

CS2323: Computer Architecture

Programming Assignment 2: MIPS Simulator

Report

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The program is a simulator to simulate execution of MIPS programs. It accepts the relative path of the MIPS code as the input, as well as the execution mode. There are two execution modes:

1. Step by Step Mode - in this mode, the program will run one instruction at a time, and display the state of the registers and memory after each instruction. The next instruction will be executed when the user presses a key.
2. Execution Mode - The program will execute all the instructions till a halt is encountered.

The instructions supported are add, addi, sub, mul, and, andi, or, ori, nor, slt, slti, beq, bne, lw, sw, j, and halt. halt is a new instruction, which when encountered causes the program to terminate.

Instructions to use the program:

To compile the code, use the following command:

```
g++ CS15BTECH11036_Assignment2.cpp -o CS15BTECH11036_Assignment2.cpp -std=c++0x
```

The flag `std=c++0x` denotes that the program uses C++11 standard.

To run the code, use the following command:

```
./CS15BTECH11036_Assignment2
```

The following are some guidelines to use the program:

- The program can contain .data and .text sections. There should be no text, apart from comments or blank lines, between the two sections
- Comments are supported
- The .data section can contain labels pertaining to a single word only. .space declarations are not allowed. Only integer data is supported.
- The .text section must contain a main label
- The entire program can be at most 10000 lines long. The program counter is given by 4 times the line number.
- The two ways of accessing memory are:
 - Declaring labels
 - Using the stack

- Addresses 40000 to 40396 represent the locations of memory elements for a 100 element stack, with each element of size 4 bytes. They can be accessed using the \$sp register, which initially points to the last element of the stack.
- Any memory element created in the data section is assigned an address starting from 40400.
- Every program must contain a halt statement and the program ends with the halt statement
- A line containing a label may not contain any other instruction.
- The stack pointer, or any other register, can be used only to access elements having an address that is a multiple of 4.
- The registers \$zero and \$at may not be modified. Any other register may be modified. \$at may not be used in any instruction.
- Any value used must lie between -2147483648 and 2147483647, both inclusive.
- The stack pointer can be moved only in multiples of 4.
- Any label must start with an alphabet, and can contain only numbers and alphabets
- Anything after a halt is not executed, unless execution moves there through jumps. Any errors in the flow of control after halt are ignored, except if there are any preprocessing errors, such as redeclaration of data or text sections or labels, or invalid labels.
- Overflows in arithmetic will not throw an error.
- Except in displaying the address, all values used use the decimal number system.

Outputs for sample test cases:

sample1.s:

MIPS Simulator

Program to simulate execution in MIPS Assembly language. Two modes are available:

1. Step by Step Mode - View state after each instruction
2. Execution Mode - View state after end of execution

Enter the relative path of the input file and the mode number:
samples/sample1.s

2

Initialized and ready to execute. Current state is as follows:

Executing instruction: lw \$s0, A # \$s0 contains A

Program Counter: 52

Registers:

Register	Value	Register	Value
zero[0]:	0	s0[16]:	0
at[1]:	0	s1[17]:	0
v0[2]:	0	s2[18]:	0
v1[3]:	0	s3[19]:	0
a0[4]:	0	s4[20]:	0
a1[5]:	0	s5[21]:	0
a2[6]:	0	s6[22]:	0
a3[7]:	0	s7[23]:	0
t0[8]:	0	t8[24]:	0
t1[9]:	0	t9[25]:	0
t2[10]:	0	k0[26]:	0
t3[11]:	0	k1[27]:	0
t4[12]:	0	gp[28]:	100000000

```
t5[13]:      0          sp[29]:    40396
t6[14]:      0          s8[30]:      0
t7[15]:      0          ra[31]:      0
```

Memory:

Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value
9c40	<Stack>:	0	9c90	<Stack>:	0	9ce0	<Stack>:	0	9d30	<Stack>:	0	9d80	<Stack>:	0
9c44	<Stack>:	0	9c94	<Stack>:	0	9ce4	<Stack>:	0	9d34	<Stack>:	0	9d84	<Stack>:	0
9c48	<Stack>:	0	9c98	<Stack>:	0	9ce8	<Stack>:	0	9d38	<Stack>:	0	9d88	<Stack>:	0
9c4c	<Stack>:	0	9c9c	<Stack>:	0	9cec	<Stack>:	0	9d3c	<Stack>:	0	9d8c	<Stack>:	0
9c50	<Stack>:	0	9ca0	<Stack>:	0	9cf0	<Stack>:	0	9d40	<Stack>:	0	9d90	<Stack>:	0
9c54	<Stack>:	0	9ca4	<Stack>:	0	9cf4	<Stack>:	0	9d44	<Stack>:	0	9d94	<Stack>:	0
9c58	<Stack>:	0	9ca8	<Stack>:	0	9cf8	<Stack>:	0	9d48	<Stack>:	0	9d98	<Stack>:	0
9c5c	<Stack>:	0	9cac	<Stack>:	0	9cfc	<Stack>:	0	9d4c	<Stack>:	0	9d9c	<Stack>:	0
9c60	<Stack>:	0	9cb0	<Stack>:	0	9d00	<Stack>:	0	9d50	<Stack>:	0	9da0	<Stack>:	0
9c64	<Stack>:	0	9cb4	<Stack>:	0	9d04	<Stack>:	0	9d54	<Stack>:	0	9da4	<Stack>:	0
9c68	<Stack>:	0	9cb8	<Stack>:	0	9d08	<Stack>:	0	9d58	<Stack>:	0	9da8	<Stack>:	0
9c6c	<Stack>:	0	9cbc	<Stack>:	0	9d0c	<Stack>:	0	9d5c	<Stack>:	0	9dac	<Stack>:	0
9c70	<Stack>:	0	9cc0	<Stack>:	0	9d10	<Stack>:	0	9d60	<Stack>:	0	9db0	<Stack>:	0
9c74	<Stack>:	0	9cc4	<Stack>:	0	9d14	<Stack>:	0	9d64	<Stack>:	0	9db4	<Stack>:	0
9c78	<Stack>:	0	9cc8	<Stack>:	0	9d18	<Stack>:	0	9d68	<Stack>:	0	9db8	<Stack>:	0
9c7c	<Stack>:	0	9ccc	<Stack>:	0	9d1c	<Stack>:	0	9d6c	<Stack>:	0	9dbc	<Stack>:	0
9c80	<Stack>:	0	9cd0	<Stack>:	0	9d20	<Stack>:	0	9d70	<Stack>:	0	9dc0	<Stack>:	0
9c84	<Stack>:	0	9cd4	<Stack>:	0	9d24	<Stack>:	0	9d74	<Stack>:	0	9dc4	<Stack>:	0
9c88	<Stack>:	0	9cd8	<Stack>:	0	9d28	<Stack>:	0	9d78	<Stack>:	0	9dc8	<Stack>:	0
9c8c	<Stack>:	0	9cdc	<Stack>:	0	9d2c	<Stack>:	0	9d7c	<Stack>:	0	9dcc	<Stack>:	0
9dd0	A:	1												
9dd4	B:	2												
9dd8	band:	0												
9ddc	bnor:	0												
9de0	bor:	0												
9de4	differ:	0												
9de8	product:	0												
9dec	sum:	0												

Starting execution

Executing instruction: halt

Program Counter: 112

Registers:

Register	Value	Register	Value
zero[0]:	0	s0[16]:	1
at[1]:	0	s1[17]:	2
v0[2]:	0	s2[18]:	0
v1[3]:	0	s3[19]:	0
a0[4]:	0	s4[20]:	0
a1[5]:	0	s5[21]:	0
a2[6]:	0	s6[22]:	0
a3[7]:	0	s7[23]:	0
t0[8]:	-4	t8[24]:	0
t1[9]:	0	t9[25]:	0
t2[10]:	0	k0[26]:	0
t3[11]:	0	k1[27]:	0
t4[12]:	0	gp[28]:	10000000
t5[13]:	0	sp[29]:	40396
t6[14]:	0	s8[30]:	0
t7[15]:	0	ra[31]:	0

Memory:

Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value
9c40	<Stack>:	0	9c90	<Stack>:	0	9ce0	<Stack>:	0	9d30	<Stack>:	0	9d80	<Stack>:	0
9c44	<Stack>:	0	9c94	<Stack>:	0	9ce4	<Stack>:	0	9d34	<Stack>:	0	9d84	<Stack>:	0
9c48	<Stack>:	0	9c98	<Stack>:	0	9ce8	<Stack>:	0	9d38	<Stack>:	0	9d88	<Stack>:	0
9c4c	<Stack>:	0	9c9c	<Stack>:	0	9cec	<Stack>:	0	9d3c	<Stack>:	0	9d8c	<Stack>:	0
9c50	<Stack>:	0	9ca0	<Stack>:	0	9cf0	<Stack>:	0	9d40	<Stack>:	0	9d90	<Stack>:	0
9c54	<Stack>:	0	9ca4	<Stack>:	0	9cf4	<Stack>:	0	9d44	<Stack>:	0	9d94	<Stack>:	0
9c58	<Stack>:	0	9ca8	<Stack>:	0	9cf8	<Stack>:	0	9d48	<Stack>:	0	9d98	<Stack>:	0
9c5c	<Stack>:	0	9cac	<Stack>:	0	9cfc	<Stack>:	0	9d4c	<Stack>:	0	9d9c	<Stack>:	0
9c60	<Stack>:	0	9cb0	<Stack>:	0	9d00	<Stack>:	0	9d50	<Stack>:	0	9da0	<Stack>:	0
9c64	<Stack>:	0	9cb4	<Stack>:	0	9d04	<Stack>:	0	9d54	<Stack>:	0	9da4	<Stack>:	0
9c68	<Stack>:	0	9cb8	<Stack>:	0	9d08	<Stack>:	0	9d58	<Stack>:	0	9da8	<Stack>:	0

9c6c <Stack>:	0	9cbc <Stack>:	0	9d0c <Stack>:	0	9d5c <Stack>:	0	9dac <Stack>:	0
9c70 <Stack>:	0	9cc0 <Stack>:	0	9d10 <Stack>:	0	9d60 <Stack>:	0	9db0 <Stack>:	0
9c74 <Stack>:	0	9cc4 <Stack>:	0	9d14 <Stack>:	0	9d64 <Stack>:	0	9db4 <Stack>:	0
9c78 <Stack>:	0	9cc8 <Stack>:	0	9d18 <Stack>:	0	9d68 <Stack>:	0	9db8 <Stack>:	0
9c7c <Stack>:	0	9ccc <Stack>:	0	9d1c <Stack>:	0	9d6c <Stack>:	0	9dbc <Stack>:	0
9c80 <Stack>:	0	9cd0 <Stack>:	0	9d20 <Stack>:	0	9d70 <Stack>:	0	9dc0 <Stack>:	0
9c84 <Stack>:	0	9cd4 <Stack>:	0	9d24 <Stack>:	0	9d74 <Stack>:	0	9dc4 <Stack>:	0
9c88 <Stack>:	0	9cd8 <Stack>:	0	9d28 <Stack>:	0	9d78 <Stack>:	0	9dc8 <Stack>:	0
9c8c <Stack>:	0	9cdc <Stack>:	0	9d2c <Stack>:	0	9d7c <Stack>:	0	9dcc <Stack>:	0
9dd0	A:	1							
9dd4	B:	2							
9dd8	band:	0							
9ddc	bnor:	-4							
9de0	bor:	3							
9de4	differ:	-1							
9de8	product:	2							
9dec	sum:	3							

Execution completed successfully

sample2.s:

MIPS Simulator

Program to simulate execution in MIPS Assembly language. Two modes are available:

1. Step by Step Mode - View state after each instruction
2. Execution Mode - View state after end of execution

Enter the relative path of the input file and the mode number:

samples/sample2.s

2

Initialized and ready to execute. Current state is as follows:

Executing instruction: lw \$s0, N # \$s0 contains N

Program Counter: 40

Registers:

Register	Value	Register	Value
zero[0]:	0	s0[16]:	0
at[1]:	0	s1[17]:	0
v0[2]:	0	s2[18]:	0
v1[3]:	0	s3[19]:	0
a0[4]:	0	s4[20]:	0
a1[5]:	0	s5[21]:	0
a2[6]:	0	s6[22]:	0
a3[7]:	0	s7[23]:	0
t0[8]:	0	t8[24]:	0
t1[9]:	0	t9[25]:	0
t2[10]:	0	k0[26]:	0
t3[11]:	0	k1[27]:	0
t4[12]:	0	gp[28]:	100000000
t5[13]:	0	sp[29]:	40396
t6[14]:	0	s8[30]:	0
t7[15]:	0	ra[31]:	0

