

I spent 2h for this lab.

div9(15):

code:

```
1 main:
2 addi a0, zero, 15
3 addi t0, zero, 9 # t0 = 9
4 addi a1, zero, 3 # a1 = 3
5 addi t1, zero, a0 # t1 = a0
6 addi t2, zero, 8 # t2 = 8
7 j subtract # call function
8
9 subtract:
10 sub t1, t1, t0 # t1 = a0 - 9
11 beq t1, zero, equal # t1 = h + i
12 ble t1, t2, nequal # 9 > t1 nequal
13 j subtract # subtract again
14
15 equal:
16 addi a0, zero, 1
17 j end
18
19 nequal:
20 addi a0, zero, 0
21 j end
22
23 end:
24 #finished
```

div(15):

Run Step Prev Reset Dump

Machine Code	Basic Code	Original Code
0x00f00513	addi x10 x0 15	addi a0, zero, 15
0x00900293	addi x5 x0 9	addi t0, zero, 9 # t0 = 9
0x00300593	addi x11 x0 3	addi a1, zero, 3 # a1 = 3
0x00a00333	add x6 x0 x10	add t1, zero, a0 # t1 = a0
0x00800393	addi x7 x0 8	addi t2, zero, 8 # t2 = 8
0x0040006f	jai x0 4	j subtract # call function
0x00530333	sub x6 x6 x5	sub t1, t1, t0 # t1 = a0 - 9
0x00030663	beq x6 x0 12	beq t1, zero, equal # t1 = h + i
0x0063d863	bge x7 x6 16	ble t1, t2, nequal # 9 > t1 nequal
0xfffff06f	jai x0 -12	j subtract # subtract again
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00c0006f	jai x0 12	j end
0x00000513	addi x10 x0 0	addi a0, zero, 0
0x0040006f	jai x0 4	j end

console output

Registers Memory

zero	0x00000000
ra (x1)	0x00000000
sp (x2)	0x7fffffff
gp (x3)	0x10000000
tp (x4)	0x00000000
t0 (x5)	0x00000009
t1 (x6)	0x00000004
t2 (x7)	0x00000008
a0 (x8)	0x00000000
a1 (x9)	0x00000003
a2 (x10)	0x00000000
a3 (x11)	0x00000003
a4 (x12)	0x00000000
a5 (x13)	0x00000000
a6 (x14)	0x00000000
a7 (x15)	0x00000000
a8 (x16)	0x00000000
a9 (x17)	0x00000000

Display Settings Decimal

div(81):

Run Step Prev Reset Dump

Machine Code	Basic Code	Original Code
0x05100513	addi x10 x0 81	addi a0, zero, 81
0x00900293	addi x5 x0 9	addi t0, zero, 9 # t0 = 9
0x00300593	addi x11 x0 3	addi a1, zero, 3 # a1 = 3
0x00a00333	add x6 x0 x10	add t1, zero, a0 # t1 = a0
0x00800393	addi x7 x0 8	addi t2, zero, 8 # t2 = 8
0x0040006f	jai x0 4	j subtract # call function
0x00530333	sub x6 x6 x5	sub t1, t1, t0 # t1 = a0 - 9
0x00030663	beq x6 x0 12	beq t1, zero, equal # t1 = h + i
0x0063d863	bge x7 x6 16	ble t1, t2, nequal # 9 > t1 nequal
0xfffff06f	jai x0 -12	j subtract # subtract again
0x00100513	addi x10 x0 1	addi a0, zero, 1
0x00c0006f	jai x0 12	j end
0x00000513	addi x10 x0 0	addi a0, zero, 0
0x0040006f	jai x0 4	j end

console output

Registers Memory

zero	0x00000000
ra (x1)	0x00000000
sp (x2)	0x7fffffff
gp (x3)	0x10000000
tp (x4)	0x00000000
t0 (x5)	0x00000009
t1 (x6)	0x00000004
t2 (x7)	0x00000008
a0 (x8)	0x00000000
a1 (x9)	0x00000003
a2 (x10)	0x00000000
a3 (x11)	0x00000003
a4 (x12)	0x00000000
a5 (x13)	0x00000000
a6 (x14)	0x00000000
a7 (x15)	0x00000000
a8 (x16)	0x00000000
a9 (x17)	0x00000000

