

**ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH**  
**TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN**  
**KHOA CÔNG NGHỆ THÔNG TIN**



**HỆ THỐNG MÁY TÍNH**  
**Assignment 02: MIPS ARITHMETIC**

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**Hồ Chí Minh – 2023**

# I. ALL TEST CASES:

a. A = -15, B = 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	13: la \$a0, inputA
	0x00400004	0x34240000 ori	\$4,\$1,0x00000000	
	0x00400008	0x24020004 addiu	\$2,\$0,0x00000004	14: li \$v0, 4
	0x0040000c	0x0000000c syscall		15: syscall
	0x00400010	0x24020005 addiu	\$2,\$0,0x00000005	18: li \$v0, 5
	0x00400014	0x0000000c syscall		19: syscall
	0x00400018	0x00020021 addu	\$16,\$0,\$2	20: move \$s0, \$v0
	0x0040001c	0x3c011001 lui	\$1,0x00001001	23: la \$a0, inputB
	0x00400020	0x34240012 ori	\$4,\$1,0x00000012	
	0x00400024	0x24020004 addiu	\$2,\$0,0x00000004	24: li \$v0, 4
0x00400078	0x00000000	0x00000000	0x00000000	25: overall

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x75706e49	0x6e692074	0x65676574	0x3a412072	0x6e490020	0x20747570	0x65746e69	0x20726567
0x10010020	0x00203a42	0x202b2041	0x00203a42	0x2d20410a	0x203a4220	0x20410a00	0x3a42202a	0x410a0020
0x10010040	0x42202f20	0x0a00203a	0x20252041	0x00203a42	0x6e61430a	0x746f6e20	0x6c616320	0x616c7563
0x10010060	0x00006574	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

Registers Coproc 1 Coproc 0

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x00000000
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0xffffffff
\$t1	9	0x00000000
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$s0	16	0xffffffff
\$s1	17	0x00000005
\$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	0x10000000
\$sp	29	0x7ffffeffc
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x0040000c
hi		0x00000000
lo		0xffffffff

Mars Messages Run I/O

Input integer A: -15  
Input integer B: 5  
A + B: -10  
A - B: -20  
A \* B: -75  
A / B: -3  
A % B: 0  
-- program is finished running --

Clear

b. A = 128, B = -126

File Edit Run Settings Tools Help

Run speed at max (no interaction)

Edit Execute

Text Segment

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3c011001	lui \$1,0x0001001	13: la \$a0, inputA
	0x00400004	0x34240000	ori \$4,\$1,0x0000000	
	0x00400008	0x24020004	addiu \$2,\$0,0x00000004	14: li \$v0, 4
	0x0040000c	0x0000000c	syscall	15: syscall
	0x00400010	0x24020005	addiu \$2,\$0,0x00000005	18: li \$v0, 5
	0x00400014	0x0000000c	syscall	19: syscall
	0x00400018	0x00020021	addu \$16,\$0,\$2	20: move \$s0, \$v0
	0x0040001c	0x3c011001	lui \$1,0x0001001	23: la \$a0, inputB
	0x00400020	0x34240012	ori \$4,\$1,0x00000012	
	0x00400024	0x24020004	addiu \$2,\$0,0x00000004	24: li \$v0, 4
	0x00400070	0x0000000c	syscall	25: syscall

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x75706e49	0x6e692074	0x65676574	0x3a412072	0x6e490020	0x20747570	0x65746e69	0x20726567
0x10010020	0x00203a42	0x202b2041	0x00203a42	0x2d20410a	0x203a4220	0x20410a00	0x3a42202a	0x410a0020
0x10010040	0x42202f20	0x0a00203a	0x20252041	0x00203a42	0x6e61430a	0x746f6e20	0x6c616320	0x616c7563
0x10010060	0x00006574	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

0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII

Mars Messages Run I/O

```

Input integer A: 128
Input integer B: -126
A + B: 2
A - B: 254
A * B: -16128
A / B: -1
A % B: 2
-- program is finished running --

```

Clear

Registers Coproc 1 Coproc 0

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x00000002
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0xffffffff
\$t1	9	0x00000002
\$t2	10	0x00000000
\$t3	11	0x00000000
\$t4	12	0x00000000
\$t5	13	0x00000000
\$t6	14	0x00000000
\$t7	15	0x00000000
\$s0	16	0x00000000
\$s1	17	0xffffffff
\$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	0x10000000
\$sp	29	0x7ffffc
\$fp	30	0x00000000
\$ra	31	0x00000000
pc		0x004000ec
hi		0x00000002
lo		0xffffffff

c.  $A = 10, B = 0$

File Edit Run Settings Tools Help

Run speed at max (no interaction)

