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Εργαστήριο 9ο:

9.9 (1):

1. IF(fetch) προσκόμιση της εντολής από την μνήμη.
2. ID(instruction decode/register file read) γίνεται η αναίγνωση των καταχωρητών καθώς και αποκωδικοποίηση της εντολής, καθώς η μορφή που έχουν οι εντολές στον MIPS γίνεται ταυτόχρονα ανάγνωση και αποκωδικοποίηση.
3. EX(execute/address calculation) εκτέλεση της λειτουργίας ή γίνεται υπολογισμός μιας διεύθυνσης.
4. MEM (memory access) γίνεται μεταβαση και προσπέλαση ενός στοιχείου στη μνήμη δεδομένων.
5. WB(write back) γίνεται εγγραφή αποτελέσματος σε έναν καταχωρητή.

(2) Οι βαθμίδες 1, 2 και 3 είναι χρήσιμες για όλες τις εντολές.

(3)α) Μόνο η 4η βαθμίδα δεν κάνει τίποτα από εντολές αρ. πράξεων

β) Η βαθμίδα WB δεν κάνει καμία χρήσιμο για τις εντολές store;

Ripes

File Help

100 ms

9.9 (4)

Editor

Processor

Memory

Source code

```
1 addi x5, x0, 1
2 addi x6, x0 ,2
3
4 add x7, x6, x5
5 add x8, x7, x7
6
7 sw x8, 100(x0)
8 lw x9, 100(x0)
```

Executable code

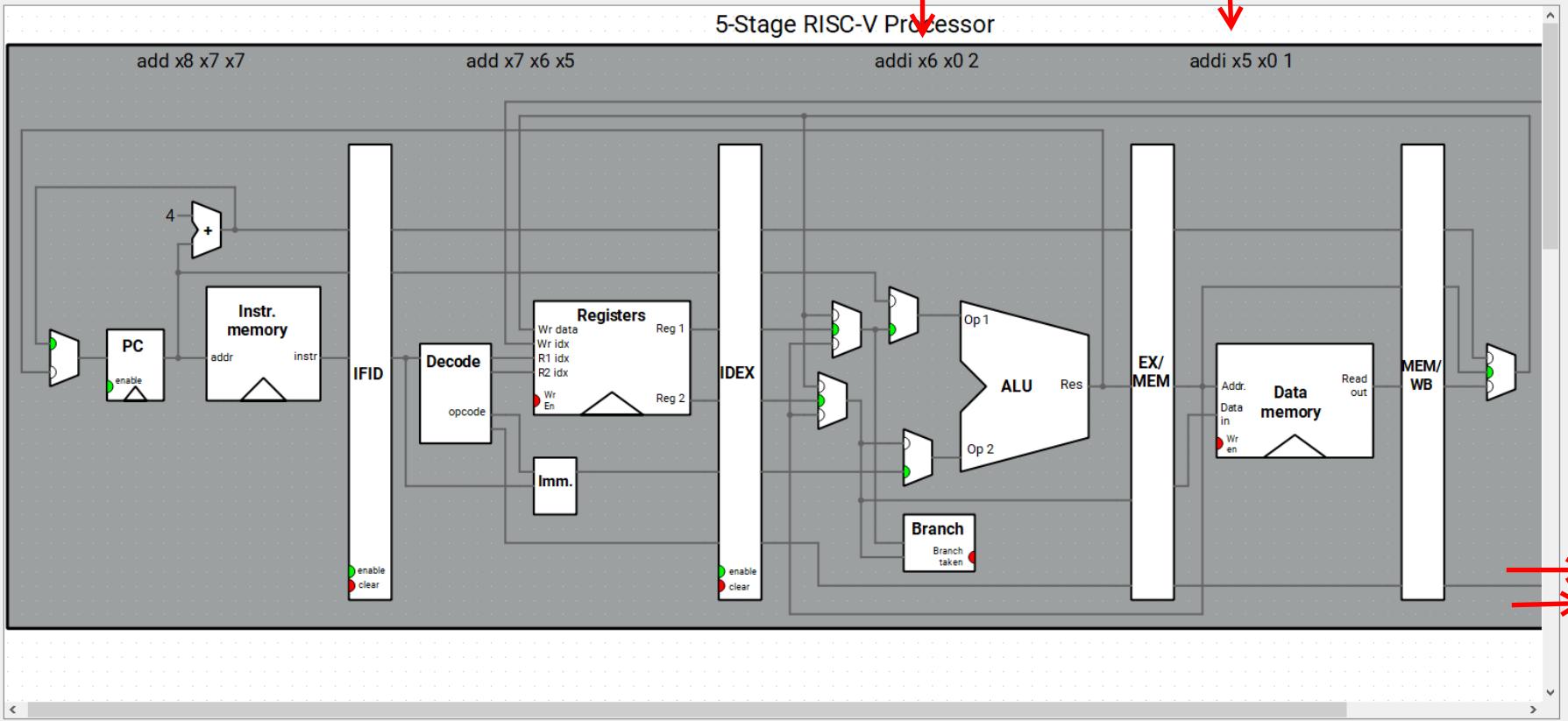
View mode: Binary Disassembled

```
0:      00100293        addi x5 x0 1
4:      00200313        addi x6 x0 2
8:      005303b3        add x7 x6 x5
c:      00738433        add x8 x7 x7
10:     06802223        sw x8 100(x0)
14:     06402483        lw x9 100(x0)
```

