

Báo Cáo bài thực hành Lab 3

Môn: Tổ chức & Cấu trúc máy tính II

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Bài 2.1

Các lệnh MIPS cơ bản và chức năng:

- **add**: Cộng hai thanh ghi (có dấu).
- **addi**: Cộng một thanh ghi với một hằng số (có dấu).
- **addu**: Cộng hai thanh ghi (cộng không dấu).
- **addiu**: Cộng một thanh ghi với một hằng số (cộng không dấu).
- **sub**: Trừ 2 thanh ghi (trừ có dấu).
- **subu**: Trừ 2 thanh ghi (trừ không dấu).
- **and**: Phép AND logic (and 2 thanh ghi).
- **andi**: Phép AND logic (and một thanh ghi với một hằng số).
- **or**: Phép OR logic. (or 2 thanh ghi).
- **nor**: Phép NOT-OR logic (not-or 2 thanh ghi).
- **lw**: Load word - Tải word (4-byte) từ bộ nhớ.
- **sw**: Store word - Lưu word (4-byte) từ bộ nhớ.
- **slt**: So sánh nhỏ hơn - thao tác có dấu (giữa 2 thanh ghi).
- **slti**: So sánh nhỏ hơn - thao tác có dấu (giữa một thanh ghi và một hằng số).
- **sltu**: So sánh nhỏ hơn - thao tác không dấu (giữa 2 thanh ghi).
- **sltiu**: So sánh nhỏ hơn - thao tác không dấu (giữa một thanh ghi và một hằng số).

```

1  .data
2  array: .word 10, 20, 30, 40    # Khai báo mảng trong .data
3  .text
4  main:
5
6  add $s0, $s1, $s2 # s0 = s1 + s2
7
8  addi $t0, $s0, -5 # t0 = t0 - 5
9
10 addu $t1, $t2, $t3 # t1 = t2 + t3 (không dấu)
11
12 addiu $t4, $zero, 3 # t4 = 0 + 3 (không dấu)
13
14 sub $s3, $s4, $s5 # s3 = s4 - s5
15
16 subu $t5, $t6, $t7 # t5 = t6 - t7 (không dấu)
17
18 and $t8, $t9, $s6 # t8 = t9 and s6
19
20 andi $s7, $s0, 2 # s7 = s0 + 2
21
22 or $t9, $t8, $t7 #
23
24 nor $s7, $s6, $s5
25
26 la $s0, array # đưa di chỉ array vào s0
27 lw $a0, 4($s0) # lấy s0[1] (tức là giá trị 20) vào a0
28
29 sw $a0, 8($s0) # lưu a0 vào s0[2] (thay giá trị 30 thành 20)
30
31 slt $t0, $s1, $s2 # t0 = (s1 < s2)
32
33 slti $t1, $s3, 100 # t1 = (s3 < 100)
34
35 sltu $t2, $s4, $s5 # t2 = (s4 < s5) (không dấu)
36
37 sltiu $t3, $s6, 4 # t3 = (s6 < 4) (không dấu)

