0x00200513

0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 1

addi x10, x0, 2

0x00400593

addi x11, x0, 4

0x00b50663

[12][10:	5]	Rs	2	Rs	1	Орр	[4::	1][11]		OPCOE	ÞΕ
0 0	0 0 0	0 0	0 1 0	0 1 1	0 1 0	0 1 0	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 1 0 1 0 1 0 1 0 0 0 0 1 0 1 0 1 1 1

Opcode: add Rs1: x10 Rs2: x10 Rd: x10

Add x10, x10,x10

0xff9ff06f



0x00b58633

0x00000013

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:
       addi x10, x0, 2
 2
       addi x11, x0, 4
 3
 4 loop:
 5
       beg x10, x11, fim
       add x10, x10, x10
 6
 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?

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 LOAC 2022.2: Roteiro 6 ava.computacao.ufcg.edu.br	ra (x1) o
0x00200513	addi x10 x0 2	addi x10, x0, 2	sp (x2) 2147483632
0x00400593	addi x11 x0 4	addi x11, x0, 4	gp (x3) 268435456
0x00b50663	beq x10 x11 12	beq x10, x11, fim	tp (x4) 0
0x00a50533	add x10 x10 x10	add x10, x10, x10	t0 (x5) 0
)xff9ff06f	jal x0 -8		
0x00b58633	jai x0 -8 add x12 x11 x11	j loop add x12, x11, x11	t1 (x6) o
			t2 (x7) 0
0x00000013	addi x0 x0 0	nop	s0 (x8)
			s1 (x9) o
			a0 (x10) o
			al (x11) o
			a2 (x12) o
			a3 (x13) 0
			ra (x1) o
Machine Code	Basic Code	Original Code	sp (x2) 2147483632
0x00200513	addi x10 x0 2	addi x10, x0, 2	
0x00400593	addi x11 x0 4	addi x11, x0, 4	gp (x3) 268435456
0x00b50663	beq x10 x11 12	beq x10, x11, fim	tp (x4) o
0x00a50533	add x10 x10 x10	add x10, x10, x10	t0 (x5) 0
0xff9ff06f	jal x0 -8	j loop	t1 (x6) 0
0x00b58633	add x12 x11 x11	add x12, x11, x11	t2 (x7) o
0x00000013	addi x0 x0 0	nop	s0 (x8) o
			s1 (x9) o
			a0 (x10) 2
			al (x11) 0
			a2 (x12) o
			a3 (x13) 0
Machine Code	Basic Code	Original Code	ra (xl) o
0x00200513	addi x10 x0 2	addi x10, x0, 2	sp (x2) 2147483632
0x00400593	addi x11 x0 4	addi x11, x0, 4	gp (x3) 268435456
0x00b50663	beq x10 x11 12	beq x10, x11, fim	tp (x4) 0
0x00a50533	add x10 x10 x10	add x10, x10, x10	t0 (x5)
0xff9ff06f	ja1 x0 -8	j loop	t1 (x6) 0
0x00b58633	add x12 x11 x11	add x12, x11, x11	t2 (x7) o
0x00000013	addi x0 x0 0	nop	
0,00000013	addr wo wo o	nop	s0 (x8)
			s1 (x9)
			a0 (x10) 2
			al (x11) 4
			a2 (x12) o
			a3 (x13) 0
No. No. of the	Police de la		a3 (x13) o ra (x1) o
	Basic Code	Original Code	ra (x1) o
0x00200513	addi x10 x0 2	addi x10, x0, 2	ra (x1) 0 sp (x2) 2147483432
0x00200513 0x00400593	addi x10 x0 2	addi x10, x0, 2 addi x11, x0, 4	xa (x1) 0
0x00200513 0x00400593 0x00b50663	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim	ra (x1) 0 sp (x2) 2147463632 gp (x3) 244435456 tp (x4) 0
0x00200513 0x00400593 0x00b50663 0x00a50533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10	ra (x1) 0 sp (x2) 2147463632 gp (x3) 24443454 tp (x4) 0 t0 (x5) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xfffff06f	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop	ra (x1) 0 sp (x2) 2147463632 gp (x3) 244435456 tp (x4) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10	ra (x1) 0 sp (x2) 2147463632 gp (x3) 24443454 tp (x4) 0 t0 (x5) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop	xa (x1) 0 sp (x2) (2147483632 gp (x3) (24455456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1)
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1) 0 sp (x2) 2147483632 gp (x3) 244435454 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) 0 ap (x2) 2147483032 gp (x3) 224435454 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0 a1 (x9) 0 a0 (x10) 2
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) 0 ap (x2) 2147483032 gp (x3) 224435454 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0 a1 (x9) 0 a0 (x10) 2 a1 (x11) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) 0 ap (x2) 2147453033 gp (x3) 224435454 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0 a1 (x9) 0 a1 (x1) 0 a2 (x12) 0
