

Roteiro 6 - Loac 2022.2

Problema 1 - Código em Assembly

```
.text
main:
    addi a0, zero, 1
    add a1, a0, a0
    addi a2, zero, 5
loop:
    beq a0, a2, fim
    slli a1, a1, 1
    addi a0, a0, 1
    j loop
fim:
    nop
```

a) Qual é a operação realizada pelo código acima?

O código realiza um loop que multiplica o valor inicial de a1 por 2 em cada iteração, enquanto o valor de a0 é menor que 5. Quando chega em 5 o programa chega ao final, executando a instrução fim e encerra a execução.

b) Qual é o conteúdo (em decimal) dos registradores a0, a1 e a2 ao final da execução do programa?

a0: 5,
a1: 32,
a2: 5.

c) Quais são os valores de loop (na instrução j loop) e fim (na instrução beq a0, a2, fim)

A instrução fim é executada quando os valores a0 e a2 forem iguais.

A instrução loop fica executando até chegar na condição de parada que seria na instrução beq a0, a2, fim.

d) Adicione "prints" da tela do simulador ao arquivo PDF. Esses "prints" deverão mostrar todo o ambiente, incluindo o código em Assembly que foi executado e os valores exibidos na interface após a execução de cada instrução (código de máquina armazenado na memória, valores do pc e dos demais registradores envolvidos).

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero0x00000000

ra (x1)0x00000000

sp (x2)0x7fffffff

gp (x3)0x10000000

tp (x4)0x00000000

t0 (x5)0x00000000

t1 (x6)0x00000000

t2 (x7)0x00000000

s0 (x8)0x00000000

s1 (x9)0x00000000

a0 (x10)0x00000000

a1 (x11)0x00000000

Display SettingsHex

Registers

Memory

Address	+0	+1	+2	+3
0x00000018	6f	f0	5f	ff
0x00000014	13	05	15	00
0x00000010	93	95	15	00
0x0000000c	63	08	c5	00
0x00000008	13	06	50	00
0x00000004	b3	05	a5	00
0x00000000	13	05	10	00
-----	--	--	--	--
-----	--	--	--	--
-----	--	--	--	--
-----	--	--	--	--
-----	--	--	--	--
-----	--	--	--	--

Display Settings

Hex

1° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000001

a1 (x11)

0x00000000

Display Settings

Hex

2° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000001

a1 (x11)

0x00000002

Display Settings

Hex

3° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

(x10)

a1 (x11)

a2 (x12)

a3 (x13)

a4 (x14)

a5 (x15)

a6 (x16)

a7 (x17)

s2 (x18)

s3

Display Settings

Hex

4° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

(x10)

a1 (x11)

a2 (x12)

a3 (x13)

a4 (x14)

a5 (x15)

a6 (x16)

a7 (x17)

s2 (x18)

s3

Display Settings

Hex

5° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

(x10)

a1 (x11)

a2 (x12)

a3 (x13)

a4 (x14)

a5 (x15)

a6 (x16)

a7 (x17)

s2 (x18)

s3

Display Settings

Hex

6° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

s0 (x8)

s1 (x9)

a0 (x10)

a1 (x11)

a2 (x12)

a3 (x13)

a4 (x14)

a5 (x15)

a6 (x16)

a7 (x17)

Display Settings

Hex

7º execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000002

a1 (x11)

0x00000004

Display Settings

Hex

8º execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000002

a1 (x11)

0x00000004

Display Settings

Hex

9° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000002

a1 (x11)

0x00000008

Display Settings

Hex

10° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000003

a1 (x11)

0x00000008

Display Settings

Hex

11° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000003

a1 (x11)

0x00000008

Display Settings

Hex

12° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000003

a1 (x11)

0x00000008

Display Settings

Hex

13° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000003

a1 (x11)

0x00000010

Display Settings

Hex

14° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000004

a1 (x11)

0x00000010

Display Settings

Hex

15° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000004

a1 (x11)

0x00000010

Display Settings

Hex

16° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000004

a1 (x11)

0x00000010

Display Settings

Hex

17° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000004

a1 (x11)

0x00000020

Display Settings

Hex

18° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero

0x00000000

ra (x1)

0x00000000

sp (x2)

0x7fffffff0

gp (x3)

0x10000000

tp (x4)

0x00000000

t0 (x5)

0x00000000

t1 (x6)

0x00000000

t2 (x7)

0x00000000

s0 (x8)

0x00000000

s1 (x9)

0x00000000

a0 (x10)

0x00000005

a1 (x11)

0x00000020

Display Settings

Hex

19° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero0x00000000

ra (x1)0x00000000

sp (x2)0x7fffffff0

gp (x3)0x10000000

tp (x4)0x00000000

t0 (x5)0x00000000

t1 (x6)0x00000000

t2 (x7)0x00000000

s0 (x8)0x00000000

s1 (x9)0x00000000

a0 (x10)0x00000005

a1 (x11)0x00000020

Display SettingsHex

20° execução:

Editor

Simulator

Run

Step

Prev

Reset

Dump

Machine Code	Basic Code	Original Code
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00a505b3	add x11 x10 x10	add a1, a0, a0
0x00500613	addi x12 x0 5	addi a2, zero, 5
0x00c50863	beq x10 x12 16	beq a0, a2, fim
0x00159593	slli x11 x11 1	slli a1, a1, 1
0x00150513	addi x10 x10 1	addi a0, a0, 1
0xff5ff06f	jal x0 -12	j loop
0x00000013	addi x0 x0 0	nop

console output

Registers

Memory

zero0x00000000

ra (x1)0x00000000

sp (x2)0x7fffffff0

gp (x3)0x10000000

tp (x4)0x00000000

t0 (x5)0x00000000

t1 (x6)0x00000000

t2 (x7)0x00000000

s0 (x8)0x00000000

s1 (x9)0x00000000

a0 (x10)0x00000005

a1 (x11)0x00000020

Display SettingsHex