```

Hình 1: Mẫu các lệnh cơ bản của MIPS

GDB Disasm					Registers Coprocessor 1 Coprocessor 2				
Text Segment					Registers	Name	Number	Value	
Step	Address	Code	Basic	Source					
1	0x00000000	0x00000000	0x00000000	0x00000000	\$0	\$0	0	0x00000000	
2	0x00000000	0x00000000	0x00000000	0x00000000	\$1	\$1	1	0x00000000	
3	0x00000000	0x00000000	0x00000000	0x00000000	\$2	\$2	2	0x00000000	
4	0x00000000	0x00000000	0x00000000	0x00000000	\$3	\$3	3	0x00000000	
5	0x00000000	0x00000000	0x00000000	0x00000000	\$4	\$4	4	0x00000000	
6	0x00000000	0x00000000	0x00000000	0x00000000	\$5	\$5	5	0x00000000	
7	0x00000000	0x00000000	0x00000000	0x00000000	\$6	\$6	6	0x00000000	
8	0x00000000	0x00000000	0x00000000	0x00000000	\$7	\$7	7	0x00000000	
9	0x00000000	0x00000000	0x00000000	0x00000000	\$8	\$8	8	0x00000000	
10	0x00000000	0x00000000	0x00000000	0x00000000	\$9	\$9	9	0x00000000	
11	0x00000000	0x00000000	0x00000000	0x00000000	\$10	\$10	10	0x00000000	
12	0x00000000	0x00000000	0x00000000	0x00000000	\$11	\$11	11	0x00000000	
13	0x00000000	0x00000000	0x00000000	0x00000000	\$12	\$12	12	0x00000000	
14	0x00000000	0x00000000	0x00000000	0x00000000	\$13	\$13	13	0x00000000	
15	0x00000000	0x00000000	0x00000000	0x00000000	\$14	\$14	14	0x00000000	
16	0x00000000	0x00000000	0x00000000	0x00000000	\$15	\$15	15	0x00000000	
17	0x00000000	0x00000000	0x00000000	0x00000000	\$16	\$16	16	0x00000000	
18	0x00000000	0x00000000	0x00000000	0x00000000	\$17	\$17	17	0x00000000	
19	0x00000000	0x00000000	0x00000000	0x00000000	\$18	\$18	18	0x00000000	
20	0x00000000	0x00000000	0x00000000	0x00000000	\$19	\$19	19	0x00000000	
21	0x00000000	0x00000000	0x00000000	0x00000000	\$20	\$20	20	0x00000000	
22	0x00000000	0x00000000	0x00000000	0x00000000	\$21	\$21	21	0x00000000	
23	0x00000000	0x00000000	0x00000000	0x00000000	\$22	\$22	22	0x00000000	
24	0x00000000	0x00000000	0x00000000	0x00000000	\$23	\$23	23	0x00000000	
25	0x00000000	0x00000000	0x00000000	0x00000000	\$24	\$24	24	0x00000000	
26	0x00000000	0x00000000	0x00000000	0x00000000	\$25	\$25	25	0x00000000	
27	0x00000000	0x00000000	0x00000000	0x00000000	\$26	\$26	26	0x00000000	
28	0x00000000	0x00000000	0x00000000	0x00000000	\$27	\$27	27	0x00000000	
29	0x00000000	0x00000000	0x00000000	0x00000000	\$28	\$28	28	0x00000000	
30	0x00000000	0x00000000	0x00000000	0x00000000	\$29	\$29	29	0x00000000	
31	0x00000000	0x00000000	0x00000000	0x00000000	\$30	\$30	30	0x00000000	
32	0x00000000	0x00000000	0x00000000	0x00000000	\$31	\$31	31	0x00000000	
33	0x00000000	0x00000000	0x00000000	0x00000000	\$32	\$32	32	0x00000000	
34	0x00000000	0x00000000	0x00000000	0x00000000	\$33	\$33	33	0x00000000	
35	0x00000000	0x00000000	0x00000000	0x00000000	\$34	\$34	34	0x00000000	
36	0x00000000	0x00000000	0x00000000	0x00000000	\$35	\$35	35	0x00000000	
37	0x00000000	0x00000000	0x00000000	0x00000000	\$36	\$36	36	0x00000000	
