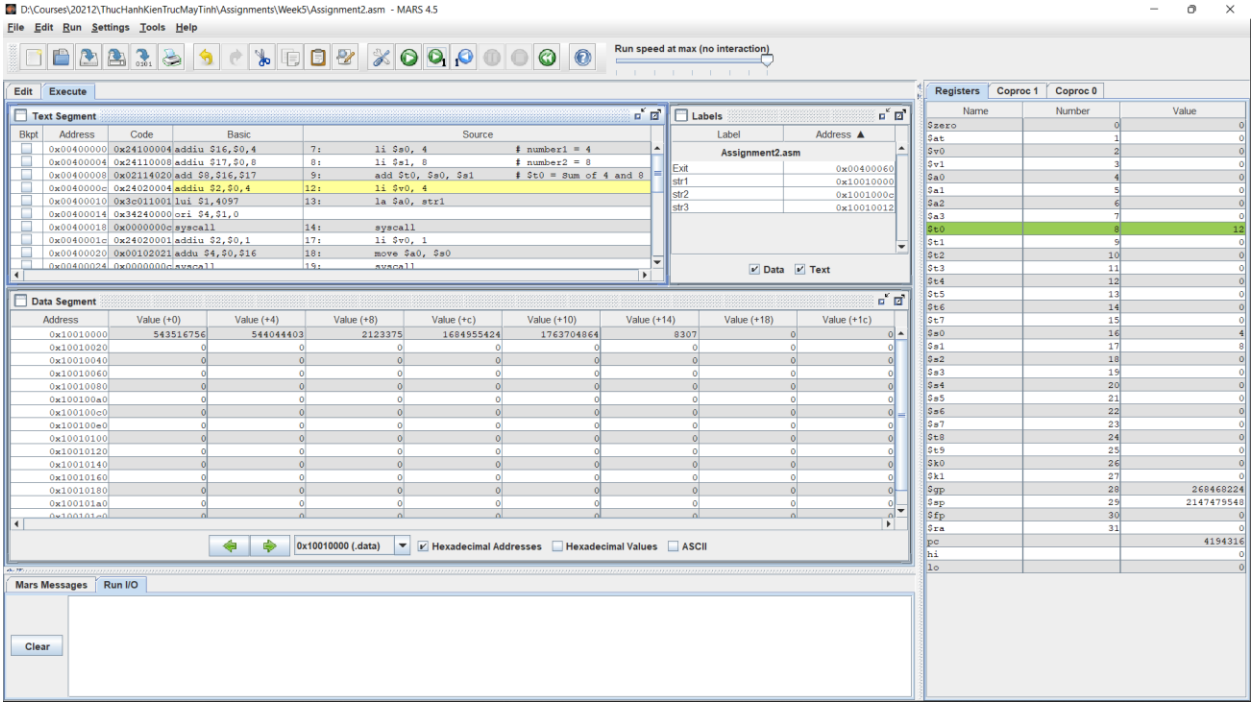
1. Assignment 1:

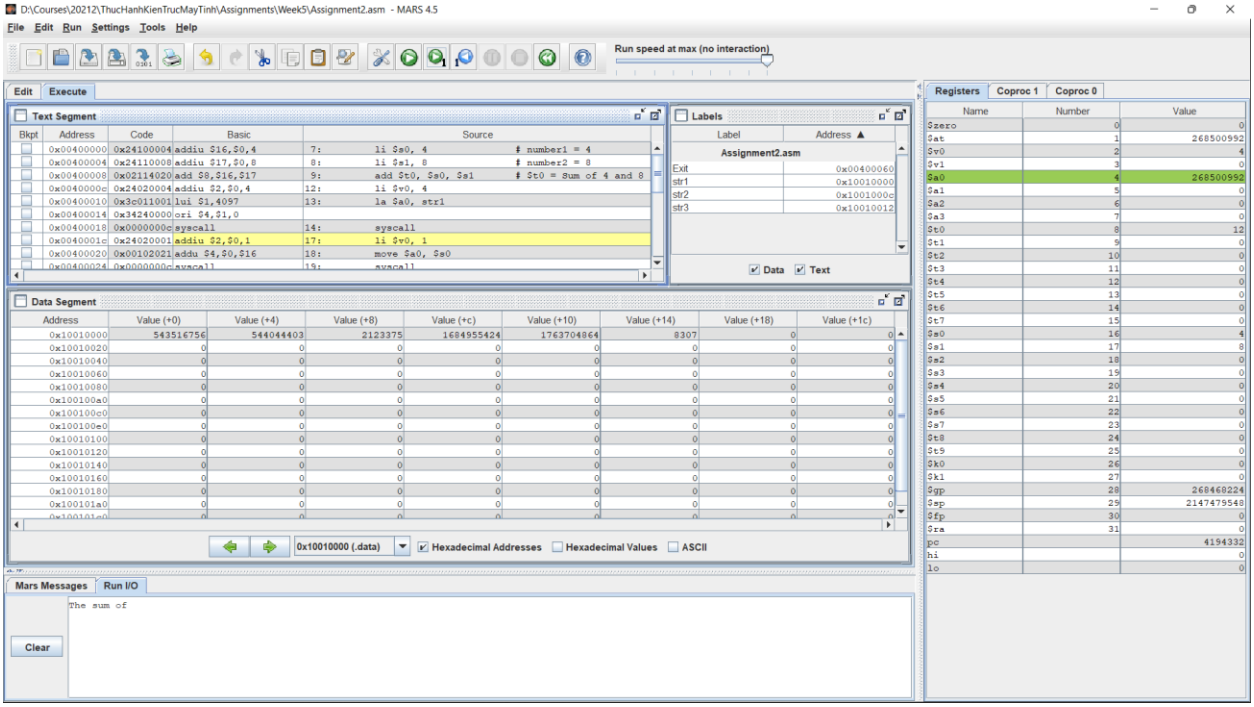
```
#Laboratory Exercise 5, Assignment 1
.data
        test: .asciiz "Pham Huy Canh"
.text
        li $v0, 4       # $v0 = 4
        la $a0, test    # Dia chi cua test duoc ghi vao $a0
        syscall         # Loi goi dich vu he thong
```