Machine Code 0x00200513 0x00400593 0x00b30663 0x00a50533 0xff9ff06f 0x00b58633 0x00000013	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) 0 sp (x2) 2147453022 gp (x3) 224425456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 s0 (x8) 0 s1 (x9) 0 a0 (x10) 2 a1 (x11) 0 a2 (x12) 0 a3 (x13) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jai x0 -8 add x12 x11 x11	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1) 0
0x00200513 0x00400533 0x00450663 0x00a50533 0xff9ff06f 0x00b58633 0x00000013	addi x10 x0 2 addi xil x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8 add x12 x11 x11 addi x0 x0 0	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop	ra (x1) 0 sp (x2) 2147453022 gp (x3) 224425456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 s0 (x8) 0 s1 (x9) 0 a0 (x10) 2 a1 (x11) 0 a2 (x12) 0 a3 (x13) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633 0x00000013	addi x10 x0 2 addi xii x0 4 beq x10 x11 12 add x10 x10 x10 Jai x0 -8 add x12 x11 x11 addi x0 x0 0	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code	xa (x1) 0
0x00200513 0x00400593 0x00b30663 0x00a50533 0xff9ff06f 0x00b58633 0x00000013	addi x10 x0 2 addi xii x0 4 beq x10 x11 12 add x10 x10 x10 Jai x0 -8 add x12 x11 x11 addi x0 x0 0	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2	xa (x1) 0
0x00200513 0x00400593 0x00b30663 0x00a50533 0xff9ff06f 0x00b58633 0x00000013	addi x10 x0 2 addi xii x0 4 beq x10 x11 12 add x10 x10 x10 Jai x0 -8 add x12 x11 x11 addi x0 x0 0 Basic Code addi x10 x0 2 addi x11 x0 4	addi x10, x0, 2 xddi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4	xa (x1) 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633 0x00000013 Machine Code 0x00200513 0x00400593	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11 addi x0 x0 0 Basic Code addi x10 x0 2 addi x11 x0 4	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fin add x10, x10, x10	xa (x1) 0
0x00200513 0x00400593 0x00400593 0x00050663 0x00050663 0x00000013 Machine Code 0x00200513 0x00400593 0x00400593 0x00400593 0x0050663 0x00400533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11 addi x0 x0 0 Basic Code addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fin add x10, x10, x10 j loop	xa (x1) 0
0x00200513 0x00400593 0x00400593 0x00050663 0x00050663 0x00058633 0x00000013 Machine Code 0x00200513 0x00400593 0x00400593 0x00400593 0x00400593 0x00400593	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 Basic Code addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 leq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1) 0
0x00200513 0x00400593 0x00400593 0x00050663 0x00050663 0x00000013 Machine Code 0x00200513 0x00400593 0x00400593 0x00400593 0x0050663 0x00400533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11 addi x0 x0 0 Basic Code addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fin add x10, x10, x10 j loop	xa (x1) 0
0x00200513 0x00400593 0x00400593 0x00050663 0x00050663 0x00058633 0x00000013 Machine Code 0x00200513 0x00400593 0x00400593 0x00400593 0x00400593 0x00400593	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 Basic Code addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 leq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1) 0
0x00200513 0x00400593 0x00400593 0x00050663 0x00050663 0x00058633 0x00000013 Machine Code 0x00200513 0x00400593 0x00400593 0x00400593 0x00400593 0x00400593	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 Basic Code addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 leq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1) 0
0x00200513 0x00400593 0x00400593 0x00050663 0x00050663 0x00058633 0x00000013 Machine Code 0x00200513 0x00400593 0x00400593 0x00400593 0x00400593 0x00400593	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 Basic Code addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11 nop Original Code addi x10, x0, 2 addi x11, x0, 4 leq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	xa (x1) 0