38	0x00000000	0x00000000	0x00000000	0x00000000	\$37	\$37	37	0x00000000	
39	0x00000000	0x00000000	0x00000000	0x00000000	\$38	\$38	38	0x00000000	
40	0x00000000	0x00000000	0x00000000	0x00000000	\$39	\$39	39	0x00000000	
41	0x00000000	0x00000000	0x00000000	0x00000000	\$40	\$40	40	0x00000000	
42	0x00000000	0x00000000	0x00000000	0x00000000	\$41	\$41	41	0x00000000	
43	0x00000000	0x00000000	0x00000000	0x00000000	\$42	\$42	42	0x00000000	
44	0x00000000	0x00000000	0x00000000	0x00000000	\$43	\$43	43	0x00000000	
45	0x00000000	0x00000000	0x00000000	0x00000000	\$44	\$44	44	0x00000000	
46	0x00000000	0x00000000	0x00000000	0x00000000	\$45	\$45	45	0x00000000	
47	0x00000000	0x00000000	0x00000000	0x00000000	\$46	\$46	46	0x00000000	
48	0x00000000	0x00000000	0x00000000	0x00000000	\$47	\$47	47	0x00000000	
49	0x00000000	0x00000000	0x00000000	0x00000000	\$48	\$48	48	0x00000000	
50	0x00000000	0x00000000	0x00000000	0x00000000	\$49	\$49	49	0x00000000	
51	0x00000000	0x00000000	0x00000000	0x00000000	\$50	\$50	50	0x00000000	
52	0x00000000	0x00000000	0x00000000	0x00000000	\$51	\$51	51	0x00000000	
53	0x00000000	0x00000000	0x00000000	0x00000000	\$52	\$52	52	0x00000000	
54	0x00000000	0x00000000	0x00000000	0x00000000	\$53	\$53	53	0x00000000	
55	0x00000000	0x00000000	0x00000000	0x00000000	\$54	\$54	54	0x00000000	
56	0x00000000	0x00000000	0x00000000	0x00000000	\$55	\$55	55	0x00000000	
57	0x00000000	0x00000000	0x00000000	0x00000000	\$56	\$56	56	0x00000000	
58	0x00000000	0x00000000	0x00000000	0x00000000	\$57	\$57	57	0x00000000	
59	0x00000000	0x00000000	0x00000000	0x00000000	\$58	\$58	58	0x00000000	
60	0x00000000	0x00000000	0x00000000	0x00000000	\$59	\$59	59	0x00000000	
61	0x00000000	0x00000000	0x00000000	0x00000000	\$60	\$60	60	0x00000000	
62	0x00000000	0x00000000	0x00000000	0x00000000	\$61	\$61	61	0x00000000	
63	0x00000000	0x00000000	0x00000000	0x00000000	\$62	\$62	62	0x00000000	
64	0x00000000	0x00000000	0x00000000	0x00000000	\$63	\$63	63	0x00000000	
65	0x00000000	0x00000000	0x00000000	0x00000000	\$64	\$64	64	0x00000000	
66	0x00000000	0x00000000	0x00000000	0x00000000	\$65	\$65	65	0x00000000	
67	0x00000000	0x00000000	0x00000000	0x00000000	\$66	\$66	66	0x00000000	
68	0x00000000	0x00000000	0x00000000	0x00000000	\$67	\$67	67	0x00000000	
69	0x00000000	0x00000000	0x00000000	0x00000000	\$68	\$68	68	0x00000000	
70	0x00000000	0x00000000	0x00000000	0x00000000	\$69	\$69	69	0x00000000	
71	0x00000000	0x00000000	0x00000000	0x00000000	\$70	\$70	70	0x00000000	
72	0x00000000	0x00000000	0x00000000	0x00000000	\$71	\$71	71	0x00000000	
73	0x00000000	0x00000000	0x00000000	0x00000000	\$72	\$72	72	0x00000000	
74	0x00000000	0x00000000	0x00000000	0x00000000	\$73	\$73	73	0x00000000	
75	0x00000000	0x00000000	0x00000000	0x00000000	\$74	\$74	74	0x00000000	
76	0x00000000	0x00000000	0x00000000	0x00000000	\$75	\$75	75	0x00000000	