Display Settings Decimal

bubblesort:
code

```
1 main:
2 j arrayinit
3
4 arrayinit: #initialize array
5 addi s0, zero, -15
6 addi s1, zero, 42
7 addi s2, zero, 73
8 addi s3, zero, 19
9 addi s4, zero, -8
10 addi s5, zero, 24
11 addi s6, zero, 16
12 addi s7, zero, -2
13 addi s8, zero, 99
14 addi s9, zero, -78
15
16 sw s0, 0x400(zero)
17 sw s1, 0x404(zero)
18 sw s2, 0x408(zero)
19 sw s3, 0x40c(zero)
20 sw s4, 0x410(zero)
21 sw s5, 0x414(zero)
22 sw s6, 0x418(zero)
23 sw s7, 0x41c(zero)
24 sw s8, 0x420(zero)
25 sw s9, 0x424(zero)
26
27 addi s5, zero, 21
28 addi s6, zero, 23
29 addi s7, zero, -88
30 addi s8, zero, 49
31 addi s9, zero, 101
32
33 sw s5, 0x428(zero)
34 sw s6, 0x42c(zero)
35 sw s7, 0x430(zero)
36 sw s8, 0x434(zero)
37 sw s9, 0x438(zero)
38
```

memory:

Run Step Prev Reset Dump

Machine Code	Basic Code	Original Code
0x0040006f	jal x0 4	j arrayinit
0xff1100413	addi x8 x0 -15	addi s0, zero, -15
0x02a00493	addi x9 x0 42	addi s1, zero, 42
0x04900913	addi x19 x0 73	addi s2, zero, 73
0x01300993	addi x19 x0 19	addi s3, zero, 19
0xff900a13	addi x20 x0 -8	addi s4, zero, -8
0x01800a93	addi x21 x0 24	addi s5, zero, 24
0x01000b13	addi x22 x0 16	addi s6, zero, 16
0xffe00b93	addi x23 x0 -2	addi s7, zero, -2
0x06300c13	addi x24 x0 99	addi s8, zero, 99
0xf2b200c93	addi x25 x0 -78	addi s9, zero, -78
0x40802023	sw x8 1024(x0)	sw s0, 0x400(zero)
0x40902223	sw x9 1028(x0)	sw s1, 0x404(zero)
0x41202423	sw x19 1032(x0)	sw s2, 0x408(zero)

console output

Registers Memory

Address	+0	+1	+2	+3
0x00000418	19	0	0	0
0x00000414	16	0	0	0
0x00000410	-2	-1	-1	-1
0x0000040c	-8	-1	-1	-1
0x00000408	-15	-1	-1	-1
0x00000404	-78	-1	-1	-1
0x00000400	-88	-1	-1	-1
0x000003fc	0	0	0	0
0x000003f8	0	0	0	0
0x000003f4	0	0	0	0
0x000003f0	0	0	0	0
0x000003ec	0	0	0	0
0x000003e8	0	0	0	0

Jump to -- choose -- Up Down

Display Settings Decimal

Run Step Prev Reset Dump

Machine Code	Basic Code	Original Code
0x0040006f	jal x0 4	j arrayinit
0xff1100413	addi x8 x0 -15	addi s0, zero, -15
0x02a00493	addi x9 x0 42	addi s1, zero, 42
0x04900913	addi x19 x0 73	addi s2, zero, 73
0x01300993	addi x19 x0 19	addi s3, zero, 19
0xff900a13	addi x20 x0 -8	addi s4, zero, -8
0x01800a93	addi x21 x0 24	addi s5, zero, 24
0x01000b13	addi x22 x0 16	addi s6, zero, 16
0xffe00b93	addi x23 x0 -2	addi s7, zero, -2
0x06300c13	addi x24 x0 99	addi s8, zero, 99
0xf2b200c93	addi x25 x0 -78	addi s9, zero, -78
0x40802023	sw x8 1024(x0)	sw s0, 0x400(zero)
0x40902223	sw x9 1028(x0)	sw s1, 0x404(zero)
0x41202423	sw x19 1032(x0)	sw s2, 0x408(zero)

console output

Registers Memory

Address	+0	+1	+2	+3
0x00000448	0	0	0	0
0x00000444	0	0	0	0
0x00000440	0	0	0	0
0x0000043c	0	0	0	0
0x00000438	101	0	0	0
0x00000434	99	0	0	0
0x00000430	73	0	0	0
0x0000042c	49	0	0	0
0x00000428	42	0	0	0
0x00000424	24	0	0	0
0x00000420	23	0	0	0
0x0000041c	21	0	0	0
0x00000418	19	0	0	0