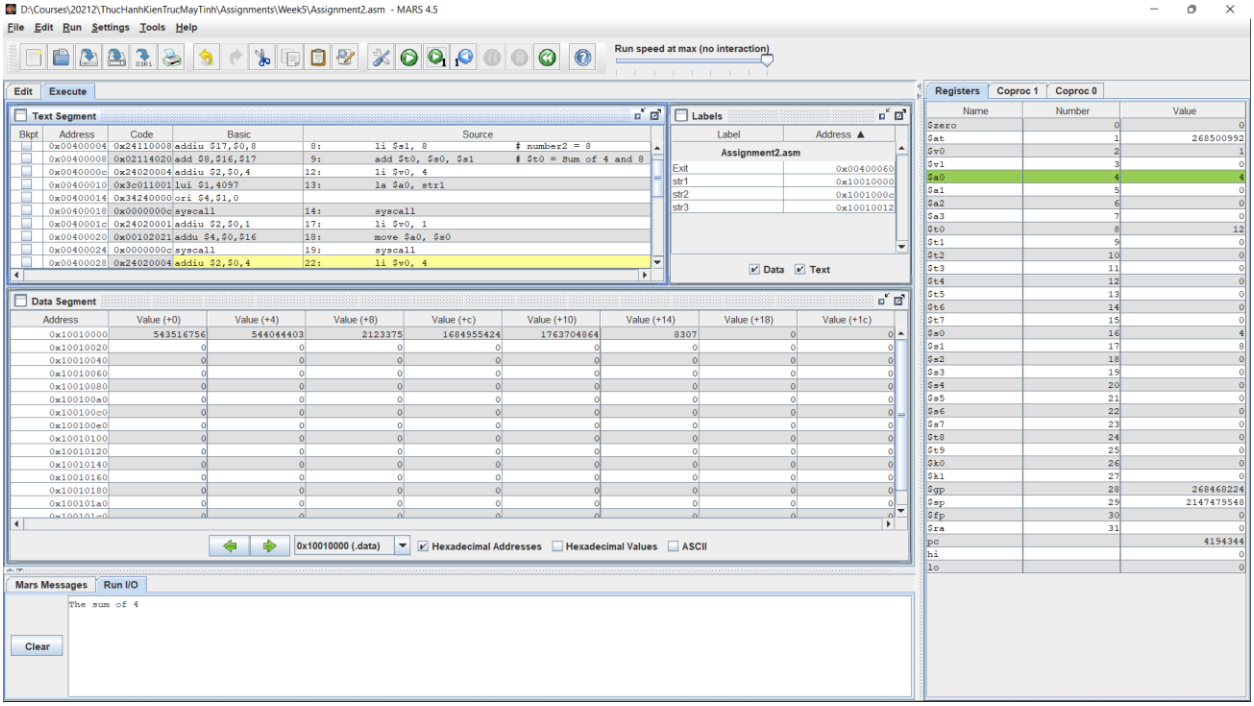


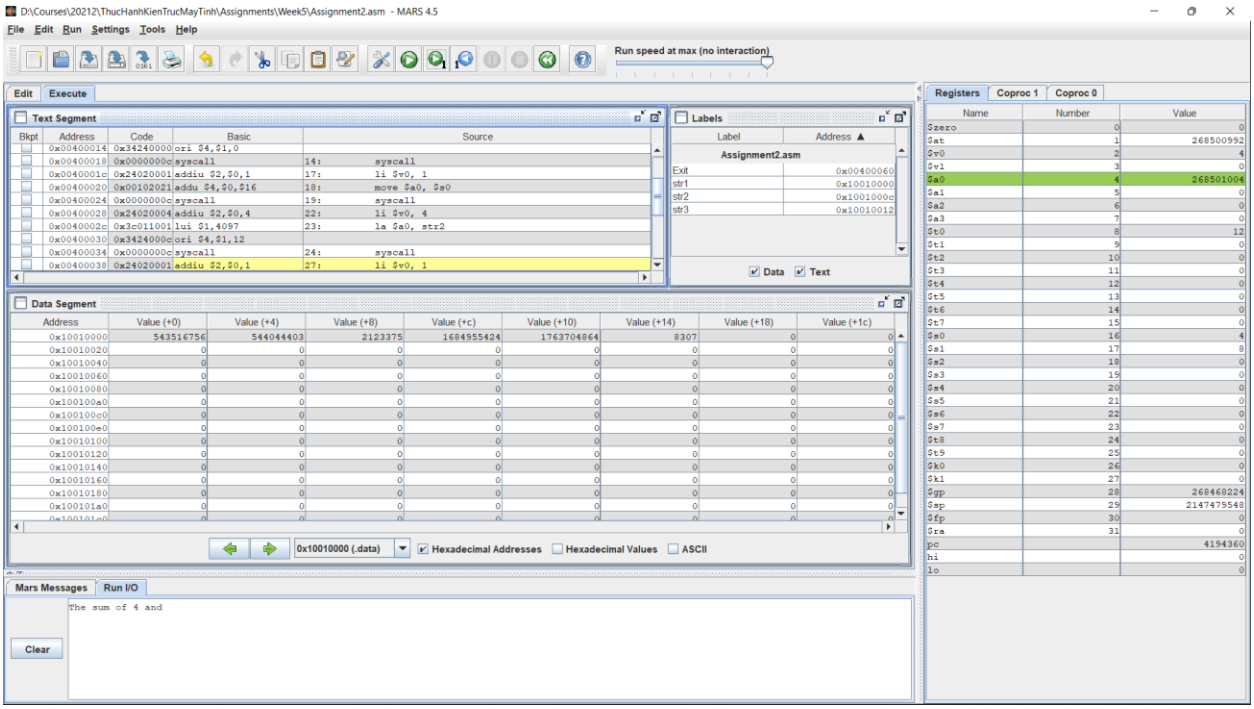
2. Assignment 2:

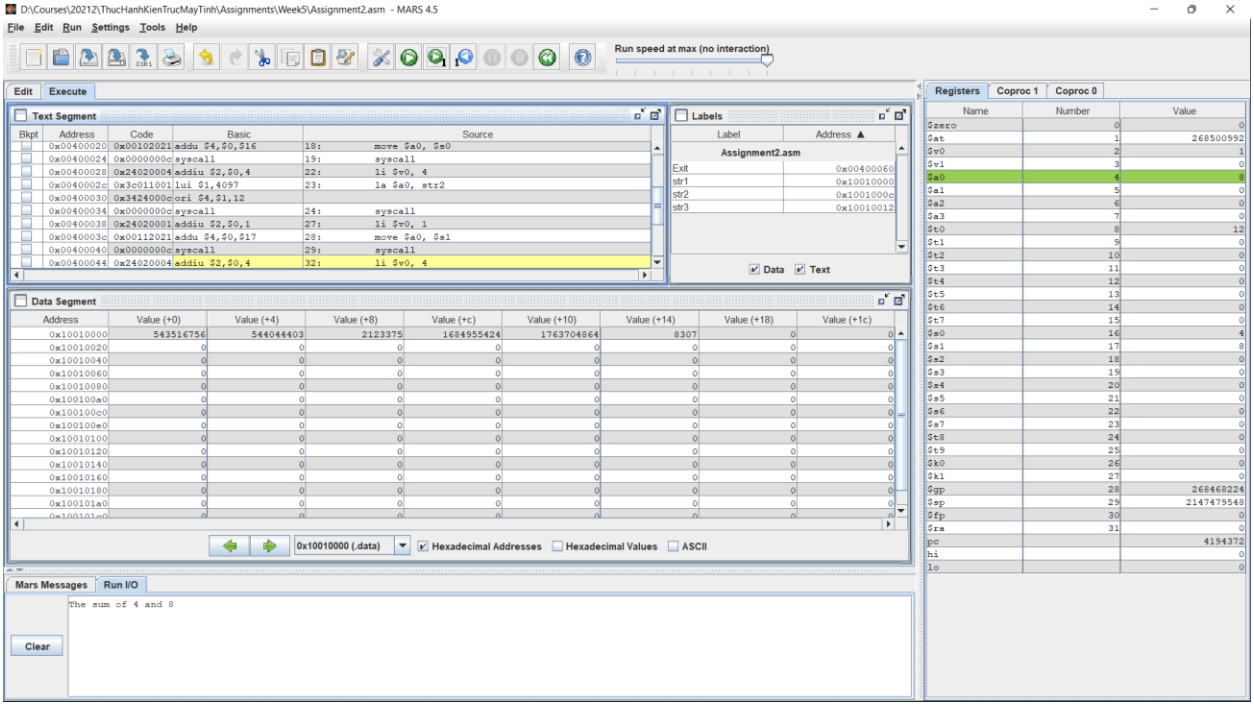
```
.data
      str1: .asciiz "The sum of "
      str2: .asciiz " and "
      str3: .asciiz " is "
.text
      li $s0, 4          # number1 = 4
      li $s1, 8          # number2 = 8
      add $t0, $s0, $s1      # $t0 = Sum of 4 and 8
      li $v0, 4          # Print string "str1"
      la $a0, str1
      syscall
      li $v0, 1          # Print $s0
      move $a0, $s0
      syscall
      li $v0, 4          # Print string "str2"
      la $a0, str2
      syscall
      li $v0, 1          # Print $s1
      move $a0, $s1
      syscall
      li $v0, 4          # Print string "str3"
      la $a0, str3
      syscall
      li $v0, 1          # Print $t0
      move $a0, $t0
      syscall
Exit: li $v0, 10
      syscall
```

