

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 03: MIPS - Procedure

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Hồ Chí Minh – 2023

I. ALL TEST CASES:

a. Array: 1 2 3 4 5

Text Segment

Bkpt	Address	Code	Basic	Source
	0x00400000	0x0c100015	jal	0x00400054
	0x00400004	0x0c10003f	jal	0x004000fc
	0x00400008	0x0c100067	jal	0x0040019c
	0x0040000c	0x24020004	addiu	\$2,\$0,0x00000004
	0x00400010	0x3c011001	lui	\$1,0x00001001
	0x00400014	0x34240030	ori	\$4,\$1,0x00000030
	0x00400018	0x0000000c	syscall	
	0x0040001c	0x3c011001	lui	\$1,0x00001001
	0x00400020	0x00000000	lw	\$a0,result

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x65746e45	0x61762072	0x3a65756c	0x72410020	0x3a796172	0x6e450020	0x20726574	0x20656874
0x10010020	0x657a6973	0x20666f20	0x61727261	0x00203a79	0x206d7553	0x6f20666f	0x6e206464	0x65626d75
0x10010040	0x69207372	0x7261206e	0x20796172	0x5400203d	0x73206568	0x20657a69	0x69207369	0x6c61766e
0x10010060	0x202e6469	0x20797254	0x69616761	0x000a2e6e	0x000a0020	0x74697845	0x74697720	0x6f632068
0x10010080	0x30206564	0x00000000	0x00000009	0x00000005	0x00000001	0x00000002	0x00000003	0x00000004
0x100100a0	0x00000005	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

Registers

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x10010074
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000014
\$t1	9	0x00000014
\$t2	10	0x00000009
\$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	0x10000000
\$sp	29	0x7ffffcfc
\$fp	30	0x00000000
\$ra	31	0x00400054
pc		0x00400054
hi		0x00000000
lo		0x00000000

Mars Messages

```

Enter the size of array: 5
Enter value: 1
Enter value: 2
Enter value: 3
Enter value: 4
Enter value: 5
Array: 1 2 3 4 5
Sum of odd numbers in array = 9
Exit with code 0
-- program is finished running --
  
```

b. Array: 5 9 10 13 15 49

File Edit Run Settings Tools Help

Run speed at max (no interaction)

Edit Execute

Text Segment

Bkpt	Address	Code	Basic	Source
0x00400000	0x0c100015	jal	0x00400054	18: jal input_array
0x00400004	0x0c10003f	jal	0x004000fc	19: jal output_array
0x00400008	0x0c100067	jal	0x0040019c	20: jal sum_odd
0x0040000c	0x24020004	addiu	\$2,\$0,0x00000004	22: li \$v0, 4
0x00400010	0x3c011001	lui	\$1,0x0001001	23: la \$a0, tbd_result
0x00400014	0x34240030	ori	\$4,\$1,0x00000030	
0x00400018	0x0000000c	syscall		24: syscall
0x0040001c	0x3c011001	lui	\$1,0x0001001	25: lw \$a0, result

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x65746e45	0x61762072	0x3a65756c	0x72410020	0x3a796172	0x6e450020	0x20726574	0x20656874
0x10010020	0x657a6973	0x20666f20	0x61727261	0x00203a79	0x206d7553	0x6f20666f	0x6e206464	0x65626d75
0x10010040	0x69207372	0x7261206e	0x20796172	0x5400203d	0x73206568	0x20657a69	0x69207369	0x6c61766e
0x10010060	0x202e6469	0x20797254	0x69616761	0x000a2e6e	0x000a0020	0x74697845	0x74697720	0x6f632068
0x10010080	0x30206564	0x00000000	0x0000005b	0x00000006	0x00000005	0x00000009	0x0000000a	0x0000000d
0x100100a0	0x0000000f	0x00000031	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

0x10010000 (.data) ✓ Hexadecimal Addresses ✓ Hexadecimal Values ASCII

Mars Messages Run I/O

Enter the size of array: 6
Enter value: 5
Enter value: 9
Enter value: 10
Enter value: 13
Enter value: 15
Enter value: 49
Array: 5 9 10 13 15 49
Sum of odd numbers in array = 91
Exit with code 0
--- program is finished running ---