Ripes

File Help

9.9 (4α)



Registers

Name	Alias	Value
x0	zero	0x00000000
x1	ra	0x00000000
x2	sp	0x7ffffff0
x3	gp	0x10000000
x4	tp	0x00000000
x5	t0	0x00000000
x6	t1	0x00000000
x7	t2	0x00000000
x8	s0	0x00000000
x9	s1	0x00000000
x10	a0	0x00000000
x11	a1	0x00000000
x12	a2	0x00000000
x13	a3	0x00000000

Display type: Hex

Instruction memory

BP	Addr	Stage	Instruction
☐	0x0	MEM	addi x5 x0 1
☐	0x4	EX	addi x6 x0 2
☐	0x8	ID	add x7 x6 x5
☐	0xc	IF	add x8 x7 x7
☐	0x10		sw x8 100(x0)
☐	0x14		lw x9 100(x0)

Output

Εντολές μεταξύ καταχωρητών και σταθερών.

Statistics

Cycles:	3
Instrs. retired:	0
CPI:	
IPC:	

Ripes

File Help

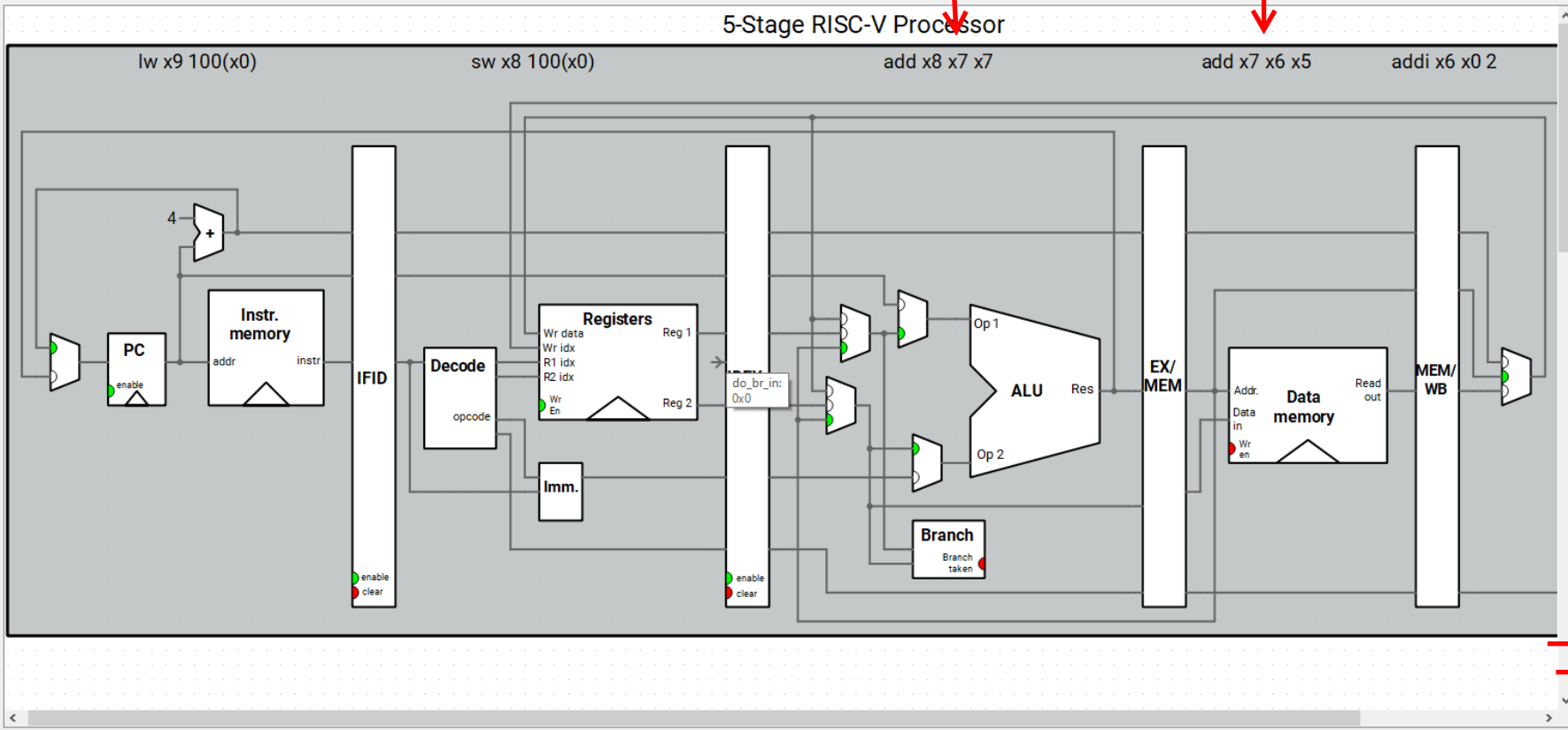
100 ms

9.9 (4β)

Editor

Processor

Memory



Registers

Name	Alias	Value
x0	zero	0x00000000
x1	ra	0x00000000
x2	sp	0x7ffffff0
x3	gp	0x10000000
x4	tp	0x00000000
x5	t0	0x00000001
x6	t1	0x00000000
x7	t2	0x00000000
x8	s0	0x00000000
x9	s1	0x00000000
x10	a0	0x00000000
x11	a1	0x00000000
x12	a2	0x00000000
x13	a3	0x00000000

Display type: Hex

Instruction memory

BP	Addr	Stage	Instruction
☐	0x0		addi x5 x0 1
☐	0x4	WB	addi x6 x0 2
☐	0x8	MEM	add x7 x6 x5
☐	0xc	EX	add x8 x7 x7
☐	0x10	ID	sw x8 100(x0)
☐	0x14	IF	lw x9 100(x0)

Output

Εντολές αριθμητικών πράξεων.