77	0x00000000	0x00000000	0x00000000	0x00000000	\$76	\$76	76	0x00000000	
78	0x00000000	0x00000000	0x00000000	0x00000000	\$77	\$77	77	0x00000000	
79	0x00000000	0x00000000	0x00000000	0x00000000	\$78	\$78	78	0x00000000	
80	0x00000000	0x00000000	0x00000000	0x00000000	\$79	\$79	79	0x00000000	
81	0x00000000	0x00000000	0x00000000	0x00000000	\$80	\$80	80	0x00000000	
82	0x00000000	0x00000000	0x00000000	0x00000000	\$81	\$81	81	0x00000000	
83	0x00000000	0x00000000	0x00000000	0x00000000	\$82	\$82	82	0x00000000	
84	0x00000000	0x00000000	0x00000000	0x00000000	\$83	\$83	83	0x00000000	
85	0x00000000	0x00000000	0x00000000	0x00000000	\$84	\$84	84	0x00000000	
86	0x00000000	0x00000000	0x00000000	0x00000000	\$85	\$85	85	0x00000000	
87	0x00000000	0x00000000	0x00000000	0x00000000	\$86	\$86	86	0x00000000	
88	0x00000000	0x00000000	0x00000000	0x00000000	\$87	\$87	87	0x00000000	
89	0x00000000	0x00000000	0x00000000	0x00000000	\$88	\$88	88	0x00000000	
90	0x00000000	0x00000000	0x00000000	0x00000000	\$89	\$89	89	0x00000000	
91	0x00000000	0x00000000	0x00000000	0x00000000	\$90	\$90	90	0x00000000	
92	0x00000000	0x00000000	0x00000000	0x00000000	\$91	\$91	91	0x00000000	
93	0x00000000	0x00000000	0x00000000	0x00000000	\$92	\$92	92	0x00000000	
94	0x00000000	0x00000000	0x00000000	0x00000000	\$93	\$93	93	0x00000000	
95	0x00000000	0x00000000	0x00000000	0x00000000	\$94	\$94	94	0x00000000	
96	0x00000000	0x00000000	0x00000000	0x00000000	\$95	\$95	95	0x00000000	
97	0x00000000	0x00000000	0x00000000	0x00000000	\$96	\$96	96	0x00000000	
98	0x00000000	0x00000000	0x00000000	0x00000000	\$97	\$97	97	0x00000000	
99	0x00000000	0x00000000	0x00000000	0x00000000	\$98	\$98	98	0x00000000	
100	0x00000000	0x00000000	0x00000000	0x00000000	\$99	\$99	99	0x00000000	
101	0x00000000	0x00000000	0x00000000	0x00000000	\$100	\$100	100	0x00000000	
102	0x00000000	0x00000000	0x00000000	0x00000000	\$101	\$101	101	0x00000000	
103	0x00000000	0x00000000	0x00000000	0x00000000	\$102	\$102	102	0x00000000	
104	0x00000000	0x00000000	0x00000000	0x00000000	\$103	\$103	103	0x00000000	
105	0x00000000	0x00000000	0x00000000	0x00000000	\$104	\$104	104	0x00000000	
106	0x00000000	0x00000000	0x00000000	0x00000000	\$105	\$105	105	0x00000000	
107	0x00000000	0x00000000	0x00000000	0x00000000	\$106	\$106	106	0x00000000	
108	0x00000000	0x00000000	0x00000000	0x00000000	\$107	\$107	107	0x00000000	
109	0x00000000	0x00000000	0x00000000	0x00000000	\$108	\$108	108	0x00000000	
110	0x00000000	0x00000000	0x00000000	0x00000000	\$109	\$109	109	0x00000000	
111	0x00000000	0x00000000	0x00000000	0x00000000	\$110	\$110	110	0x00000000	
112	0x00000000	0x00000000	0x00000000	0x00000000	\$111	\$111	111	0x00000000	
113	0x00000000	0x00000000	0x00000000	0x00000000	\$112	\$112	112	0x00000000	
114	0x00000000	0x00000000	0x00000000	0x00000000	\$113	\$113	113	0x00000000	
115	0x00000000	0x00000000							