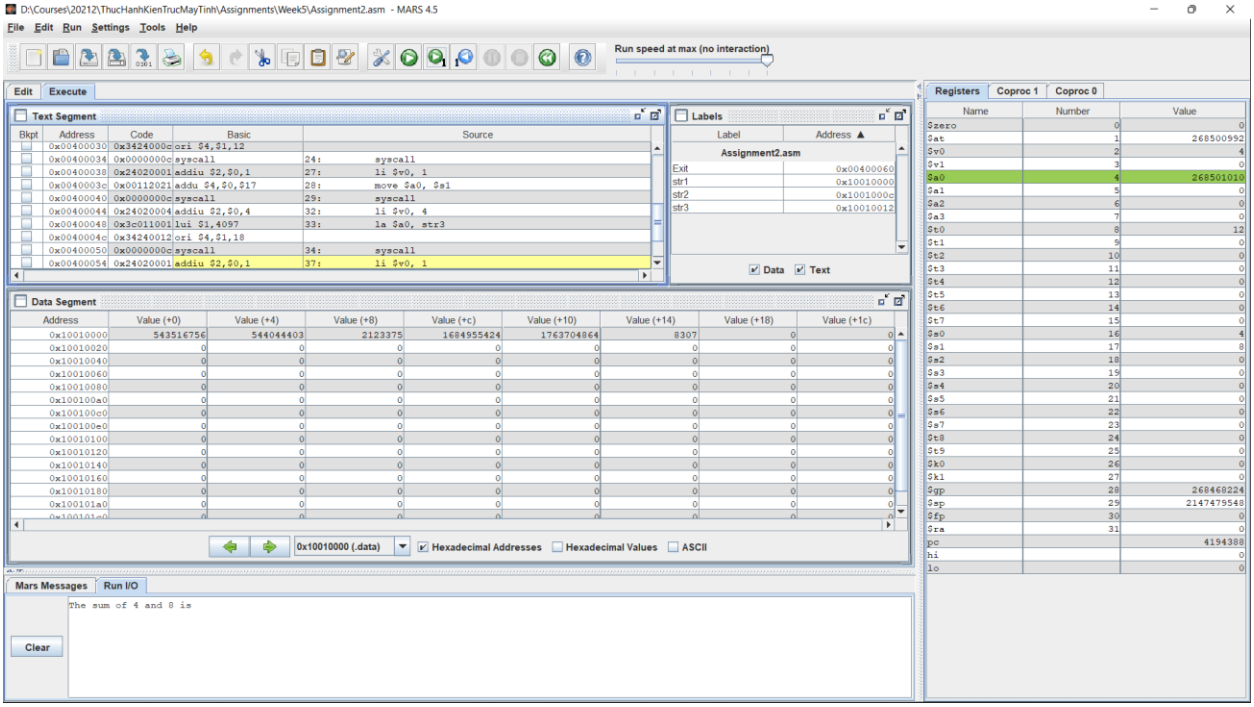

D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400000 0x24100004 addiu $16,$0,4 7: li $s0, 4 # number1 = 4
0x00400004 0x24110008 addiu $17,$0,8 8: li $s1, 8 # number2 = 8
0x00400008 0x02114020 add $8,$16,$17 9: add $t0, $s0, $s1 # $t0 = Sum of 4 and 8
0x0040000c 0x24020004 addiu $2,$0,4 12: li $v0, 4
0x00400010 0x3c011001 lui $1,4097 13: la $a0, str1
0x00400014 0x34240000 ori $4,$1,0
0x00400018 0x0000000c syscall 14: syscall
0x0040001c 0x24020001 addiu $2,$0,1 17: li $v0, 1
0x00400020 0x00102021 addu $4,$0,$16 18: move $a0, $s0
0x00400024 0x0000000c syscall 19: syscall
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x10010020 0 0 0 0 0 0 0 0
0x10010040 0 0 0 0 0 0 0 0
0x10010060 0 0 0 0 0 0 0 0
0x10010080 0 0 0 0 0 0 0 0
0x100100a0 0 0 0 0 0 0 0 0
0x100100c0 0 0 0 0 0 0 0 0
0x100100e0 0 0 0 0 0 0 0 0
0x10010100 0 0 0 0 0 0 0 0
0x10010120 0 0 0 0 0 0 0 0
0x10010140 0 0 0 0 0 0 0 0
0x10010160 0 0 0 0 0 0 0 0
0x10010180 0 0 0 0 0 0 0 0
0x100101a0 0 0 0 0 0 0 0 0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 0
$v0 2 0
$v1 3 0
$a0 4 0
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194316
hi 0
lo 0