Statistics

Cycles:	5
Instrs. retired:	1
CPI:	5
IPC:	0.2

Ripes

File Help

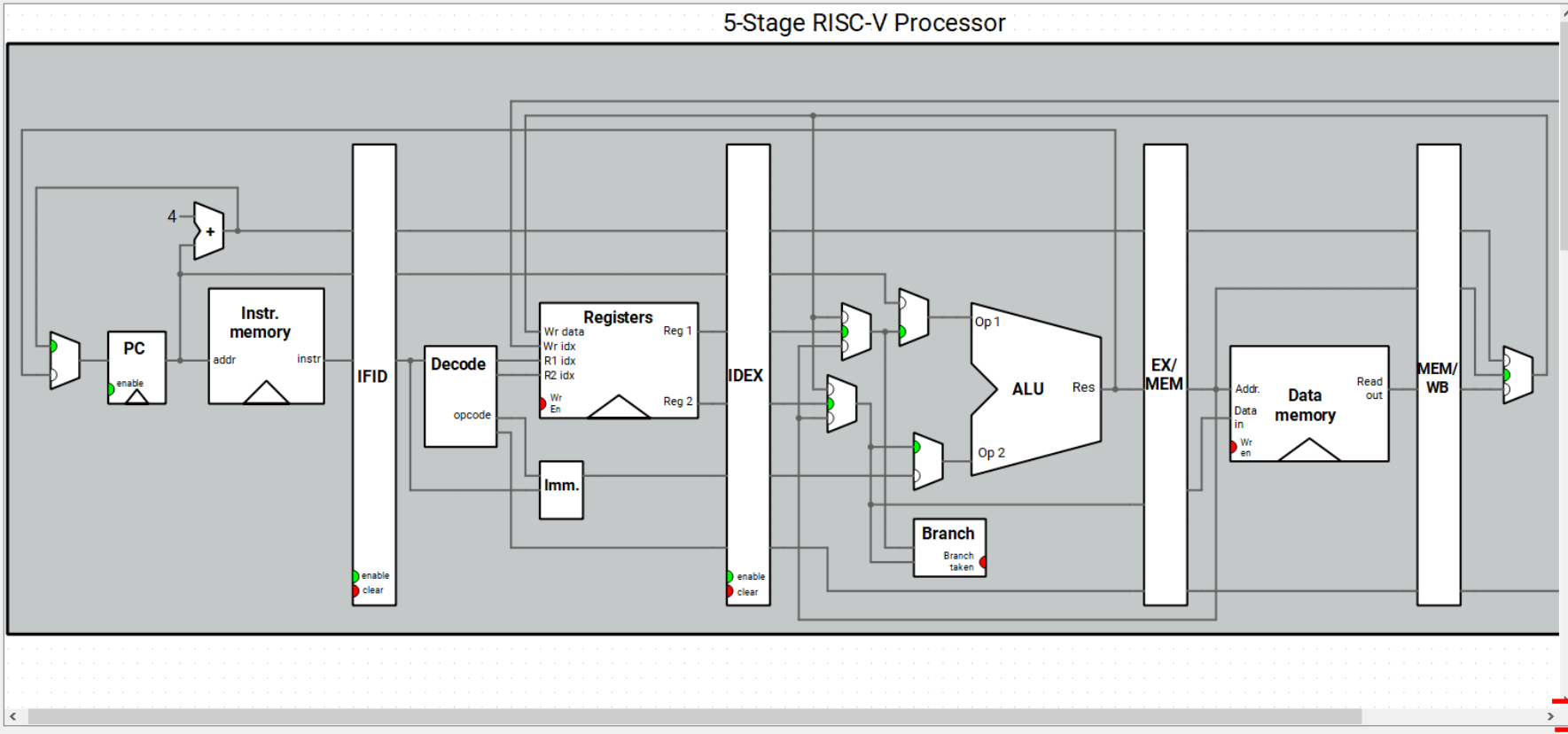
100 ms

9.9 (4γ)

Editor

Processor

Memory



Registers

Name	Alias	Value
x0	zero	0x00000000
x1	ra	0x00000000
x2	sp	0x7ffffff0
x3	gp	0x10000000
x4	tp	0x00000000
x5	t0	0x00000001
x6	t1	0x00000002
x7	t2	0x00000003
x8	s0	0x00000006
x9	s1	0x00000006
x10	a0	0x00000000
x11	a1	0x00000000
x12	a2	0x00000000
x13	a3	0x00000000

Display type: Hex

Instruction memory

BP	Addr	Stage	Instruction
☐	0x0		addi x5 x0 1
☐	0x4		addi x6 x0 2
☐	0x8		add x7 x6 x5
☐	0xc		add x8 x7 x7
☐	0x10		sw x8 100(x0)
☐	0x14		lw x9 100(x0)

Output

Εντολές load και store.