Memory:

Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value
9c40 <Stack>:		0	9c90 <Stack>:		0	9ce0 <Stack>:		0	9d30 <Stack>:		0	9d80 <Stack>:		0
9c44 <Stack>:		0	9c94 <Stack>:		0	9ce4 <Stack>:		0	9d34 <Stack>:		0	9d84 <Stack>:		0
9c48 <Stack>:		0	9c98 <Stack>:		0	9ce8 <Stack>:		0	9d38 <Stack>:		0	9d88 <Stack>:		0
9c4c <Stack>:		0	9c9c <Stack>:		0	9cec <Stack>:		0	9d3c <Stack>:		0	9d8c <Stack>:		0
9c50 <Stack>:		0	9ca0 <Stack>:		0	9cf0 <Stack>:		0	9d40 <Stack>:		0	9d90 <Stack>:		0
9c54 <Stack>:		0	9ca4 <Stack>:		0	9cf4 <Stack>:		0	9d44 <Stack>:		0	9d94 <Stack>:		0
9c58 <Stack>:		0	9ca8 <Stack>:		0	9cf8 <Stack>:		0	9d48 <Stack>:		0	9d98 <Stack>:		0
9c5c <Stack>:		0	9cac <Stack>:		0	9cfc <Stack>:		0	9d4c <Stack>:		0	9d9c <Stack>:		0
9c60 <Stack>:		0	9cb0 <Stack>:		0	9d00 <Stack>:		0	9d50 <Stack>:		0	9da0 <Stack>:		0
9c64 <Stack>:		0	9cb4 <Stack>:		0	9d04 <Stack>:		0	9d54 <Stack>:		0	9da4 <Stack>:		0
9c68 <Stack>:		0	9cb8 <Stack>:		0	9d08 <Stack>:		0	9d58 <Stack>:		0	9da8 <Stack>:		0
9c6c <Stack>:		0	9cbc <Stack>:		0	9d0c <Stack>:		0	9d5c <Stack>:		0	9dac <Stack>:		0
9c70 <Stack>:		0	9cc0 <Stack>:		0	9d10 <Stack>:		0	9d60 <Stack>:		0	9db0 <Stack>:		0
9c74 <Stack>:		0	9cc4 <Stack>:		0	9d14 <Stack>:		0	9d64 <Stack>:		0	9db4 <Stack>:		0

9c78 <Stack>:	0	9cc8 <Stack>:	0	9d18 <Stack>:	0	9d68 <Stack>:	0	9db8 <Stack>:	0
9c7c <Stack>:	0	9ccc <Stack>:	0	9d1c <Stack>:	0	9d6c <Stack>:	0	9dbc <Stack>:	0
9c80 <Stack>:	0	9cd0 <Stack>:	0	9d20 <Stack>:	0	9d70 <Stack>:	0	9dc0 <Stack>:	0
9c84 <Stack>:	0	9cd4 <Stack>:	0	9d24 <Stack>:	0	9d74 <Stack>:	0	9dc4 <Stack>:	0
9c88 <Stack>:	0	9cd8 <Stack>:	0	9d28 <Stack>:	0	9d78 <Stack>:	0	9dc8 <Stack>:	0
9c8c <Stack>:	0	9cdc <Stack>:	0	9d2c <Stack>:	0	9d7c <Stack>:	0	9dcc <Stack>:	0
9dd0 A:	0								
9dd4 B:	1								
9dd8 N:	20								
9ddc ceilN2:	9								
9de0 result:	0								

Starting execution

Executing instruction: halt

Program Counter: 140

Registers:

Register	Value	Register	Value
zero[0]:	0	s0[16]:	20
at[1]:	0	s1[17]:	9
v0[2]:	0	s2[18]:	0
v1[3]:	0	s3[19]:	0
a0[4]:	0	s4[20]:	0
a1[5]:	0	s5[21]:	0
a2[6]:	0	s6[22]:	0
a3[7]:	0	s7[23]:	0
t0[8]:	2584	t8[24]:	0
t1[9]:	4181	t9[25]:	0
t2[10]:	9	k0[26]:	0
t3[11]:	0	k1[27]:	0
t4[12]:	0	gp[28]:	10000000
t5[13]:	0	sp[29]:	40396
t6[14]:	0	s8[30]:	0
t7[15]:	0	ra[31]:	0