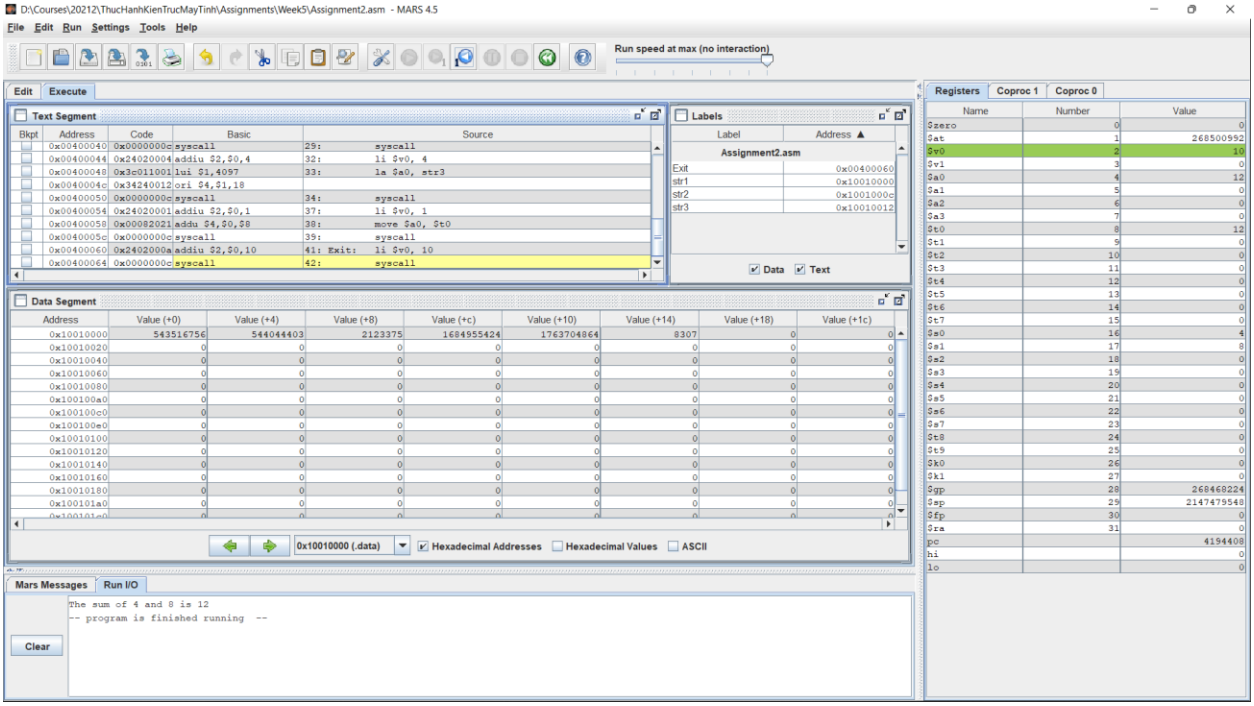

D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400000 0x24100004 addiu $16,$0,4 7: li $s0, 4 # number1 = 4
0x00400004 0x24110008 addiu $17,$0,8 8: li $s1, 8 # number2 = 8
0x00400008 0x02114020 add $8,$16,$17 9: add $t0, $s0, $s1 # $t0 = Sum of 4 and 8
0x0040000c 0x24020004 addiu $2,$0,4 12: li $v0, 4
0x00400010 0x3c011001 lui $1,4097 13: la $a0, str1
0x00400014 0x34240000 ori $4,$1,0
0x00400018 0x0000000c syscall 14: syscall
0x0040001c 0x24020001 addiu $2,$0,1 17: li $v0, 1
0x00400020 0x00102021 addu $4,$0,$16 18: move $a0, $s0
0x00400024 0x0000000c syscall 19: syscall
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x10010020 0 0 0 0 0 0 0 0
0x10010040 0 0 0 0 0 0 0 0
0x10010060 0 0 0 0 0 0 0 0
0x10010080 0 0 0 0 0 0 0 0
0x100100a0 0 0 0 0 0 0 0 0
0x100100c0 0 0 0 0 0 0 0 0
0x100100e0 0 0 0 0 0 0 0 0
0x10010100 0 0 0 0 0 0 0 0
0x10010120 0 0 0 0 0 0 0 0
0x10010140 0 0 0 0 0 0 0 0
0x10010160 0 0 0 0 0 0 0 0
0x10010180 0 0 0 0 0 0 0 0
0x100101a0 0 0 0 0 0 0 0 0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
The sum of
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500992
$v0 2 4
$v1 3 0
$a0 4 268500992
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194332
hi 0
lo 0

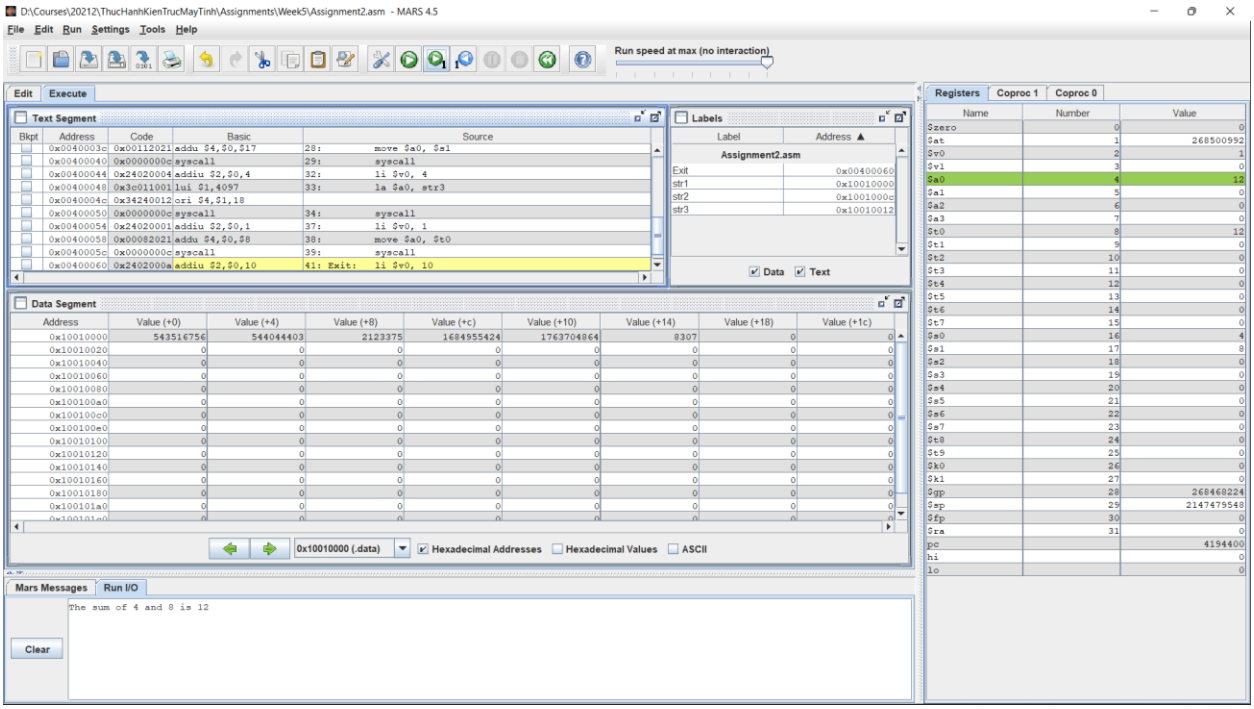

D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400004 0x24110008 addiu $17,$0,8 8: li $s1, 8 # number2 = 8
0x00400008 0x02114020 add $8,$16,$17 9: add $t0, $s0, $s1 # $t0 = sum of 4 and 8
0x0040000c 0x24020004 addiu $2,$0,4 12: li $v0, 4
0x00400010 0x3c011001 lui $1,4097 13: la $a0, str1
0x00400014 0x34240000 ori $4,$1,0
0x00400018 0x0000000c syscall 14: syscall
0x0040001c 0x24020001 addiu $2,$0,1 17: li $v0, 1
0x00400020 0x00102021 addu $4,$0,$16 18: move $a0, $s0
0x00400024 0x0000000c syscall 19: syscall
0x00400028 0x24020004 addiu $2,$0,4 22: li $v0, 4
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
The sum of 4
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500592
$v0 2 1
$v1 3 0
$a0 4 4
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194344
hi 0
lo 0