Statistics

Cycles:	10
Instrs. retired:	6
CPI:	1.67
IPC:	0.6

Ripes

File Help

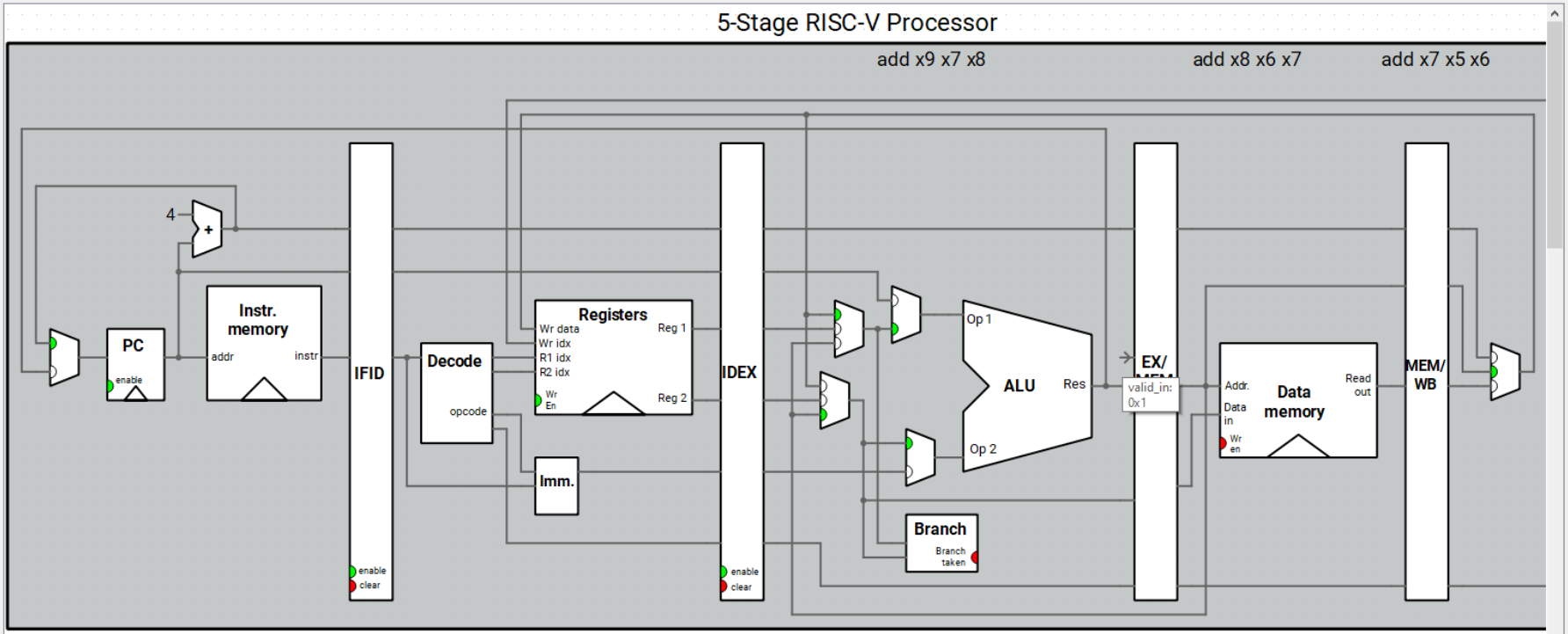
100 ms

9.9 (5)