Bài 2.2 Chuyển code sang MIPS

```
addi $t0, $zero, 0x10010018

lw $t3, 0x10010010

add $t1, $s0, $t3

lw $t2, 4($t0)
add $t1, $t1, $t2

sw $t1, 12($t0)
```

- dòng **addi** đầu tiên là thay vì phải tự chỉnh tay giá trị $t0 = 0x10010018$ thì mình tự cộng giá trị đó vào $t0$ luôn.
- lw** là mình sẽ load word giá trị từ địa chỉ $0x10010010$ vào $t3$, đại diện cho biến C .
- lw** ở dòng thứ 4 là mình sẽ lấy giá trị từ $B[1]$ vào $t2$.
- 2 dòng **add** là mình sẽ coi $t1$ là đáp án cần tìm, cộng 3 biến A , C và $B[1]$ vào.
- cuối cùng là **sw** (store word) đáp án $t1$ vào $B[3]$.

Text Segment									
Dispt	Address	Code	Basic	Source	Name	Number	Value		
<input type="checkbox"/>	0x00400000	0x3e011001	lui \$t0, 0x00000001	1: addi \$t0, \$zero, 0x10010018	\$zero	0	0x00000000		
<input type="checkbox"/>	0x00400004	0x34210018	ori \$t1, 0x00000018		\$at	1	0x10010000		
<input type="checkbox"/>	0x00400008	0x00014020	add \$t0, \$t1		\$v0	2	0x00000000		
<input type="checkbox"/>	0x0040000c	0x3e011001	lui \$t1, 0x00000001	3: lw \$t3, 0x10010010	\$v1	3	0x00000000		
<input type="checkbox"/>	0x00400010	0x8c2b0010	lw \$t1, 0x00000010(\$t1)		\$a0	4	0x00000000		
<input type="checkbox"/>	0x00400014	0x02044020	add \$t0, \$t1, \$t1	5: add \$t1, \$a0, \$t3	\$a1	5	0x00000000		
<input type="checkbox"/>	0x00400018	0x02044020	add \$t1, \$t0, \$t1	7: lw \$t2, 4(\$t0)	\$a2	6	0x00000000		
<input type="checkbox"/>	0x0040001c	0x012a4020	add \$t0, \$t1, \$t0	8: add \$t1, \$t1, \$t2	\$a3	7	0x00000000		
<input type="checkbox"/>	0x00400020	0xad90000c	sw \$t0, 0x0000000c(\$t0)	10: sw \$t1, 12(\$t0)	\$t0	8	0x10010018		
					\$t1	9	0x00000004		
					\$t2	10	0x00000003		
					\$t3	11	0x00000002		
					\$t4	12	0x00000000		
					\$t5	13	0x00000000		
					\$t6	14	0x00000000		
					\$t7	15	0x00000000		
					\$t8	16	0x00000001		
					\$t9	17	0x00000000		
					\$a0	18	0x00000000		
					\$a1	19	0x00000000		
					\$a2	20	0x00000000		
					\$a3	21	0x00000000		
					\$a4	22	0x00000000		
					\$a5	23	0x00000000		
					\$a6	24	0x00000000		
					\$a7	25	0x00000000		
					\$a8	26	0x00000000		
					\$a9	27	0x00000000		
					\$a10	28	0x00000000		
					\$a11	29	0x00000000		
					\$a12	30	0x00000000		
					\$a13	31	0x00000000		
					\$a14	32	0x00000000		
					\$a15	33	0x00000000		
					\$a16	34	0x00000000		
					\$a17	35	0x00000000		
					\$a18	36	0x00000000		
					\$a19	37	0x00000000		
					\$a20	38	0x00000000		
					\$a21	39	0x00000000		
					\$a22	40	0x00000000		
					\$a23	41	0x00000000		
					\$a24	42	0x00000000		
					\$a25	43	0x00000000		
					\$a26	44	0x00000000		
					\$a27	45	0x00000000		
					\$a28	46	0x00000000		
					\$a29	47	0x00000000		
					\$a30	48	0x00000000		