D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.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
0x00400014 0x34240000 ori $4,$1,0
0x00400018 0x0000000c syscall 14: syscall
0x0040001c 0x24020001 addiu $2,$0,1 17: li $v0, 1
0x00400020 0x00102021 addu $4,$0,$16 18: move $a0, $s0
0x00400024 0x0000000c syscall 19: syscall
0x00400028 0x24020004 addiu $2,$0,4 22: li $v0, 4
0x0040002c 0x3c011001 lui $1,4097 23: la $a0, str2
0x00400030 0x3424000c ori $4,$1,12
0x00400034 0x0000000c syscall 24: syscall
0x00400038 0x24020001 addiu $2,$0,1 27: li $v0, 1
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
The sum of 4 and
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500592
$v0 2 4
$v1 3 0
$a0 4 268501004
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194360
hi 0
lo 0


D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.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
0x00400020 0x00102021 addu $4,$0,$16 18: move $a0, $s0
0x00400024 0x0000000c syscall 19: syscall
0x00400028 0x24020004 addiu $2,$0,4 22: li $v0, 4
0x0040002c 0x3c011001 lui $1,4097 23: la $a0, str2
0x00400030 0x3424000c ori $4,$1,12
0x00400034 0x0000000c syscall 24: syscall
0x00400038 0x24020001 addiu $2,$0,1 27: li $v0, 1
0x0040003c 0x00112021 addu $4,$0,$17 28: move $a0, $s1
0x00400040 0x0000000c syscall 29: syscall
0x00400044 0x24020004 addiu $2,$0,4 32: li $v0, 4
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x10010020 0 0 0 0 0 0 0 0
0x10010040 0 0 0 0 0 0 0 0
0x10010060 0 0 0 0 0 0 0 0
0x10010080 0 0 0 0 0 0 0 0
0x100100a0 0 0 0 0 0 0 0 0
0x100100c0 0 0 0 0 0 0 0 0
0x100100e0 0 0 0 0 0 0 0 0
0x10010100 0 0 0 0 0 0 0 0
0x10010120 0 0 0 0 0 0 0 0
0x10010140 0 0 0 0 0 0 0 0
0x10010160 0 0 0 0 0 0 0 0
0x10010180 0 0 0 0 0 0 0 0
0x100101a0 0 0 0 0 0 0 0 0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500592
$v0 2 1
$v1 3 0
$a0 4 0
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194372
hi 0
lo 0
Mars Messages Run I/O
The sum of 4 and 8
Clear

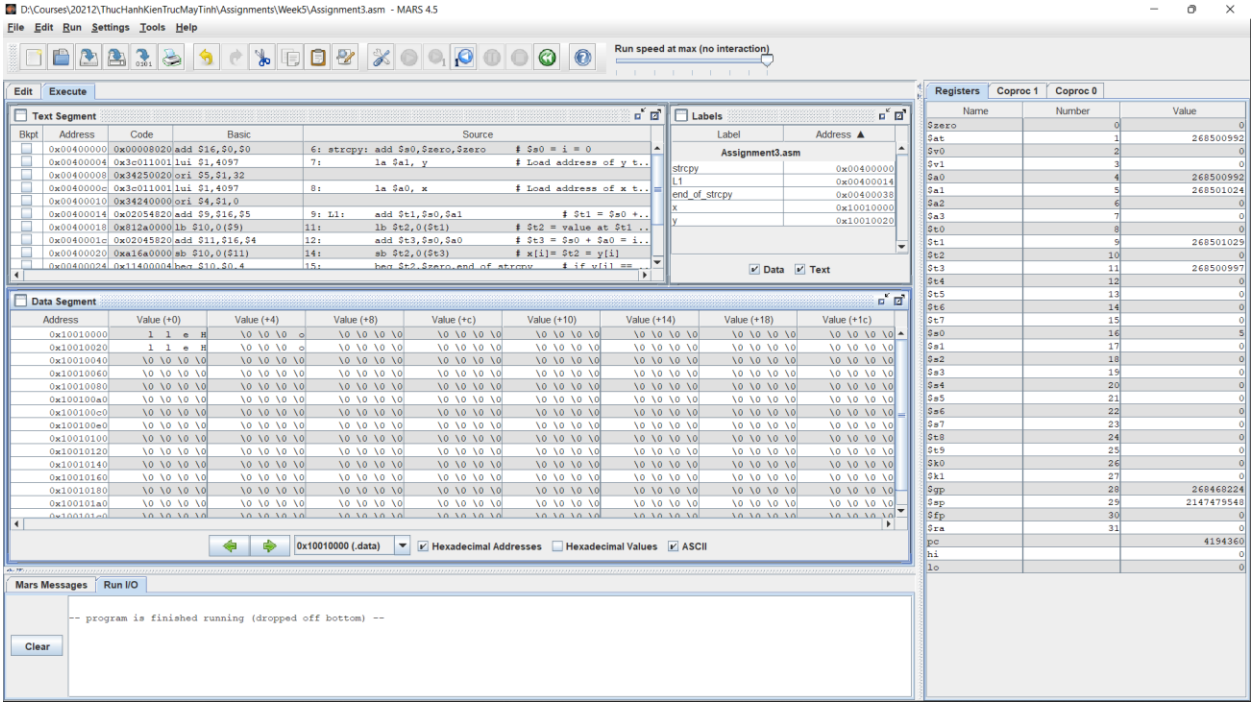

D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.asm - MARS 4.5
File Edit Run Settings Tools Help
Run speed at max (no interaction)
Edit Execute
Text Segment
Bkpt Address Code Basic Source
0x00400030 0x3424000c ori $4,$1,12
0x00400034 0x0000000c syscall 24: syscall
0x00400038 0x24020001 addiu $2,$0,1 27: li $v0, 1
0x0040003c 0x00112021 addu $4,$0,$17 28: move $a0, $s1
0x00400040 0x0000000c syscall 29: syscall
0x00400044 0x24020004 addiu $2,$0,4 32: li $v0, 4
0x00400048 0x3c011001 lui $1,4097 33: la $a0, str3
0x0040004c 0x34240012 ori $4,$1,18
0x00400050 0x0000000c syscall 34: syscall
0x00400054 0x24020001 addiu $2,$0,1 37: li $v0, 1
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x10010020 0 0 0 0 0 0 0 0
0x10010040 0 0 0 0 0 0 0 0
0x10010060 0 0 0 0 0 0 0 0
0x10010080 0 0 0 0 0 0 0 0
0x100100a0 0 0 0 0 0 0 0 0
0x100100c0 0 0 0 0 0 0 0 0
0x100100e0 0 0 0 0 0 0 0 0
0x10010100 0 0 0 0 0 0 0 0
0x10010120 0 0 0 0 0 0 0 0
0x10010140 0 0 0 0 0 0 0 0
0x10010160 0 0 0 0 0 0 0 0
0x10010180 0 0 0 0 0 0 0 0
0x100101a0 0 0 0 0 0 0 0 0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500592
$v0 2 4
$v1 3 0
$a0 4 268501010
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194388
hi 0
lo 0
Mars Messages Run I/O
The sum of 4 and 8 is
Clear