Registers Coproc 1 Coproc 0

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x10010074
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000018
\$t1	9	0x0000001b
\$t2	10	0x0000005b
\$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
\$s8	24	0x00000000
\$s9	25	0x00000000
\$k0	26	0x00000000
\$k1	27	0x00000000
\$gp	28	0x10000000
\$sp	29	0x7ffffeffc
\$fp	30	0x00000000
\$ra	31	0x0040000c
pc		0x00400054
hi		0x00000000
lo		0x00000000

c. Array: -3 -9 13 15

File Edit Run Settings Tools Help

Run speed at max (no interaction)

Assemble the current file and clear breakpoints

Edit Execute

Bkpt	Address	Code	Basic	Source
	0x00400000	0x0c100015	jal 0x00400054	18: jal input_array
	0x00400004	0x0c10003f	jal 0x004000fc	19: jal output_array
	0x00400008	0x0c100067	jal 0x0040019c	20: jal sum_odd
	0x0040000c	0x24020004	addiu \$2,\$0,0x00000004	22: li \$v0, 4
	0x00400010	0x3c011001	lui \$1,0x00001001	23: la \$a0, tbd_result
	0x00400014	0x34240030	ori \$4,\$1,0x00000030	
	0x00400018	0x0000000c	syscall	24: syscall
	0x0040001c	0x3c011001	lui \$1,0x00001001	25: lw \$a0, result
	0x00400020	0x00000000		

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x65746e45	0x61762072	0x3a65756c	0x72410020	0x3a796172	0x6e450020	0x20726574	0x20656874
0x10010020	0x657a6973	0x20666f20	0x61727261	0x00203a79	0x206d7553	0x6f20666f	0x6e206464	0x65626d75
0x10010040	0x69207372	0x7261206e	0x20796172	0x5400203d	0x73206568	0x20657a69	0x69207369	0x6c61766e
0x10010060	0x202e6469	0x20797254	0x69616761	0x000a2e6e	0x000a0020	0x74697720	0x6f632068	0x0000000f
0x10010080	0x30206564	0x00000000	0x00000010	0x00000004	0xffffffff	0xffffffff	0x0000000d	0x0000000f
0x100100a0	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

0x10010000 (.data) ✓ Hexadecimal Addresses ✓ Hexadecimal Values ASCII

Mars Messages Run I/O

```

Enter the size of array: 4
Enter value: -3
Enter value: -9
Enter value: 13
Enter value: 15
Array: -3 -9 13 15
Sum of odd numbers in array = 16
Exit with code 0
--- program is finished running ---

```

Clear

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x10010074
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000010
\$t1	9	0x00000010
\$t2	10	0x00000010
\$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	0x10000000
\$sp	29	0x7ffffcfc
\$fp	30	0x00000000
\$ra	31	0x0040000c
pc		0x00400054
hi		0x00000000
lo		0x00000000

d. Array: -1 -15 -19 -2 -18

File Edit Run Settings Tools Help

Run speed at max (no interaction)

Registers Coproc 1 Coproc 0

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x10010074
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x00000014
\$t1	9	0x00000014
\$t2	10	0xfffffdd
\$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	0x10000000
\$sp	29	0x7fffffc
\$fp	30	0x00000000
\$ra	31	0x0040000c
pc		0x00400054
hi		0x00000000
lo		0x00000000

Text Segment

Bkpt	Address	Code	Basic	Source
	0x00400000	0x0c100015	jal 0x00400054	18: jal input_array
	0x00400004	0x0c10003f	jal 0x004000fc	19: jal output_array
	0x00400008	0x0c100067	jal 0x0040019c	20: jal sum_odd
	0x0040000c	0x24020004	addiu \$2,\$0,0x00000004	22: li \$v0, 4
	0x00400010	0x3c011001	lui \$1,0x0001001	23: la \$a0, tb4_result
	0x00400014	0x34240030	ori \$4,\$1,0x00000030	
	0x00400018	0x0000000c	syscall	24: syscall
	0x0040001c	0x3c011001	lui \$1,0x0001001	25: lw \$a0, result
	0x00400020	0x0c100074	jal 0x0040019c	