					\$a31	49	0x00000000		
					\$a32	50	0x00000000		
					\$a33	51	0x00000000		
					\$a34	52	0x00000000		
					\$a35	53	0x00000000		
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					\$a37	55	0x00000000		
					\$a38	56	0x00000000		
					\$a39	57	0x00000000		
					\$a40	58	0x00000000		
					\$a41	59	0x00000000		
					\$a42	60	0x00000000		
					\$a43	61	0x00000000		
					\$a44	62	0x00000000		
					\$a45	63	0x00000000		
					\$a46	64	0x00000000		
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					\$a48	66	0x00000000		
					\$a49	67	0x00000000		
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					\$a51	69	0x00000000		
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					\$a53	71	0x00000000		
					\$a54	72	0x00000000		
					\$a55	73	0x00000000		
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					\$a61	79	0x00000000		
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					\$a63	81	0x00000000		
					\$a64	82	0x00000000		
					\$a65	83	0x00000000		
					\$a66	84	0x00000000		
					\$a67	85	0x00000000		
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					\$a69	87	0x00000000		
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					\$a79	97	0x00000000		
					\$a80	98	0x00000000		
					\$a81	99	0x00000000		
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					\$a83	101	0x00000000		
					\$a84	102	0x00000000		
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					\$a87	105	0x00000000		
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					\$a91	109	0x00000000		
					\$a92	110	0x00000000		
					\$a93	111	0x00000000		
					\$a94	112	0x00000000		
					\$a95	113	0x00000000		
					\$a96	114	0x00000000		
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					\$a133	151	0x00000000		
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					\$a135	153	0x00000000		
					\$a136	154	0x00000000		
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					\$a139	157	0x00000000		
					\$a140	158	0x00000000		
					\$a141	159	0x00000000		
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					\$a147	165	0x00000000		
					\$a148	166	0x00000000		
					\$a149	167	0x00000000		
					\$a150	168	0x00000000		
					\$a151	169	0x00000000		
					\$a152	170	0x00000000		
					\$a153	171	0x00000000		
					\$a154	172	0x00000000		
					\$a155	173	0x00000000		
					\$a156	174	0x00000000		
					\$a157	175	0x00000000		
					\$a158	176	0x00000000		
					\$a159	177	0x00000000		
					\$a160	178	0x00000000		
					\$a161	179	0x00000000		
					\$a162	180	0x00000000		
					\$a163	181	0x00000000		
					\$a164	182	0x00000000		
					\$a165	183	0x00000000		
					\$a166	184	0x00000000		
					\$a16				