Editor

Processor

Memory



Registers

Name	Alias	Value
x0	zero	0x00000000
x1	ra	0x00000000
x2	sp	0x7ffffff0
x3	gp	0x10000000
x4	tp	0x00000000
x5	t0	0x00000000
x6	t1	0x00000000
x7	t2	0x00000000
x8	s0	0x00000000
x9	s1	0x00000000
x10	a0	0x00000000
x11	a1	0x00000000
x12	a2	0x00000000
x13	a3	0x00000000

Display type: Hex

Instruction memory

BP	Addr	Stage	Instruction
☐	0x0	WB	add x7 x5 x6
☐	0x4	MEM	add x8 x6 x7
☐	0x8	EX	add x9 x7 x8

Output

Statistics

Cycles:	4
Instrs. retired:	0
CPI:	
IPC:	

Ripes

File Help

100 ms

9.9 (6)

Editor

Processor

Memory

Source code

```
1  .data
2  argument1:   .word 1
3  argument2:   .word 2
4  argument3:   .word 3
5  argument4:   .word 4
6  argument5:   .word 5
7
8  .text
9  main:
10
11     la s0, argument1
12
13     lw s1, 0(s0)
14     lw s2, 4(s0)
15
16     add s7, s1, s2
17     sw s7, 16(s0)
18
19     lw s3, 8(s0)
20     sub, s10 , s1 ,s3
21
22     sw s10, 12(s0)
```

Executable code

View mode: Binary Disassembled

```
00000000 <main>:
    0:      10000417        auipc x8 0x65536
    4:      00040413        addi x8 x8 0
    8:      00042483        lw x9 0(x8)
    c:      00442903        lw x18 4(x8)
   10:      01248bb3        add x23 x9 x18
   14:      01742823        sw x23 16(x8)
   18:      00842983        lw x19 8(x8)
   1c:      41348d33        sub x26 x9 x19
   20:      01a42623        sw x26 12(x8)                                    WB
```