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x65746e45	0x61762072	0x3a65756c	0x72410020	0x3a796172	0x6e450020	0x20726574	0x20656874
0x10010020	0x657a6973	0x20666f20	0x61727261	0x00203a79	0x206d7553	0x6f20666f	0x6e206464	0x65626d75
0x10010040	0x69207372	0x7261206e	0x20796172	0x5400203d	0x73206568	0x20657a69	0x69207369	0x6c61766e
0x10010060	0x20206469	0x20797254	0x69616761	0x000a206e	0x000a0020	0x74697845	0x74697720	0x6f632068
0x10010080	0x30206564	0x00000000	0xfffffdd	0x00000005	0xfffffff	0xfffffff1	0xffffffed	0xfffffff
0x100100a0	0xfffffee	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000

Mars Messages Run I/O

```

Enter the size of array: 5
Enter value: -1
Enter value: -15
Enter value: -19
Enter value: -2
Enter value: -18
Array: -1 -15 -19 -2 -18
Sum of odd numbers in array = -35
Exit with code 0
-- program is finished running --

```

Clear

e. Array: 3 4 5 2 4 76 23 54 65 23 45 2 8 9 7

Text Segment

Bkpt	Address	Code	Basic	Source
	0x00400000	0x0c100015	jal 0x00400054	18: jal input_array
	0x00400004	0x0c10003f	jal 0x004000fc	19: jal output_array
	0x00400008	0x0c100067	jal 0x0040019c	20: jal sum_odd
	0x0040000c	0x24020004	addiu \$2,\$0,0x00000004	22: li \$v0, 4
	0x00400010	0x3c011001	lui \$1,0x00001001	23: la \$a0, tb4_result
	0x00400014	0x34240030	ori \$4,\$1,0x00000030	
	0x00400018	0x0000000c	syscall	24: syscall
	0x0040001c	0x3c011001	lui \$1,0x00001001	25: lw \$a0, result
	0x00400020	0x00000000	0x00000000	

Data Segment

Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x10010000	0x65746e45	0x61762072	0x3a65756c	0x72410020	0x3a796172	0x6e450020	0x20726574	0x20656874
0x10010020	0x657a6973	0x20666f20	0x61727261	0x00203a79	0x206d7553	0x6f20666f	0x6e206464	0x65626d75
0x10010040	0x69207372	0x7261206e	0x20796172	0x5400203d	0x73206568	0x20657a69	0x69207369	0x6f637068
0x10010060	0x202e6469	0x20797254	0x69616761	0x000a2e6e	0x000a0020	0x74697845	0x74697720	0x6f632068
0x10010080	0x30206564	0x00000000	0x000000b4	0x0000000f	0x00000003	0x00000004	0x00000005	0x00000002
0x100100a0	0x00000004	0x0000004c	0x00000017	0x00000036	0x00000041	0x00000017	0x0000002d	0x00000002

Registers

Name	Number	Value
\$zero	0	0x00000000
\$at	1	0x10010000
\$v0	2	0x0000000a
\$v1	3	0x00000000
\$a0	4	0x10010074
\$a1	5	0x00000000
\$a2	6	0x00000000
\$a3	7	0x00000000
\$t0	8	0x0000003c
\$t1	9	0x0000003c
\$t2	10	0x000000b4
\$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	0x10000000
\$sp	29	0x7ffffcfc
\$fp	30	0x00000000
\$ra	31	0x0040000c
pc		0x00400054
hi		0x00000000
lo		0x00000000

Mars Messages

```

Enter the size of array: 15
Enter value: 3
Enter value: 4
Enter value: 5
Enter value: 2
Enter value: 4
Enter value: 76
Enter value: 23
Enter value: 54
Enter value: 65
Enter value: 23
Enter value: 45
Enter value: 2
Enter value: 8
Enter value: 9
Enter value: 7
Array: 3 4 5 2 4 76 23 54 65 23 45 2 8 9 7
Sum of odd numbers in array = 180
Exit with code 0
-- program is finished running --
  
```

II. Percentage of work is done: 90 %