Memory:

Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value
9c40 <Stack>:	0	9c90 <Stack>:	0	9ce0 <Stack>:	0	9d30 <Stack>:	0	9d80 <Stack>:	0					
9c44 <Stack>:	0	9c94 <Stack>:	0	9ce4 <Stack>:	0	9d34 <Stack>:	0	9d84 <Stack>:	0					
9c48 <Stack>:	0	9c98 <Stack>:	0	9ce8 <Stack>:	0	9d38 <Stack>:	0	9d88 <Stack>:	0					
9c4c <Stack>:	0	9c9c <Stack>:	0	9cec <Stack>:	0	9d3c <Stack>:	0	9d8c <Stack>:	0					
9c50 <Stack>:	0	9ca0 <Stack>:	0	9cf0 <Stack>:	0	9d40 <Stack>:	0	9d90 <Stack>:	0					
9c54 <Stack>:	0	9ca4 <Stack>:	0	9cf4 <Stack>:	0	9d44 <Stack>:	0	9d94 <Stack>:	0					
9c58 <Stack>:	0	9ca8 <Stack>:	0	9cf8 <Stack>:	0	9d48 <Stack>:	0	9d98 <Stack>:	0					
9c5c <Stack>:	0	9cac <Stack>:	0	9cfc <Stack>:	0	9d4c <Stack>:	0	9d9c <Stack>:	0					
9c60 <Stack>:	0	9cb0 <Stack>:	0	9d00 <Stack>:	0	9d50 <Stack>:	0	9da0 <Stack>:	0					
9c64 <Stack>:	0	9cb4 <Stack>:	0	9d04 <Stack>:	0	9d54 <Stack>:	0	9da4 <Stack>:	0					
9c68 <Stack>:	0	9cb8 <Stack>:	0	9d08 <Stack>:	0	9d58 <Stack>:	0	9da8 <Stack>:	0					
9c6c <Stack>:	0	9cbc <Stack>:	0	9d0c <Stack>:	0	9d5c <Stack>:	0	9dac <Stack>:	0					
9c70 <Stack>:	0	9cc0 <Stack>:	0	9d10 <Stack>:	0	9d60 <Stack>:	0	9db0 <Stack>:	0					
9c74 <Stack>:	0	9cc4 <Stack>:	0	9d14 <Stack>:	0	9d64 <Stack>:	0	9db4 <Stack>:	0					
9c78 <Stack>:	0	9cc8 <Stack>:	0	9d18 <Stack>:	0	9d68 <Stack>:	0	9db8 <Stack>:	0					
9c7c <Stack>:	0	9ccc <Stack>:	0	9d1c <Stack>:	0	9d6c <Stack>:	0	9dbc <Stack>:	0					
9c80 <Stack>:	0	9cd0 <Stack>:	0	9d20 <Stack>:	0	9d70 <Stack>:	0	9dc0 <Stack>:	0					
9c84 <Stack>:	0	9cd4 <Stack>:	0	9d24 <Stack>:	0	9d74 <Stack>:	0	9dc4 <Stack>:	0					
9c88 <Stack>:	0	9cd8 <Stack>:	0	9d28 <Stack>:	0	9d78 <Stack>:	0	9dc8 <Stack>:	0					
9c8c <Stack>:	0	9cdc <Stack>:	0	9d2c <Stack>:	0	9d7c <Stack>:	0	9dcc <Stack>:	0					
9dd0 A:	0													
9dd4 B:	1													
9dd8 N:	20													
9ddc ceilN2:	9													
9de0 result:	4181													

Execution completed successfully

sample3.s:

MIPS Simulator

Program to simulate execution in MIPS Assembly language. Two modes are available:

- 1. Step by Step Mode - View state after each instruction
- 2. Execution Mode - View state after end of execution

Enter the relative path of the input file and the mode number:
samples/sample3.s

2
Initialized and ready to execute. Current state is as follows:

Executing instruction: lw \$t0, N # \$t0 contains N

Program Counter: 28

Registers:

Register	Value	Register	Value
zero[0]:	0	s0[16]:	0
at[1]:	0	s1[17]:	0
v0[2]:	0	s2[18]:	0
v1[3]:	0	s3[19]:	0
a0[4]:	0	s4[20]:	0
a1[5]:	0	s5[21]:	0
a2[6]:	0	s6[22]:	0
a3[7]:	0	s7[23]:	0
t0[8]:	0	t8[24]:	0
t1[9]:	0	t9[25]:	0
t2[10]:	0	k0[26]:	0
t3[11]:	0	k1[27]:	0
t4[12]:	0	gp[28]:	100000000
t5[13]:	0	sp[29]:	40396
t6[14]:	0	s8[30]:	0
t7[15]:	0	ra[31]:	0

Memory:

Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value
9c40 <Stack>:		0	9c90 <Stack>:		0	9ce0 <Stack>:		0	9d30 <Stack>:		0	9d80 <Stack>:		0
9c44 <Stack>:		0	9c94 <Stack>:		0	9ce4 <Stack>:		0	9d34 <Stack>:		0	9d84 <Stack>:		0
9c48 <Stack>:		0	9c98 <Stack>:		0	9ce8 <Stack>:		0	9d38 <Stack>:		0	9d88 <Stack>:		0
9c4c <Stack>:		0	9c9c <Stack>:		0	9cec <Stack>:		0	9d3c <Stack>:		0	9d8c <Stack>:		0
9c50 <Stack>:		0	9ca0 <Stack>:		0	9cf0 <Stack>:		0	9d40 <Stack>:		0	9d90 <Stack>:		0
9c54 <Stack>:		0	9ca4 <Stack>:		0	9cf4 <Stack>:		0	9d44 <Stack>:		0	9d94 <Stack>:		0
9c58 <Stack>:		0	9ca8 <Stack>:		0	9cf8 <Stack>:		0	9d48 <Stack>:		0	9d98 <Stack>:		0
9c5c <Stack>:		0	9cac <Stack>:		0	9cfc <Stack>:		0	9d4c <Stack>:		0	9d9c <Stack>:		0
9c60 <Stack>:		0	9cb0 <Stack>:		0	9d00 <Stack>:		0	9d50 <Stack>:		0	9da0 <Stack>:		0
9c64 <Stack>:		0	9cb4 <Stack>:		0	9d04 <Stack>:		0	9d54 <Stack>:		0	9da4 <Stack>:		0
9c68 <Stack>:		0	9cb8 <Stack>:		0	9d08 <Stack>:		0	9d58 <Stack>:		0	9da8 <Stack>:		0
9c6c <Stack>:		0	9cbc <Stack>:		0	9d0c <Stack>:		0	9d5c <Stack>:		0	9dac <Stack>:		0
9c70 <Stack>:		0	9cc0 <Stack>:		0	9d10 <Stack>:		0	9d60 <Stack>:		0	9db0 <Stack>:		0
9c74 <Stack>:		0	9cc4 <Stack>:		0	9d14 <Stack>:		0	9d64 <Stack>:		0	9db4 <Stack>:		0
9c78 <Stack>:		0	9cc8 <Stack>:		0	9d18 <Stack>:		0	9d68 <Stack>:		0	9db8 <Stack>:		0
9c7c <Stack>:		0	9ccc <Stack>:		0	9d1c <Stack>:		0	9d6c <Stack>:		0	9dbc <Stack>:		0
9c80 <Stack>:		0	9cd0 <Stack>:		0	9d20 <Stack>:		0	9d70 <Stack>:		0	9dc0 <Stack>:		0
9c84 <Stack>:		0	9cd4 <Stack>:		0	9d24 <Stack>:		0	9d74 <Stack>:		0	9dc4 <Stack>:		0
9c88 <Stack>:		0	9cd8 <Stack>:		0	9d28 <Stack>:		0	9d78 <Stack>:		0	9dc8 <Stack>:		0
9c8c <Stack>:		0	9cdc <Stack>:		0	9d2c <Stack>:		0	9d7c <Stack>:		0	9dcc <Stack>:		0
9dd0 N:	1234													
9dd4 result:	0													

Starting execution

Executing instruction: halt

Program Counter: 60

Registers:

Register	Value	Register	Value
zero[0]:	0	s0[16]:	0
at[1]:	0	s1[17]:	0
v0[2]:	0	s2[18]:	0
v1[3]:	0	s3[19]:	0
a0[4]:	0	s4[20]:	0

```
a1[ 5]:      0          s5[21]:      0
a2[ 6]:      0          s6[22]:      0
a3[ 7]:      0          s7[23]:      0
t0[ 8]:    1234          t8[24]:      0
t1[ 9]:      0          t9[25]:      0
t2[10]:      0          k0[26]:      0
t3[11]:      0          k1[27]:      0
t4[12]:      0          gp[28]:    100000000
t5[13]:      0          sp[29]:      40396
t6[14]:      0          s8[30]:      0
t7[15]:      0          ra[31]:      0
```

Memory:

Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value	Address	Label	Value
9c40	<Stack>:	0	9c90	<Stack>:	0	9ce0	<Stack>:	0	9d30	<Stack>:	0	9d80	<Stack>:	0
9c44	<Stack>:	0	9c94	<Stack>:	0	9ce4	<Stack>:	0	9d34	<Stack>:	0	9d84	<Stack>:	0
9c48	<Stack>:	0	9c98	<Stack>:	0	9ce8	<Stack>:	0	9d38	<Stack>:	0	9d88	<Stack>:	0
9c4c	<Stack>:	0	9c9c	<Stack>:	0	9cec	<Stack>:	0	9d3c	<Stack>:	0	9d8c	<Stack>:	0
9c50	<Stack>:	0	9ca0	<Stack>:	0	9cf0	<Stack>:	0	9d40	<Stack>:	0	9d90	<Stack>:	0
9c54	<Stack>:	0	9ca4	<Stack>:	0	9cf4	<Stack>:	0	9d44	<Stack>:	0	9d94	<Stack>:	0
9c58	<Stack>:	0	9ca8	<Stack>:	0	9cf8	<Stack>:	0	9d48	<Stack>:	0	9d98	<Stack>:	0
9c5c	<Stack>:	0	9cac	<Stack>:	0	9cfc	<Stack>:	0	9d4c	<Stack>:	0	9d9c	<Stack>:	0
9c60	<Stack>:	0	9cb0	<Stack>:	0	9d00	<Stack>:	0	9d50	<Stack>:	0	9da0	<Stack>:	0
9c64	<Stack>:	0	9cb4	<Stack>:	0	9d04	<Stack>:	0	9d54	<Stack>:	0	9da4	<Stack>:	0
9c68	<Stack>:	0	9cb8	<Stack>:	0	9d08	<Stack>:	0	9d58	<Stack>:	0	9da8	<Stack>:	0
9c6c	<Stack>:	0	9cbc	<Stack>:	0	9d0c	<Stack>:	0	9d5c	<Stack>:	0	9dac	<Stack>:	0
9c70	<Stack>:	0	9cc0	<Stack>:	0	9d10	<Stack>:	0	9d60	<Stack>:	0	9db0	<Stack>:	0
9c74	<Stack>:	0	9cc4	<Stack>:	0	9d14	<Stack>:	0	9d64	<Stack>:	0	9db4	<Stack>:	0
9c78	<Stack>:	0	9cc8	<Stack>:	0	9d18	<Stack>:	0	9d68	<Stack>:	0	9db8	<Stack>:	0
9c7c	<Stack>:	0	9ccc	<Stack>:	0	9d1c	<Stack>:	0	9d6c	<Stack>:	0	9dbc	<Stack>:	0
9c80	<Stack>:	0	9cd0	<Stack>:	0	9d20	<Stack>:	0	9d70	<Stack>:	0	9dc0	<Stack>:	0
9c84	<Stack>:	0	9cd4	<Stack>:	0	9d24	<Stack>:	0	9d74	<Stack>:	0	9dc4	<Stack>:	0
9c88	<Stack>:	0	9cd8	<Stack>:	0	9d28	<Stack>:	0	9d78	<Stack>:	0	9dc8	<Stack>:	1234
9c8c	<Stack>:	0	9cdc	<Stack>:	0	9d2c	<Stack>:	0	9d7c	<Stack>:	0	9dcc	<Stack>:	0
9dd0	N:	1234												
9dd4	result:	1275												

Execution completed successfully