Machine Code	Basic Code	Original Code	ra (x1)	
0x00200513	addi x10 x0 2	addi x10, x0, 2	sp (x2) 2147483632	
0x00400593	addi x11 x0 4	addi x11, x0, 4	gp (x3) 268435456	
0x00b50663	beq x10 x11 12	beq x10, x11, fim	tp (x4) 0	
0x00a50533	add x10 x10 x10	add x10, x10, x10	t0 (x5) 0	
0xff9ff06f	jal x0 -8	j loop	t1 (x6) 0	
0x00b58633	add x12 x11 x11	add x12, x11, x11	t2 (x7) o	
0x0000013	addi x0 x0 0	nop	s0 (x8) o	
			s1 (x9) o	
			a0 (x10) 2	
			al (x11) 4	
			a2 (x12) o	
			a3 (x13)	
			a3 (x13) 0 ra (x1) 0	
Machine Code	Basic Code	Original Code	ra (x1) 0	
0x00200513	addi x10 x0 2	addi x10, x0, 2	ra (x1) 0 sp (x2) 2147425322	
0x00200513 0x00400593	addi x10 x0 2 addi x11 x0 4	addi x10, x0, 2 addi x11, x0, 4	ra (x1) ○ sp (x2) 214948832 gp (x3) 224838456	
0x00200513 0x00400593 0x00b50663	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim	ra (x1) 0 sp (x2) 2141949492 gp (x3) 264434545 tp (x4) 0	
0x00200513 0x00400593 0x00b50663 0x00a50533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10	ra (x1) 0 sp (x2) 216765012 gp (x3) 26815456 tp (x4) 0 t0 (x5) 0	
0x00200513 0x00400593 0x00b50663 0x00a50533 0xfffff06f	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 3a1 x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 3 loop	ra (x1) 0 sp (x2) 210040412 gp (x3) 20403456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0	
0x00200513 0x00400593 0x00b50663 0x00a50533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 3 loop add x12, x11, x11	ra (x1) 0 sp (x2) 21445452 gp (x3) 24445456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0	
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 101 x0 -1 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 3 loop	ra (x1) 0 ap (x2) 214745912 gp (x3) 24455456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0	
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 101 x0 -1 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 3 loop add x12, x11, x11	ra (x1) 0 ap (x2) 214745912 gp (x3) 25445456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0 a1 (x9) 0	
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 101 x0 -1 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 3 loop add x12, x11, x11	ra (x1)	
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 101 x0 -1 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 3 loop add x12, x11, x11	ra (x1) 0 ap (x2) 214745912 gp (x3) 25445456 tp (x4) 0 t0 (x5) 0 t1 (x6) 0 t2 (x7) 0 a0 (x8) 0 a1 (x9) 0	

