

0x00200513

0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

**addi x10, x0, 2**

0x00400593

0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

**addi x11, x0, 4**

0x00b50663

0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	0	1	1	0	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

[12][10:5]				Rs2				Rs1				Opp				[4:1][11]				OPCODE			
------------	--	--	--	-----	--	--	--	-----	--	--	--	-----	--	--	--	-----------	--	--	--	--------	--	--	--

0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	0	1	1	0	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	1	1	0	0

Opcode: beq

Rs1: x10

Rs2: x11

Jump: + 12

**Beq x10, x11, 12**

0x00a50533

0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	1	0	1	0	0	1	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Opcode: add

Rs1: x10

Rs2: x10

Rd: x10

**Add x10, x10,x10**

0xff9ff06f

1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Jal x0, -8

0x00b58633

0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

add x12, x11, x11

0x00000013

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

addi x0, x0, 0 (nop)

addi x10, x0, 2

addi x11, x0, 4

beq x10, x11, 12

add x10, x10,x10

jal x0, -8

add x12, x11, x11

addi x0, x0, 0 (nop)

a) Qual é o código em Assembly correspondente?

```
1 main:
2     addi x10, x0, 2
3     addi x11, x0, 4
4 loop:
5     beq x10, x11, fim
6     add x10, x10, x10
7     j loop
8 fim:
9     add x12, x11, x11
10    nop
11
```

b) Qual é a operação realizada pelo código acima?

O código acima é um loop que multiplica repetidamente o valor inicial do registrador x10 por 2 até que x10 seja igual a x11. Após o loop, o código adiciona o valor de x11 a si mesmo e executa uma instrução NOP (sem operação).

c) Quais são os registradores utilizados no código?

X10, X11, X12

d) Quais são os conteúdos desses registradores ao final da execução do programa

4, 4, 8

e) 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).

Machine Code	Basic Code	Original Code
0x00200513	addi x10 x0 2	addi x10, x0, 2
0x00400593	addi x11 x0 4	addi x11, x0, 4
0x00b50663	beq x10 x11 12	beq x10, x11, fim
0x00a50533	add x10 x10 x10	add x10, x10, x10
0xff9ff06f	j al x0 -8	j loop
0x00b58633	add x12 x11 x11	add x12, x11, x11
0x00000013	addi x0 x0 0	nop

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0x00b50663	beq x10 x11 12	beq x10, x11, fim
0x00a50533	add x10 x10 x10	add x10, x10, x10
0xff9ff06f	j al x0 -8	j loop
0x00b58633	add x12 x11 x11	add x12, x11, x11
0x00000013	addi x0 x0 0	nop

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0x00b50663	beq x10 x11 12	beq x10, x11, fim
0x00a50533	add x10 x10 x10	add x10, x10, x10
0xff9ff06f	j al x0 -8	j loop
0x00b58633	add x12 x11 x11	add x12, x11, x11
0x00000013	addi x0 x0 0	nop

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0x00b50663	beq x10 x11 12	beq x10, x11, fim
0x00a50533	add x10 x10 x10	add x10, x10, x10
0xff9ff06f	j al x0 -8	j loop
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0x00a50533	add x10 x10 x10	add x10, x10, x10
0xff9ff06f	j al x0 -8	j loop
0x00b58633	add x12 x11 x11	add x12, x11, x11
0x00000013	addi x0 x0 0	nop

ra (x1)	<input type="text" value="0"/>
sp (x2)	<input type="text" value="2147483632"/>
gp (x3)	<input type="text" value="268435456"/>
tp (x4)	<input type="text" value="0"/>
t0 (x5)	<input type="text" value="0"/>
t1 (x6)	<input type="text" value="0"/>
t2 (x7)	<input type="text" value="0"/>
s0 (x8)	<input type="text" value="0"/>
s1 (x9)	<input type="text" value="0"/>
a0 (x10)	<input type="text" value="0"/>
a1 (x11)	<input type="text" value="0"/>
a2 (x12)	<input type="text" value="0"/>
a3 (x13)	<input type="text" value="0"/>
ra (x1)	<input type="text" value="0"/>
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t2 (x7)	<input type="text" value="0"/>
s0 (x8)	<input type="text" value="0"/>
s1 (x9)	<input type="text" value="0"/>
a0 (x10)	<input type="text" value="2"/>
a1 (x11)	<input type="text" value="0"/>
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a3 (x13)	<input type="text" value="0"/>
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s1 (x9)	<input type="text" value="0"/>
a0 (x10)	<input type="text" value="2"/>
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s1 (x9)	<input type="text" value="0"/>
a0 (x10)	<input type="text" value="2"/>
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s1 (x9)	<input type="text" value="0"/>
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t2 (x7)	<input type="text" value="0"/>
s0 (x8)	<input type="text" value="0"/>
s1 (x9)	<input type="text" value="0"/>
a0 (x10)	<input type="text" value="4"/>
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s0 (x8)	<input type="text" value="0"/>
s1 (x9)	<input type="text" value="0"/>
a0 (x10)	<input type="text" value="8"/>
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