Jump to -- choose -- Up Down

Display Settings Decimal

gcd:
code

```
1 addi a0, zero, 25
2 addi a1, zero, 15
3
4 main:
5 jal bigsmall
6 j finish
7
8 bigsmall:
9 bne a0, a1, swap
10 j gcd
11
12 gcd:
13 addi sp, sp, -12
14 sw a0, 8(sp) # a0 = a
15 sw a1, 4(sp) # a1 = b
16 sw ra, 0(sp)
17 addi t0, zero, 0
18 bgt a0, t0, bothnotzero
19 addi sp, sp, 12
20 jr ra
21
22 bothnotzero:
23 bgt a1, t0, else # a0 or a1 is 0
24 addi sp, sp, 12
25 jr ra
26
27
28 else:
29 add t2, zero, a1
30 rem a1, a0, a1 # b = a mod b
31 add a0, zero, t2 # a = b
32 jal bigsmall
33 lw t0, 8(sp)
34 lw t1, 4(sp)
35 lw ra, 0(sp)
36 addi sp, sp, 12
37 jr ra
38
```

```
9 bne a0, a1, swap
10 j gcd
11
12 gcd:
13 addi sp, sp, -12
14 sw a0, 8(sp) # a0 = a
15 sw a1, 4(sp) # a1 = b
16 sw ra, 0(sp)
17 addi t0, zero, 0
18 bgt a0, t0, bothnotzero
19 addi sp, sp, 12
20 jr ra
21
22 bothnotzero:
23 bgt a1, t0, else # a0 or a1 is 0
24 addi sp, sp, 12
25 jr ra
26
27
28 else:
29 add t2, zero, a1
30 rem a1, a0, a1 # b = a mod b
31 add a0, zero, t2 # a = b
32 jal bigsmall
33 lw t0, 8(sp)
34 lw t1, 4(sp)
35 lw ra, 0(sp)
36 addi sp, sp, 12
37 jr ra
38
39 swap: # swap front and behind element
40 add t0, zero, a0
41 add a0, zero, a1
42 add a1, zero, t0
43 j gcd
44
45 finish:
46
```

gcd(25, 15)

RunStepPrevResetDump

Machine Code	Basic Code	Original Code
0x01900513	addi x10 x0 25	addi a0, zero, 25
0x00f00593	addi x11 x0 15	addi a1, zero, 15
0x008000ef	jal x1 0	jal bigsmall
0x06c000ef	jal x0 108	j finish
0x04a5dc63	bne x11 x10 88	bne a0, a1, swap
0x004000ef	jal x0 4	j gcd
0xff410113	addi x2 x2 -12	addi sp, sp, -12
0x00a12423	sw x10 8(x2)	sw a0, 8(sp) # a0 = a
0x00b12223	sw x11 4(x2)	sw a1, 4(sp) # a1 = b
0x00112023	sw x1 0(x2)	sw ra, 0(sp)
0x00000293	addi x5 x0 0	addi t0, zero, 0
0x00a2c663	blt x5 x10 12	bgt a0, t0, bothnotzero
0x00c10113	addi x2 x2 12	addi sp, sp, 12
0x00008067	jalr x0 x1 0	jr ra

console output

RegistersMemory

zero	0
ra (x1)	12
sp (x2)	2147483632
gp (x3)	242939456
tp (x4)	0
t0 (x5)	25
t1 (x6)	15
t2 (x7)	0
a0 (x8)	0
a1 (x9)	0
a0 (x10)	5
a1 (x11)	0
a2 (x12)	0
a3 (x13)	0
a4 (x14)	0
a5 (x15)	0
a6 (x16)	0
a7 (x17)	0

Display SettingsDecimal

gcd(64,96)

96)

RunStepPrevResetDump

Machine Code	Basic Code	Original Code
0x04000513	addi x10 x0 64	addi a0, zero, 64
0x04000593	addi x11 x0 96	addi a1, zero, 96
0x008000ef	jal x1 8	jal bigsmall
0x06c0006f	jal x0 108	j finish
0x04a5dc63	bge x11 x10 88	ble a0, a1, swap
0x0040006f	jal x0 4	j gcd
0xff410113	addi x2 x2 -12	addi sp, sp, -12
0x00a12423	sw x10 8(x2)	sw a0, 8(sp) # a0 = a
0x00b12223	sw x11 4(x2)	sw a1, 4(sp) # a1 = b
0x00112023	sw x1 0(x2)	sw ra, 0(sp)
0x00000293	addi x5 x0 0	addi t0, zero, 0
0x00a2c663	blt x5 x10 12	bgt a0, t0, bothnotzero
0x00c10113	addi x2 x2 12	addi sp, sp, 12
0x00008067	jalr x0 x1 0	jr ra

console output

RegistersMemory

zero	0
ra (x1)	12
sp (x2)	2147483632
gp (x3)	202435456
tp (x4)	0
t0 (x5)	96
t1 (x6)	64
t2 (x7)	32
s0 (x8)	0
s1 (x9)	0
a0 (x10)	32
a1 (x11)	0
a2 (x12)	0
a3 (x13)	0
a4 (x14)	0
a5 (x15)	0
a6 (x16)	0
a7 (x17)	0

