MONTCLAIR STATE UNIVERSITY

Department of CSIT

Homework # X

Last, First (name)

Number-title-of the course

Instructor: Dr. G.E. Antoniou

Day, Month, Year

Problem 1: QUADRATIC EQUATION ($s0)

Arithmetic example (Assembly Language).

Solution:

Formula that calculates the delta for the following quadratic equation:

$$\Delta = b^2 - 4ac$$

The program reads the values of a, b, and c from the user and loads them in the register. The program calculates the value of b^2 first. Then, it calculates the value of $4ac$. To do this we load the value 4 in a register. We subtract $4ac$ from b^2. Then, the program outputs the value to the user.

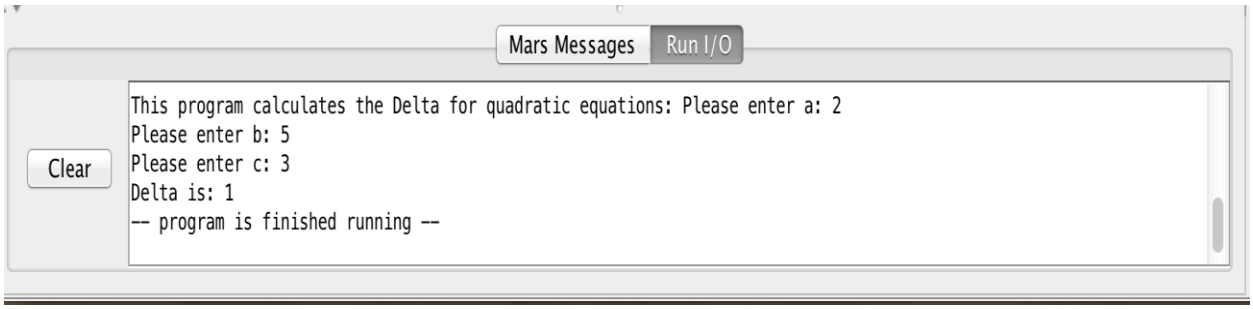
Code:

```
# Homework X . Problem 1
# This program calculates the value: Delta = b^2 - 4ac

        .text
        .globl main
main:
# prints "This program calculates the Delta for quadratic equations: "
        la      $a0, welcomeMessage
        li      $v0, 4
        syscall

# prints "Please enter a: "
        la      $a0, entera
        li      $v0, 4
        syscall

# inputs the value a
        li      $v0, 5
        syscall
        move    $t0, $v0

# prints "Please enter b: "
        la      $a0, enterb
        li      $v0, 4
        syscall

# inputs the value b
        li      $v0, 5
        syscall
        move    $t1, $v0
```

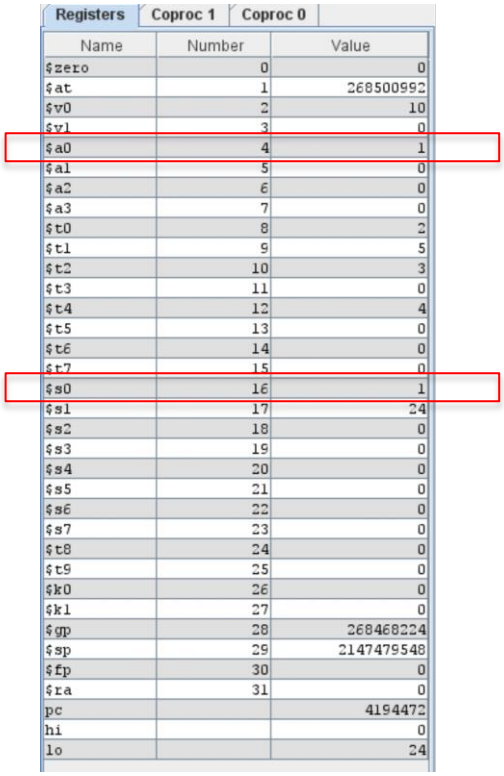
```
# prints "Please enter c: "
        la      $a0, enterc
        li      $v0, 4
        syscall

# inputs the value c
        li      $v0, 5
        syscall
        move    $t2, $v0

# calculates b^2 and puts it in #s0
        mult    $t1, $t1
        mflo    $s0

# loads the constant 4 at $t4
        li      $t4, 4

# calculates 4*a and puts it in $s1
        mult    $t4, $t0
        mflo    $s1

# calculates 4*a*b and puts it in $s1
        mult    $s1, $t2
        mflo    $s1

# calculates delta = b^2-4*a*c and puts it in $s0
        sub     $s0, $s0, $s1

# prints "Delta is: "
        la      $a0, answer
        li      $v0, 4
        syscall

# prints the output of the operation ($s0)
        move    $a0, $s0
        li      $v0, 1
        syscall

# exits the program
        li      $v0, 10
        syscall
```

```
.data
welcomeMessage:
        .asciiz "This program calculates the Delta for quadratic equations: "
entera:
        .asciiz "Please enter a: "
enterb:
        .asciiz "Please enter b: "
enterc:
        .asciiz "Please enter c: "
answer:
        .asciiz "Delta is: "
```

Sample Run (Console):



Sample Run (Registers area), only in decimal:



Registers | Coproc 1 | Coproc 0

Name	Number	Value
$zero	0	0
$at	1	268500992
$v0	2	10
$v1	3	0
$a0	4	1
$a1	5	0
$a2	6	0
$a3	7	0
$t0	8	2
$t1	9	5
$t2	10	3
$t3	11	0
$t4	12	4
$t5	13	0
$t6	14	0
$t7	15	0
$s0	16	1
$s1	17	24
$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		4194472
hi		0
lo		24

Result:

State the final answer (result): **Δ = 1.**

Brief Comments:

The program runs correctly, according to the specifications.