D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.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
0x00400040 0x0000000c syscall 29: syscall
0x00400044 0x24020004 addiu $2,$0,4 32: li $v0, 4
0x00400048 0x3c011001 lui $1,4097 33: la $a0, str3
0x0040004c 0x34240012 ori $4,$1,18
0x00400050 0x0000000c syscall 34: syscall
0x00400054 0x24020001 addiu $2,$0,1 37: li $v0, 1
0x00400058 0x00082021 addu $4,$0,$8 38: move $a0, $t0
0x0040005c 0x0000000c syscall 39: syscall
0x00400060 0x2402000a addiu $2,$0,10 41: Exit: li $v0, 10
0x00400064 0x0000000c syscall 42: syscall
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x10010020 0 0 0 0 0 0 0 0
0x10010040 0 0 0 0 0 0 0 0
0x10010060 0 0 0 0 0 0 0 0
0x10010080 0 0 0 0 0 0 0 0
0x100100a0 0 0 0 0 0 0 0 0
0x100100c0 0 0 0 0 0 0 0 0
0x100100e0 0 0 0 0 0 0 0 0
0x10010100 0 0 0 0 0 0 0 0
0x10010120 0 0 0 0 0 0 0 0
0x10010140 0 0 0 0 0 0 0 0
0x10010160 0 0 0 0 0 0 0 0
0x10010180 0 0 0 0 0 0 0 0
0x100101a0 0 0 0 0 0 0 0 0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
The sum of 4 and 8 is 12
-- program is finished running --
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500592
$v0 2 10
$v1 3 0
$a0 4 12
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194408
hi 0
lo 0


D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment2.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
0x0040003c 0x00112021 addu $4,$0,$17 28: move $a0, $s1
0x00400040 0x0000000c syscall 29: syscall
0x00400044 0x24020004 addiu $2,$0,4 32: li $v0, 4
0x00400048 0x3c011001 lui $1,4097 33: la $a0, str3
0x0040004c 0x34240012 ori $4,$1,18
0x00400050 0x0000000c syscall 34: syscall
0x00400054 0x24020001 addiu $2,$0,1 37: li $v0, 1
0x00400058 0x00082021 addu $4,$0,$8 38: move $a0, $t0
0x0040005c 0x0000000c syscall 39: syscall
0x00400060 0x2402000a addiu $2,$0,10 41: Exit: li $v0, 10
Labels
Label Address
Assignment2.asm
Exit 0x00400060
str1 0x10010000
str2 0x1001000c
str3 0x10010012
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 543516756 544044403 2123375 1684955424 1763704864 8307 0 0
0x10010020 0 0 0 0 0 0 0 0
0x10010040 0 0 0 0 0 0 0 0
0x10010060 0 0 0 0 0 0 0 0
0x10010080 0 0 0 0 0 0 0 0
0x100100a0 0 0 0 0 0 0 0 0
0x100100c0 0 0 0 0 0 0 0 0
0x100100e0 0 0 0 0 0 0 0 0
0x10010100 0 0 0 0 0 0 0 0
0x10010120 0 0 0 0 0 0 0 0
0x10010140 0 0 0 0 0 0 0 0
0x10010160 0 0 0 0 0 0 0 0
0x10010180 0 0 0 0 0 0 0 0
0x100101a0 0 0 0 0 0 0 0 0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
The sum of 4 and 8 is 12
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500592
$v0 2 1
$v1 3 0
$a0 4 12
$a1 5 0
$a2 6 0
$a3 7 0
$t0 8 12
$t1 9 0
$t2 10 0
$t3 11 0
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 4
$s1 17 8
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194400
hi 0
lo 0

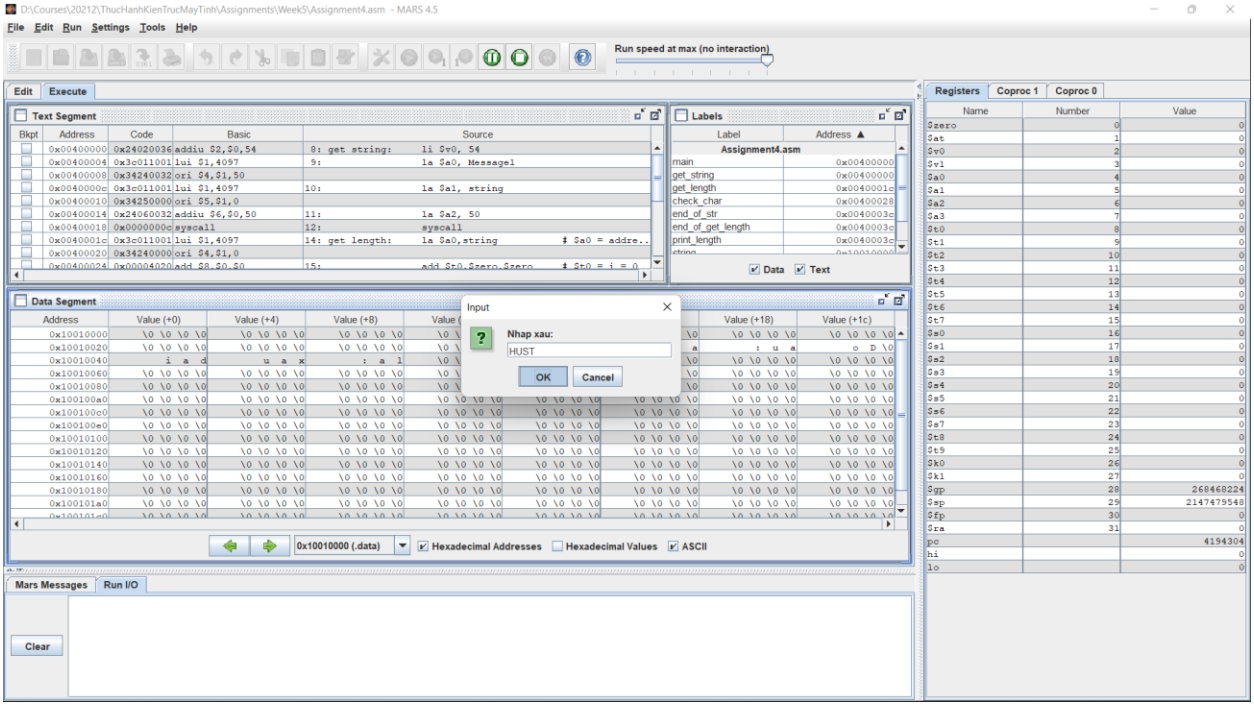
3. Assignment 3:

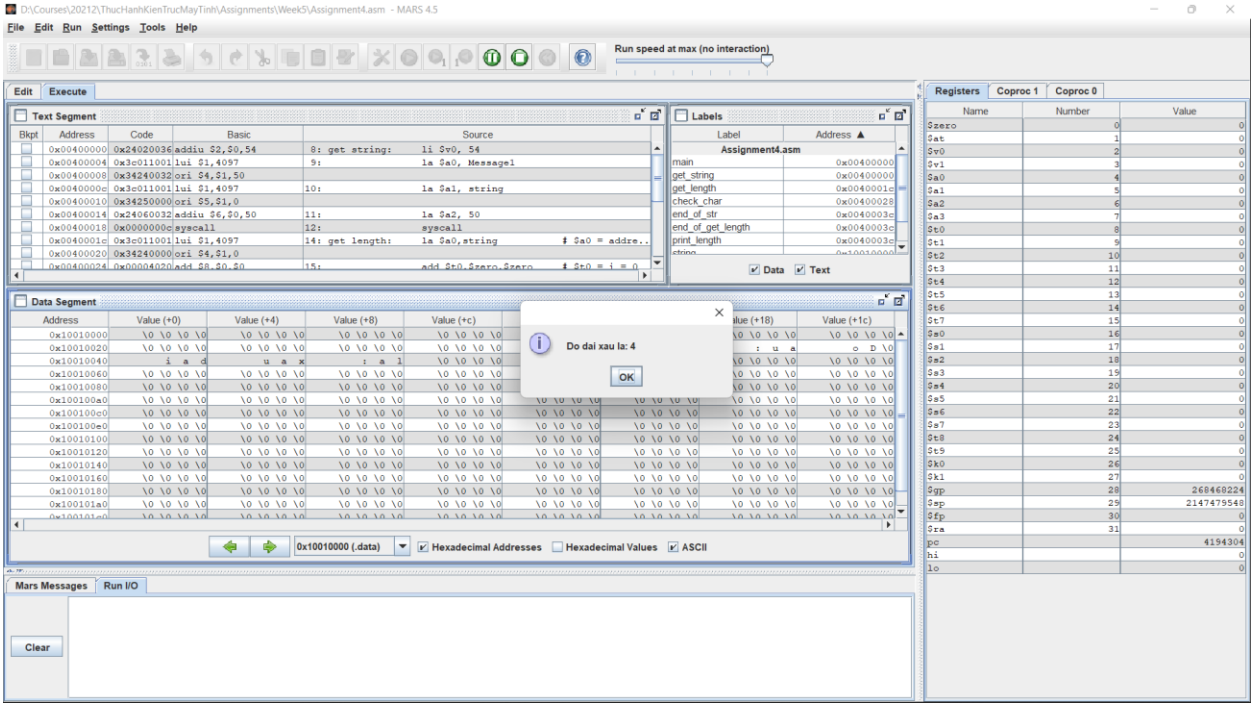
```
#Laboratory Exercise 5, Assignment 3
.data
     x: .space 32          # destination string x, empty
     y: .asciiz "Hello"    # source string y
.text
strcpy:    add $s0, $zero, $zero      # $s0 = i = 0
           la $a1, y         # Load address of y to $a1
           la $a0, x         # Load address of x to $a0
L1:   add $t1,$s0,$a1        # $t1 = $s0 + $a1 = i + y[0]
                                 # = address of y[i]
      lb $t2,0($t1)          # $t2 = value at $t1 = y[i]
      add $t3,$s0,$a0        # $t3 = $s0 + $a0 = i + x[0]
                                 # = address of x[i]
      sb $t2,0($t3)          # x[i]= $t2 = y[i]
      beq $t2,$zero,end_of_strcpy   # if y[i] == 0, exit
      nop
      addi $s0,$s0,1         # $s0 = $s0 + 1 <-> i = i + 1
      j L1              # next character
      nop
end_of_strcpy:
```


D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment3.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 0x00008020 add $16,$0,$0 6: strcpy: add $s0,$zero,$zero # $s0 = i = 0
0x00400004 0x3c011001 lui $1,4097 7: la $a1, y # Load address of y t..
0x00400008 0x34250020 ori $5,$1,32
0x0040000c 0x3c011001 lui $1,4097 8: la $a0, x # Load address of x t..
0x00400010 0x34240000 ori $4,$1,0
0x00400014 0x02054820 add $9,$16,$5 9: L1: add $t1,$s0,$a1 # $t1 = $s0 +..
0x00400018 0x812a0000 lb $10,0($9) 11: lb $t2,0($t1) # $t2 = value at $t1 ..
0x0040001c 0x02045820 add $11,$16,$4 12: add $t3,$s0,$a0 # $t3 = $s0 + $a0 = i..
0x00400020 0xa16a0000 sb $10,0($11) 14: sb $t2,0($t3) # x[i]= $t2 = y[i]
0x00400024 0x11400004 beq $10,$0,4 15: beq $t2,$zero,end_of_strcpy # if y[i] ==
Labels
Label Address
Assignment3.asm
strcpy 0x00400000
L1 0x00400014
end_of_strcpy 0x00400038
x 0x10010000
y 0x10010020
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 l l e H
0x10010020 l l e H
0x10010040
0x10010060
0x10010080
0x100100a0
0x100100c0
0x100100e0
0x10010100
0x10010120
0x10010140
0x10010160
0x10010180
0x100101a0
0x100101c0
0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII
Mars Messages Run I/O
-- program is finished running (dropped off bottom) --
Clear
Registers Coproc 1 Coproc 0
Name Number Value
$zero 0 0
$at 1 268500992
$v0 2 0
$v1 3 0
$a0 4 268500992
$a1 5 268501024
$a2 6 0
$a3 7 0
$t0 8 0
$t1 9 268501025
$t2 10 0
$t3 11 268500997
$t4 12 0
$t5 13 0
$t6 14 0
$t7 15 0
$s0 16 5
$s1 17 0
$s2 18 0
$s3 19 0
$s4 20 0
$s5 21 0
$s6 22 0
$s7 23 0
$t8 24 0
$t9 25 0
$k0 26 0
$k1 27 0
$gp 28 268468224
$sp 29 2147479548
$fp 30 0
$ra 31 0
pc 4194360
hi 0
lo 0

4. Assignment 4:

```
#Laboratory Exercise 5, Assignment 4
.data
      string: .space 50
      Message1: .asciiz "Nhap xau: "
      Message2: .asciiz "Do dai xau la: "
.text
main:
get_string:  li $v0, 54    # Get a string from dialog
  la $a0, Message1         # Load address of the Message1 to $a0
  la $a1, string  # Load address of input buffer "string" to $a1
  la $a2, 50       # Maximum number of characters to read = 50
                syscall
get_length:     la $a0,string          # $a0 = address(string[0])
                add $t0,$zero,$zero    # $t0 = i = 0
check_char:     add $t1,$a0,$t0        # $t1 = $a0 + $t0
                                       #     = address(string[i])
           lb $t2, 0($t1)              # $t2 = string[i]
           beq $t2, $zero, end_of_str # is null char?
           addi $t0, $t0, 1           # $t0 = $t0 + 1 -> i = i + 1
           j check_char
end_of_str:
end_of_get_length:
print_length:    addi $t0, $t0, -1 # Do dai xau = $t0-(null_char)
           li $v0, 56        # Show the length to message dialog
           la $a0, Message2  # Load address of the Message1 to $a0
           move $a1, $t0     # Set $a1 to contents of $t0
           syscall
```

