Simple MIPS Instructions

Aim

The aim of these exercises is to become familiar with simple **MIPS** instructions : -

Addition, **Subtraction**, and the **Logic Operations**.

These exercises make use the **Mars** Simulator Program.

Exercise 1

Moving values into registers.
MIPS uses the **add** instruction with an immediate value to place constant values directly into registers.

This program will place the value **5** into register **$t1**

```
addi $t1, $zero, 5
```

- Enter the above program into **mips** and assemble and run the program.

    Notice how the **$t1** register now has the value **5**.

$t1	9	0x00000005

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	0
$t1	9	5
$t2	10	0
$t3	11	0
$t4	12	0
$t5	13	0
$t6	14	0
$t7	15	0
$s0	16	0
$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		4194308
hi		0
lo		0

Exercise 2

Write a program that will set the registers to the following state.

Name	Number	Value
$zero	0	0
$at	1	1
$v0	2	123
$v1	3	321
$a0	4	145
$a1	5	234
$a2	6	568
$a3	7	124
$t0	8	98
$t1	9	41
$t2	10	23
$t3	11	98
$t4	12	-512
$t5	13	-256
$t6	14	-12
$t7	15	-12
$s0	16	-19
$s1	17	52
$s2	18	99
$s3	19	67
$s4	20	45
$s5	21	43
$s6	22	65
$s7	23	32
$t8	24	32
$t9	25	23
$k0	26	0
$k1	27	23
$gp	28	31
$sp	29	45
$fp	30	5
$ra	31	5

- Remember :   "addi $t1, $zero, 5"

- Number sequence :

Exercise 3

The   **Add**   instruction can be used to
- add two registers and
- place the result in a third register.

```
# Setup Registers
addi $t1, $zero, 10
addi $t2, $zero, 20
addi $t3, $zero, 30

# Do some addition
add $s1, $t1, $t2
add $s2, $t2, $t3
add $s3, $t3, $s1
```

What registers changed after this code and to what values?

Register	Value

Exercise 4

Examine the following program : -

```
# Setup Registers
addi $t1, $zero, 20
addi $t2, $zero, 40
addi $t3, $zero, 15

# Do some addition
add ?
add ?
add ?
```

Complete this program such that it sets the registers to the following values.

Name	Number	Value
$t1	9	20
$t2	10	40
$t3	11	15
$t4	12	0
$t5	13	0
$t6	14	0
$t7	15	0
$s0	16	0
$s1	17	35
$s2	18	30
$s3	19	45

Exercise 5

```
# Setup Registers
addi $t1, $zero, 20
addi $t2, $zero, 40
addi $t3, $zero, 15

# Do some arithmetic
sub $s1, $t2, $t1
sub $s2, $t1, $t3
```

What does the above program do?

Exercise 6

Complete the following program such that it sets the registers to the following values.

```
# Setup Registers
addi $t1, $zero, 60
addi $t2, $zero, 30
addi $t3, $zero, 80

# Do some math
sub ?
sub ?
```

Name	Number	Value
$t1	9	60
$t2	10	30
$t3	11	80
$t4	12	0
$t5	13	0
$t6	14	0
$t7	15	0
$s0	16	0
$s1	17	20
$s2	18	30

Exercise 7

Convert the following expression to a mips program

Y = (A – B) + (C + D)

Using the following values   A   =   35
                                 B   =   20
                                 C   =   18
                                 D   =   7

Exercise 8

What is the result of   **AND**   the values   4321   and   3212   in decimal.

Exercise 9

What is the result of   **OR**   the values   1111   and   2122   in decimal.

Exercise 10

What is the result of   **XOR**   the values   5521   and   2341   in decimal.

Exercise 11
Do the   division of 132 by 6.
   • What are the quotient and remainder values ?

Do the   division of 4231 by 17.
   • What are the quotient and remainder values ?

Do the   Multiplication of 179 by 9 ?

What is the   square of 327 ?
   • Which register shows you the answer ?

Exercise 12

Now write an assembly program that performs all the calculations in   Exercise 11   in the same program and has all the various results saved in $s   registers so that we can see them at the end.

Exercise 13

Write an assembly program that converts a weight of   11 st   and   12 lbs   into just pounds.

1 stone = 14lbs

Exercise 14

Now write an assembly program that takes a value ,

Eg 100 as a Celsius temperature and converts it into the Fahrenheit equivalent.

The temperature conversion formula needed is :

Fahrenheit = ((Celsius*9)/5)+32

Do the program for the value 100

- What about if the value was 77 ?

- How would you deal with the remainder on division ?

Directed Study

- Complete the worksheet

- How do computers store negative numbers?

   Look up   twos-complement   and test to see how this corresponds to numbers being held in registers in the MARS registers.

   Try the following as a starting point : -

   http://www.youtube.com/watch?v=9W67I2zzAfo