Ripes

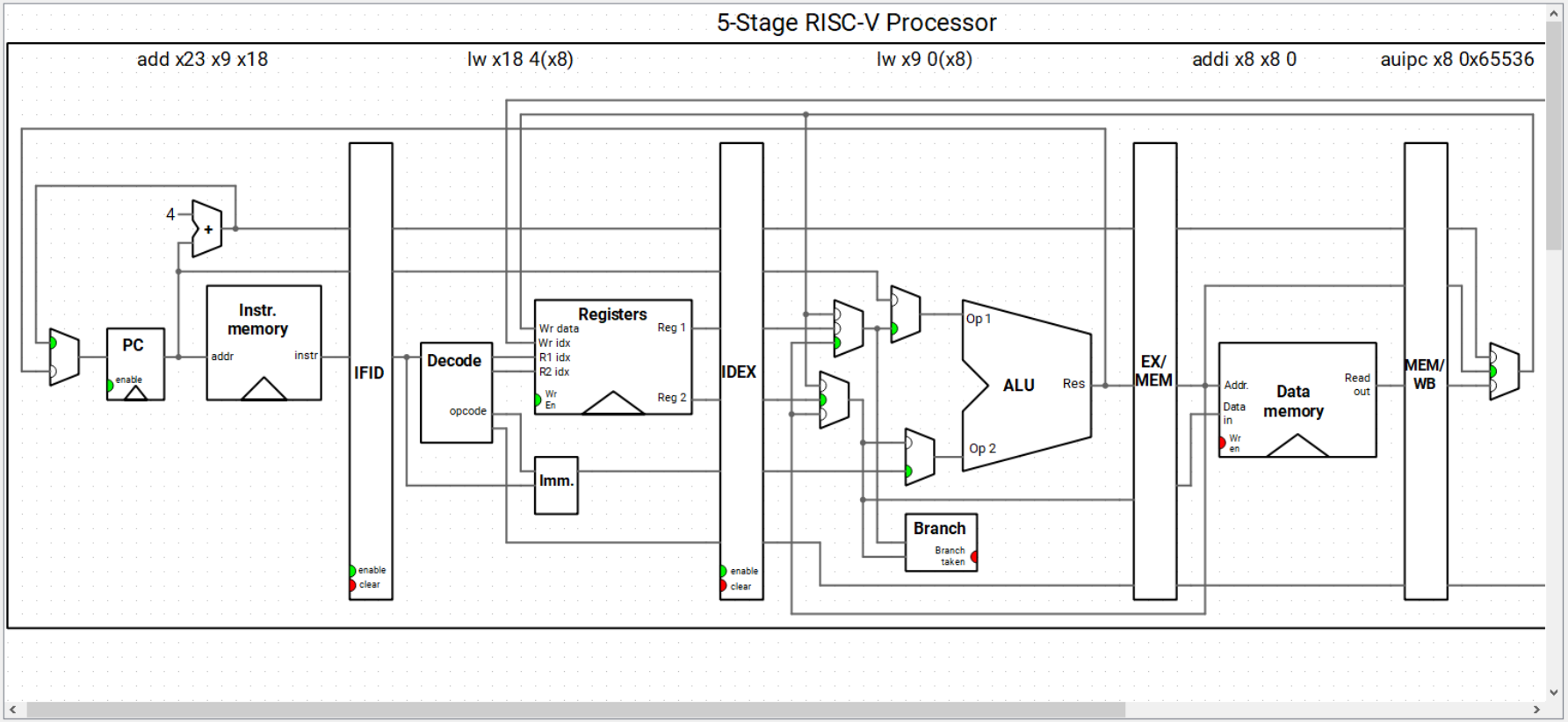
File Help

100 ms

Editor

Processor

Memory



Registers

Name	Alias	Value
x2	sp	0x7ffffff0
x3	gp	0x10000000
x4	tp	0x00000000
x5	t0	0x00000000
x6	t1	0x00000000
x7	t2	0x00000000
x8	s0	0x00000000
x9	s1	0x00000000
x10	a0	0x00000000
x11	a1	0x00000000
x12	a2	0x00000000
x13	a3	0x00000000
x14	a4	0x00000000
x15	a5	0x00000000

Display type: Hex

Instruction memory

BP	Addr	Stage	Instruction
☐	0x0	WB	auipc x8 0x65536
☐	0x4	MEM	addi x8 x8 0
☐	0x8	EX	lw x9 0(x8)
☐	0xc	ID	lw x18 4(x8)
☐	0x10	IF	add x23 x9 x18
☐	0x14		sw x23 16(x8)
☐	0x18		lw x19 8(x8)
☐	0x1c		sub x26 x9 x19
☐	0x20		sw x26 12(x8)

Output

1η Ακολουθία εντολών

Statistics

Cycles:	4
Instrs. retired:	0
CPI:	
IPC:	