Data Segment									
Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)	
0x10010000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000002	0x00000000	0x00000000	0x00000003	
0x10010020	0x00000000	0x00000004	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	
0x10010040	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	
0x10010060	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	
0x10010080	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	0x00000000	

Bài 2.3 Chuyển code điều kiện và vòng lặp

a. Câu lệnh if-else:

```
beq $s0, $s1, then
sub $s2, $t0, $t1
j exit
then:
add $s2, $t0, $t1
exit:
```

- Ý tưởng chính là so sánh i và j xem có bằng nhau không, nếu bằng thì đi xuống nhãn then, chạy lệnh $f = g + h$, ngược lại thì $f = g - h$ và nhảy xuống exit.

Text Segment					Name	Number	Value
Bkpt	Address	Code	Basic	Source			
	0x00400000	0x12110002	beq \$16,\$17,0x000...	1: beq \$s0, \$s1, then	\$zero	0	0x00000000
	0x00400004	0x01099022	sub \$18,\$5,\$9	2: sub \$s2, \$t0, \$t1	\$at	1	0x00000000
	0x00400008	0x00100004	0x00400010	3: j exit	\$v0	2	0x00000000
	0x0040000c	0x01099022	add \$18,\$5,\$9	5: add \$s2, \$t0, \$t1	\$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	0x00000001
					\$s1	17	0x00000000
					\$s2	18	0x00000001
					\$s3	19	0x00000000
					\$s4	20	0x00000000
					\$s5	21	0x00000000
					\$s6	22	0x00000000
					\$s7	23	0x00000000
					\$s8	24	0x00000000
					\$t9	25	0x00000000
					\$t0	26	0x00000000
					\$t1	27	0x00000000
					\$gp	28	0x10000000
					\$sp	29	0xffffffff
					\$fp	30	0x00000000
					\$ra	31	0x00000000
					pc		0x00400010
					hi		0x00000000
					lo		0x00000000

Data Segment								
Address	Value (+0)	Value (+4)	Value (+8)	Value (+c)	Value (+10)	Value (+14)	Value (+18)	Value (+1c)
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...	0x0000...
0x1001...	0x0000...	0x0000...	0x0000...	0x0000...	0x0			

Hình 4: Kết quả code if-else

b. Vòng lặp for:

```
addi $s2, $zero, 0
addi $s0, $zero, 1
```

For:

```
slt $t0, $s1, $s0
```

```
bne $t0, $zero, End
```

```
add $s2, $s2, $s0
```

```

addi $s0, $s0, 1
j For

End:

```

- Đầu tiên là khởi tạo s2 là sum = 0, khởi tạo s0 là i = 1
- tạo biến t0 kiểm tra xem n < i hay không, nếu n < i thì nhảy xuống nhãn End.
- sum = sum + i
- i = i + 1
- cuối cùng là nhảy lại về nhãn For

Text Segment							
Bkpt	Address	Code	Basic	Source	Name	Number	Value
	0x00400000	0x20120000	addi \$t0,\$s0,0x000...	1: addi \$s2, \$zero, 0	\$zero	0	0x00000000
	0x00400004	0x20100001	addi \$t6,\$s0,0x000...	2: addi \$s0, \$zero, 1	\$at	1	0x00000000
	0x00400008	0x230402a0	slt \$t0,\$t6,\$s0	3: slt \$t0, \$s1, \$s0	\$v0	2	0x00000000
	0x0040000c	0x15000003	bne \$t0,\$s0,0x00000003	4: bne \$t0, \$zero, End	\$v1	3	0x00000000
	0x00400010	0x02509020	addi \$t8,\$t6,\$t6	10: addi \$s2, \$s2, \$s0	\$a0	4	0x00000000
	0x00400014	0x22100001	addi \$t6,\$t6,0x000...	12: addi \$s0, \$s0, 1	\$a1	5	0x00000000
	0x00400018	0x08100002	j 0x00400008	13: j For	\$a2	6	0x00000000
					\$a3	7	0x00000000
					\$t0	8	0x00000001
					\$t1	9	0x00000000
					\$t2	10	0x00000000
					\$t3	11	0x00000000
					\$t4	12	0x00000000
					\$t5	13	0x00000000
					\$t6	14	0x00000000
					\$t7	15	0x00000000
					\$a0	16	0x00000000
					\$a1	17	0x00000004
					\$a2	18	0x0000000a
					\$a3	19	0x00000000
					\$a4	20	0x00000000
					\$a5	21	0x00000000
					\$a6	22	0x00000000
					\$a7	23	0x00000000
					\$t6	24	0x00000000
					\$t5	25	0x00000000
					\$k0	26	0x00000000
					\$k1	27	0x00000000
					\$gp	28	0x10000000
					\$sp	29	0x7fffffc0
					\$fp	30	0x00000000
					\$ra	31	0x00000000
					pc		0x0040001c
					hi		0x00000000
					lo		0x00000000

Hình 5: Kết quả code vòng lặp for