Display SettingsDecimal

gcd(71, 9)

RunStepPrevResetDump

Machine Code	Basic Code	Original Code
0x04700513	addi x10 x0 71	addi a0, zero, 71
0x00900593	addi x11 x0 9	addi a1, zero, 9
0x008000ef	jal x1 8	jal bigsmall
0x06c0006f	jal x0 108	j finish
0x04a5dc63	bge x11 x10 88	ble a0, a1, swap
0x0040006f	jal x0 4	j gcd
0xff410113	addi x2 x2 -12	addi sp, sp, -12
0x00a12423	sw x10 8(x2)	sw a0, 8(sp) # a0 = a
0x00b12223	sw x11 4(x2)	sw a1, 4(sp) # a1 = b
0x00112023	sw x1 0(x2)	sw ra, 0(sp)
0x00000293	addi x5 x0 0	addi t0, zero, 0
0x00a2c663	blt x5 x10 12	bgt a0, t0, bothnotzero
0x00c10113	addi x2 x2 12	addi sp, sp, 12
0x00008067	jalr x0 x1 0	jr ra

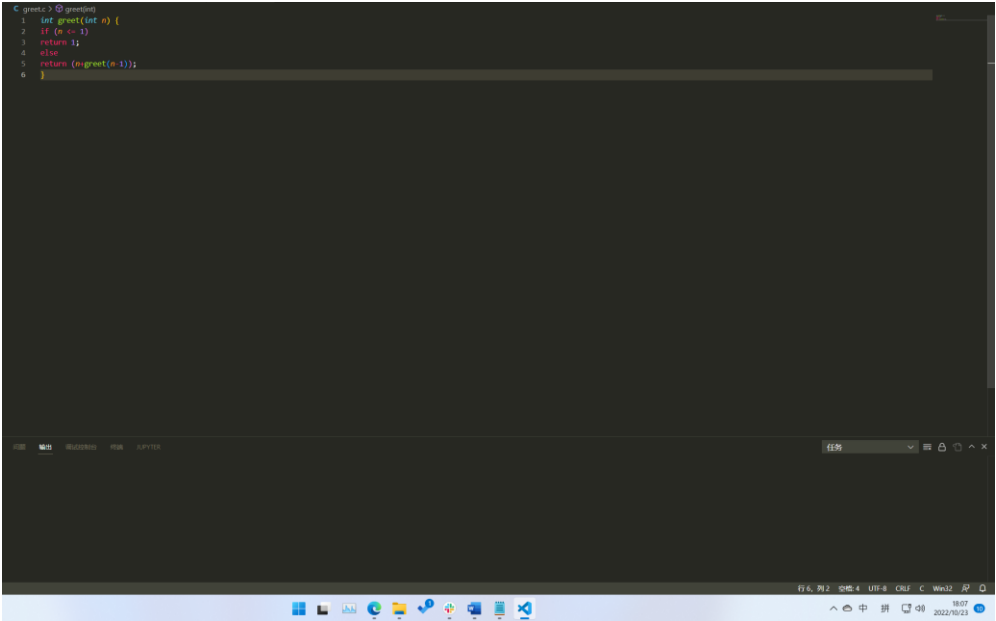
console output

RegistersMemory

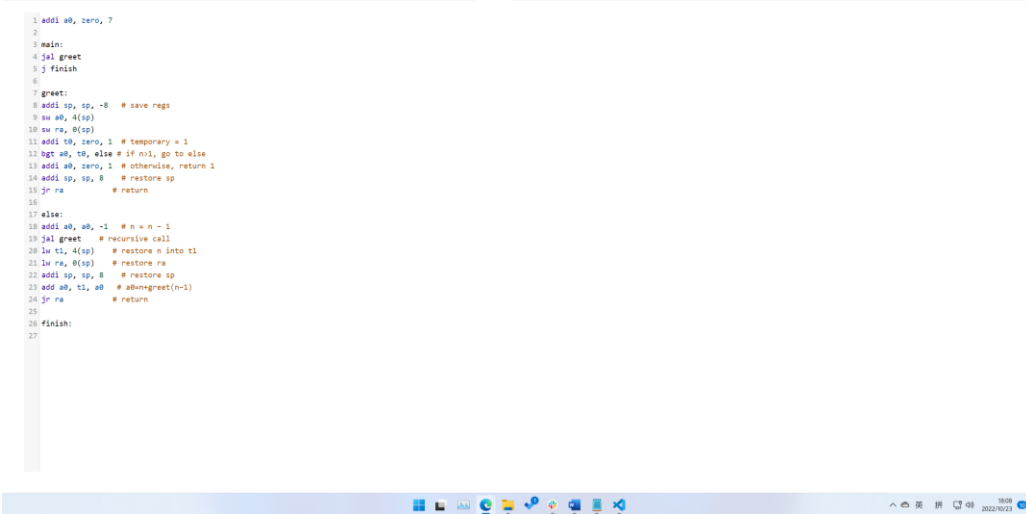
zero	0
ra (x1)	12
sp (x2)	2147483632
gp (x3)	202435456
tp (x4)	0
t0 (x5)	71
t1 (x6)	9
t2 (x7)	1
s0 (x8)	0
s1 (x9)	0
a0 (x10)	1
a1 (x11)	0
a2 (x12)	0
a3 (x13)	0
a4 (x14)	0
a5 (x15)	0
a6 (x16)	0
a7 (x17)	0