Ripes

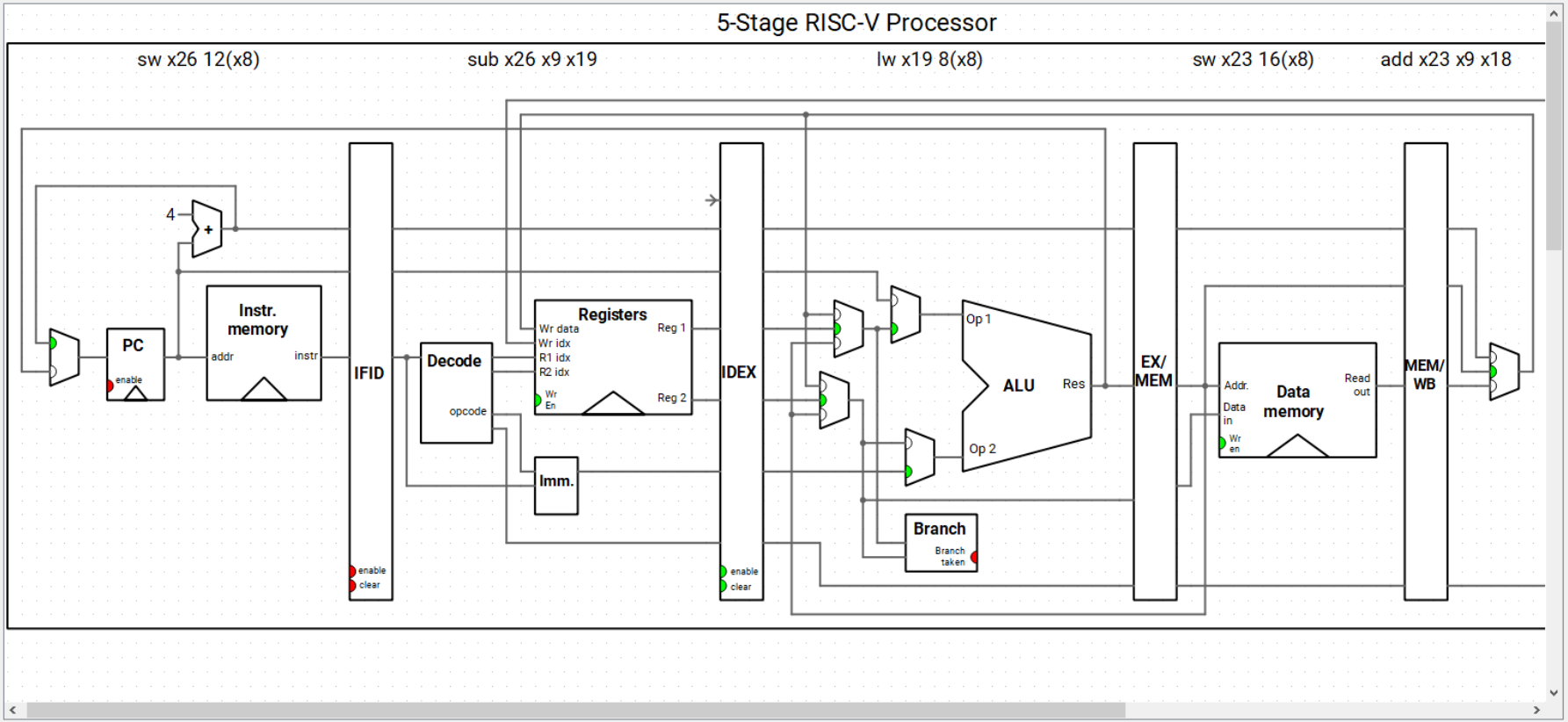
File Help

100 ms

Editor

Processor

Memory



Registers

Name	Alias	Value
x11	a1	0x00000000
x12	a2	0x00000000
x13	a3	0x00000000
x14	a4	0x00000000
x15	a5	0x00000000
x16	a6	0x00000000
x17	a7	0x00000000
x18	s2	0x00000002
x19	s3	0x00000000
x20	s4	0x00000000
x21	s5	0x00000000
x22	s6	0x00000000
x23	s7	0x00000000
x24	s8	0x00000000

Display type: Hex

Instruction memory

BP	Addr	Stage	Instruction
☐	0x0		auipc x8 0x65536
☐	0x4		addi x8 x8 0
☐	0x8		lw x9 0(x8)
☐	0xc		lw x18 4(x8)
☐	0x10	WB	add x23 x9 x18
☐	0x14	MEM	sw x23 16(x8)
☐	0x18	EX	lw x19 8(x8)
☐	0x1c	ID	sub x26 x9 x19
☐	0x20	IF	sw x26 12(x8)

Output

2η Ακολουθία εντολών με lw

Statistics

Cycles:	9
Instrs. retired:	4
CPI:	2.25
IPC:	0.444