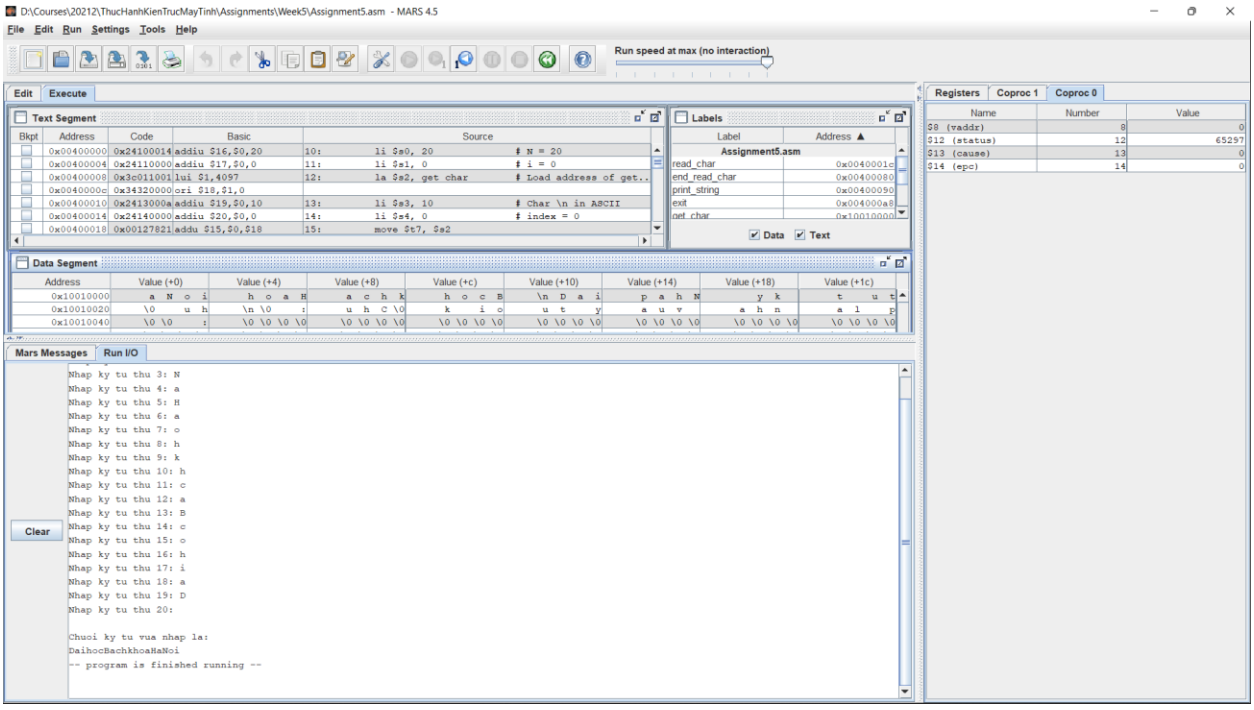

Input
Nhap xau:
HUST
OK
Cancel


Do dai xau la: 4
OK

5. Assignment 5:

```
#Laboratory Exercise 5, Assignment 5
.data
	get_char: .space 20
	message1: .asciiz "Nhap ky tu thu "
	message2: .asciiz ": "
	message3: .asciiz "\n"
	message4: .asciiz "Chuoi ky tu vua nhap la: "

.text
	li $s0, 20		# N = 20
	li $s1, 0		# i = 0
	la $s2, get_char	# Load address of get_char[0]
	li $s3, 10		# Char \n in ASCII
read_char:
	beq $s1, $s0, end_read_char # i = N branch to exit
	# Show message "Nhap ky tu thu i: "
	li $v0, 4
	la $a0, message1
	syscall

	addi $t1, $s1, 1
	li $v0, 1
	move $a0, $t1
	syscall

	li $v0, 4
	la $a0, message2
	syscall
```

```
	li $v0, 12	# Read character
	syscall
	move $t0, $v0
	beq $t0, $s3, end_read_char # Press "Enter" branch to exit

	li $v0, 4
	la $a0, message3
	syscall
	add $s5, $s2, $s1	# $s5=Address of get_char[i]=get_char[0]+i
	sb $t0, 0($s5)		# Store character to get_char[i]
	addi $s1, $s1, 1	# i++
	j read_char
end_read_char:
	li $v0, 4		# Show message4
	la $a0, message4
	syscall
print_string:
	li $v0, 11		# Show ky tu tai dia chi trong $s5
	lb $a0, 0($s5)
	syscall

	beq $s5, $s2, exit	# $s5 = address cua ky tu cuoi cung
	addi $s5, $s5, -1	# Tien dan den ky tu dau tien
	j print_string
exit:
	li $v0, 10
	syscall
```


D:\Courses\20212\ThucHanhKienTrucMayTinh\Assignments\Week5\Assignment5.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 0x24100014 addiu $16,$0,20 10: li $s0, 20 # N = 20
0x00400004 0x24110000 addiu $17,$0,0 11: li $s1, 0 # i = 0
0x00400008 0x3c011001 lui $1,4097 12: la $s2, get_char # Load address of get..
0x0040000c 0x34320000 ori $18,$1,0
0x00400010 0x2413000a addiu $19,$0,10 13: li $s3, 10 # Char \n in ASCII
0x00400014 0x24140000 addiu $20,$0,0 14: li $s4, 0 # index = 0
0x00400018 0x00127821 addu $15,$0,$18 15: move $t7, $s2
Labels
Label Address
Assignment5.asm
read_char 0x0040001c
end_read_char 0x00400080
print_string 0x00400090
exit 0x004000a8
Data Text
Data Segment
Address Value (+0) Value (+4) Value (+8) Value (+c) Value (+10) Value (+14) Value (+18) Value (+1c)
0x10010000 a N o i h o a H a c h k h o c B \n D a i p a h N y k t u t
0x10010020 \0 u h \n \0 : u h C \0 k i o u t y a u v a h n a l p
0x10010040 \0 \0 : \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0 \0
Mars Messages Run I/O
Clear
Nhap ky tu thu 3: N
Nhap ky tu thu 4: a
Nhap ky tu thu 5: H
Nhap ky tu thu 6: a
Nhap ky tu thu 7: o
Nhap ky tu thu 8: h
Nhap ky tu thu 9: k
Nhap ky tu thu 10: h
Nhap ky tu thu 11: c
Nhap ky tu thu 12: a
Nhap ky tu thu 13: B
Nhap ky tu thu 14: c
Nhap ky tu thu 15: o
Nhap ky tu thu 16: h
Nhap ky tu thu 17: i
Nhap ky tu thu 18: a
Nhap ky tu thu 19: D
Nhap ky tu thu 20:
Chuoi ky tu vua nhap la:
DaihocBachkhoaHaNoi
-- program is finished running --
Registers Coproc 1 Coproc 0
Name Number Value
$8 (vaddr) 8 0
$12 (status) 12 65297
$13 (cause) 13 0
$14 (epc) 14 0