Edit Execute

Text Segment

Bkpt	Address	Code	Basic	Source
	0x00400000	0x3c011001	lui \$1,0x0001001	13: la \$a0, inputA
	0x00400004	0x34240000	ori \$4,\$1,0x00000000	
	0x00400008	0x24020004	addiu \$2,\$0,0x00000004	14: li \$v0, 4
	0x0040000c	0x0000000c	syscall	15: syscall
	0x00400010	0x24020005	addiu \$2,\$0,0x00000005	18: li \$v0, 5
	0x00400014	0x0000000c	syscall	19: syscall
	0x00400018	0x00020021	addu \$16,\$0,\$2	20: move \$s0, \$v0
	0x0040001c	0x3c011001	lui \$1,0x0001001	23: la \$a0, inputB
	0x00400020	0x34240012	ori \$4,\$1,0x00000012	
	0x00400024	0x24020004	addiu \$2,\$0,0x00000004	24: li \$v0, 4
	0x00400070	0x0000000c	syscall	25: syscall

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x75706e49	0x6e692074	0x65676574	0x3a412072	0x6e490020	0x20747570	0x65746e69	0x20726567
0x10010020	0x00203a42	0x202b2041	0x00203a42	0x2d20410a	0x203a4220	0x20410a00	0x3a42202a	0x410a0020
0x10010040	0x42202f20	0x0a00203a	0x20252041	0x00203a42	0x6e61430a	0x746f6e20	0x6c616320	0x616c7563
0x10010060	0x00006574	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

0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII

Mars Messages Run I/O

Input integer A: 10  
Input integer B: 0  
A + B: 10  
A - B: 10  
A \* B: 0  
Can not calculate  
— program is finished running (dropped off bottom) —

Clear

Registers Coproc 1 Coproc 0

Name	Number	Value
\$0 (\$vaddr)	8	0x00000000
\$12 (status)	12	0x0000ff11
\$13 (cause)	13	0x00000000
\$14 (epc)	14	0x00000000

d.  $A = 0, B = 0$

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	13: la \$a0, inputA
	0x00400004	0x34240000	ori \$4,\$1,0x00000000	
	0x00400008	0x24020004	addiu \$2,\$0,0x00000004	14: li \$v0, 4
	0x0040000c	0x0000000c	syscall	15: syscall
	0x00400010	0x24020005	addiu \$2,\$0,0x00000005	18: li \$v0, 5
	0x00400014	0x0000000c	syscall	19: syscall
	0x00400018	0x00028021	addiu \$16,\$0,\$2	20: move \$s0, \$v0
	0x0040001c	0x3c011001	lui \$1,0x00001001	23: la \$a0, inputB
	0x00400020	0x34240012	ori \$4,\$1,0x00000012	
	0x00400024	0x24020004	addiu \$2,\$0,0x00000004	24: li \$v0, 4
	0x00400028	0x0000000c	syscall	25: syscall

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x75706e49	0x6e692074	0x65676574	0x3a412072	0x6e490020	0x20747570	0x65746e69	0x20726567
0x10010020	0x00203a42	0x202b2041	0x00203a42	0x2d20410a	0x203a4220	0x20410a00	0x3a42202a	0x410a0020
0x10010040	0x42202f20	0x0000203a	0x20252041	0x00203a42	0x6e61430a	0x746f6e20	0x6c616320	0x616c7563
0x10010060	0x00006574	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

0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII

Mars Messages Run I/O

Input integer A: 0  
Input integer B: 0  
A + B: 0  
A - B: 0  
A \* B: 0  
Can not calculate  
--- program is finished running (dropped off bottom) ---

Clear

Registers Coproc 1 Coproc 0

Name	Number	Value
\$8 (vaddr)	8	0x00000000
\$12 (status)	12	0x0000ff11
\$13 (cause)	13	0x00000000
\$14 (epc)	14	0x00000000

e.  $A = -10, B = -15$

The screenshot displays the Mars MIPS simulator interface. The top menu bar includes File, Edit, Run, Settings, Tools, and Help. Below the menu is a toolbar with various icons for file operations and simulation control. The main window is divided into several panels:

- Text Segment:** Displays assembly code with columns for Bkpt, Address, Code, Basic, and Source. The code includes instructions like `lui $1, 0x0001001`, `ori $4, $1, 0x00000000`, `addiu $2, $0, 0x00000004`, `syscall`, `li $v0, 4`, `li $v0, 5`, `move $s0, $v0`, and `la $a0, inputB`.
- Data Segment:** Shows memory addresses and their corresponding values in hexadecimal. The values are mostly zero, indicating uninitialized memory.
- Registers:** A table on the right side showing the state of registers. The registers are numbered 0 to 31, and their values are displayed in hexadecimal. The registers are divided into three sections: Registers, Coproc 1, and Coproc 0.
- Mars Messages:** A text area at the bottom left showing the input and output of the program. The input is "Input integer A: -10" and "Input integer B: -15". The output shows the results of calculations: "A + B: -25", "A - B: 5", "A \* B: 150", "A / B: 0", and "A % B: -10". The message "program is finished running" is also displayed.

II. Percentage of work is done: 100 %