Display SettingsDecimal

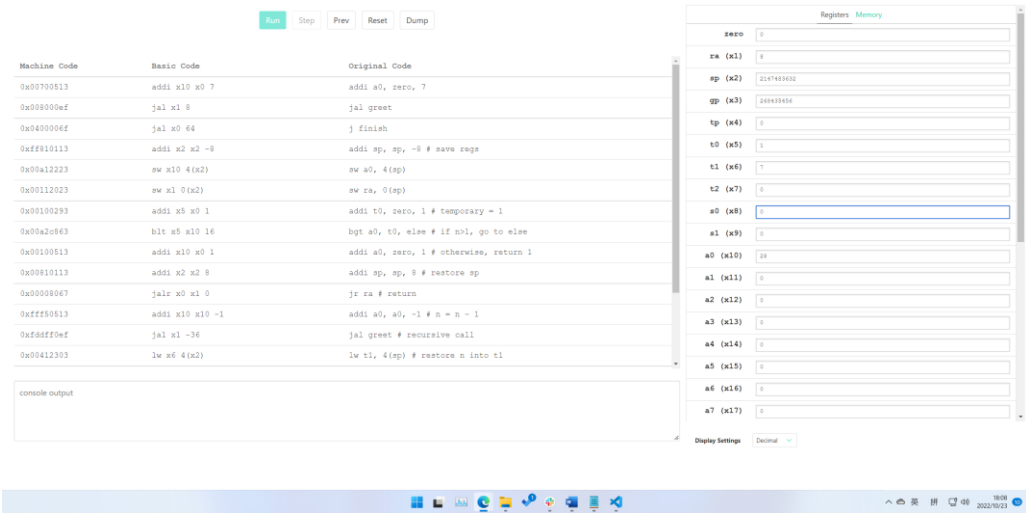
greet
C code



Assembly



greet(7)



```
greet(10)
```

Run
Step
Prev
Reset
Dump

Registers
Memory

Machine Code	Basic Code	Original Code
0x00a00513	addi x10 x0 10	addi a0, zero, 10
0x008000ef	jal x1 8	jal greet
0x0400006f	jal x0 64	j finish
0xfef910113	addi x2 x2 -8	addi sp, sp, -8 # save regs
0x00a12223	sw x10 4(x2)	sw a0, 4(sp)
0x00112023	sw x1 0(x2)	sw ra, 0(sp)
0x00100293	addi x5 x0 1	addi t0, zero, 1 # temporary = 1
0x00a2c843	blt x5 x10 16	bgt a0, t0, else # if n>1, go to else
0x00100513	addi x10 x0 1	addi a0, zero, 1 # otherwise, return 1
0x00810113	addi x2 x2 8	addi sp, sp, 8 # restore sp
0x00008047	jalr x0 x1 0	jcr ra # return
0xffff90513	addi x10 x10 -1	addi a0, a0, -1 # n = n - 1
0xf8dfff0ef	jal x1 -36	jal greet # recursive call
0x00412303	lw x6 4(x2)	lw t1, 4(sp) # restore n into t1

console output

Registers
Memory

Registers
Memory

Register	Value
zero	0
ra (x1)	8
sp (x2)	2147483632
gp (x3)	268435456
tp (x4)	0
t0 (x5)	1
t1 (x6)	10
t2 (x7)	0
a0 (x8)	0
a1 (x9)	0
a0 (x10)	55
a1 (x11)	0
a2 (x12)	0
a3 (x13)	0
a4 (x14)	0
a5 (x15)	0
a6 (x16)	0
a7 (x17)	0

Display Settings

Decimal