Machine Code	Basic Code	Original Code	ra (x1)	0
0x00200513	addi x10 x0 2	addi x10, x0, 2	sp (x2)	2147483632
0x00400593	addi x11 x0 4	addi x11, x0, 4	gp (x3)	268435456
0x00b50663	beq x10 x11 12	beq x10, x11, fim	tp (x4)	
0x00a50533	add x10 x10 x10	add x10, x10, x10	t0 (x5)	
0xff9ff06f	jal x0 -8	j 100p	t1 (x6)	
0x00b58633	add x12 x11 x11	add x12, x11, x11	t2 (x7)	
0x00000013	addi x0 x0 0	nop	s0 (x8)	
			s1 (x9)	
			a0 (x10)	4
			al (x11)	4
			a2 (x12)	
			a3 (x13)	
Machine Code	Basic Code	Original Code	a3 (x13)	
Machine Code	Basic Code addi x10 x0 2	Original Code	ra (x1)	
			ra (x1) sp (x2)	0
0x00200513	addi x10 x0 2	addi x10, x0, 2	ra (x1) sp (x2) 2	0 2147483632 284438456
0x00200513 0x00400593	addi x10 x0 2 addi x11 x0 4	addi x10, x0, 2 addi x11, x0, 4	ra (x1) c sp (x2) 2 gp (x3) 2	0 2241463632 22413836 0
0x00200513 0x00400593 0x00b50663	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim	ra (x1) a sp (x2) 2 gp (x3) 2 tp (x4) a	0 22411435432 2241134343 0
0x00200513 0x00400593 0x00b50663 0x00a50533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10	ra (x1) sp (x2) gp (x3) tp (x4) t0 (x5)	0 2241483432 22413454 0 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xfffff06f	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10	ra (x1) sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6)	0 2341483432 224433454 0 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xfffff06f 0x00b56633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) c sp (x2) 2 gp (x3) 2 tp (x4) c t0 (x5) c t1 (x6) c t2 (x7) c	0 2341483532 26443555 0 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xfffff06f 0x00b56633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) c sp (x2) 2 gp (x3) 2 tp (x4) c t0 (x5) c t1 (x6) c t2 (x7) c s0 (x8) c	0 2341483832 264433456 0 0 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f 0x00b56633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) c sp (x2) 2 gp (x3) 2 tp (x4) c t1 (x6) c t2 (x7) c s0 (x8) c s1 (x9) c	0 2147483832 264438456 0 0 0 0 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xfffff06f 0x00b56633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	ra (x1) c sp (x2) 2 gp (x3) 2 tp (x4) 6 t0 (x5) 6 t1 (x6) 6 t2 (x7) 6 s0 (x8) 6 s1 (x9) 6 a0 (x10) 4	0 2147483832 264435456 0 0 0 0 0 0

Machine Code	Basic Code	Original Code	ra (x1)	o
0x00200513	addi x10 x0 2	addi x10, x0, 2	sp (x2)	2147483632
0x00400593	addi x11 x0 4	addi x11, x0, 4	gp (x3)	268435456
0x00b50663	beq x10 x11 12	beq x10, x11, fim	tp (x4)	0
0x00a50533	add x10 x10 x10	add x10, x10, x10	t0 (x5)	0
0xff9ff06f	ja1 x0 -8	j loop	t1 (x6)	0
0x00b58633	add x12 x11 x11	add x12, x11, x11	t2 (x7)	0
0x00000013	addi x0 x0 0	nop	s0 (x8)	0
			s1 (x9)	0
			a0 (x10)	4
			al (x11)	4
			a2 (x12)	8
			a3 (x13)	0
Machine Code	Basic Code	Original Code	ra (x1)	0
Machine Code 0x00200513	Basic Code addi x10 x0 2	Original Code addi x10, x0, 2	ra (x1)	0 2147683632
0x00200513	addi x10 x0 2	addi x10, x0, 2	sp (x2)	2147483632
0x00200513 0x00400593	addi x10 x0 2 addi x11 x0 4	addi x10, x0, 2 addi x11, x0, 4	sp (x2)	2147463432 268435456
0x00200513 0x00400593 0x00b50663	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim	sp (x2) gp (x3) tp (x4)	2347495632 26443565
0x00200513 0x00400593 0x00b50663 0x00a50533	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10	sp (x2) gp (x3) tp (x4) t0 (x5)	23.06435152 264435156 0
0x00200513 0x00400593 0x00b50663 0x00a50533 0xff9ff06f	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 jal x0 -8	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop	sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6)	224543555 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
0x00200513 0x00400593 0x00b50663 0x00x50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6) t2 (x7)	21443552
0x00200513 0x00400593 0x00b50663 0x00x50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6) t2 (x7) s0 (x8)	
0x00200513 0x00400593 0x00b50663 0x00x50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6) t2 (x7) s0 (x8) s1 (x9)	
0x00200513 0x00400593 0x00b50663 0x00x50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6) t2 (x7) s0 (x8) s1 (x9) a0 (x10) a1 (x11)	
0x00200513 0x00400593 0x00b50663 0x00x50533 0xff9ff06f 0x00b58633	addi x10 x0 2 addi x11 x0 4 beq x10 x11 12 add x10 x10 x10 ja1 x0 -8 add x12 x11 x11	addi x10, x0, 2 addi x11, x0, 4 beq x10, x11, fim add x10, x10, x10 j loop add x12, x11, x11	sp (x2) gp (x3) tp (x4) t0 (x5) t1 (x6) t2 (x7) s0 (x8) s1 (x9)	