

Λύση 3ης άσκησης

Αλγόριθμος Tomasulo χωρίς ROB

Instruction

L.D F0 j k
 0 R1

IF	ID	IS	EX	WB
1				

Busy	Address
Load1	
Load2	
Load3	
Load4	
Load5	

Busy	Address	Qi
Store1		
Store2		
Store3		
Store4		
Store5		

Res. Stations
Clock 1

Time	Name	Busy	Op	Vj	Vk	Qj	Qk
	Add1						
	Add2						
	Add3						
	Add4						
	Mul1						
	Mul2						
	Mul3						
	Mul4						
	Int1						
	Int2						
	Int3						
	Int4						
	Int5						

Reg. res.status

Qi	F0	F2	F4	F6	F8	R1

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #4
 BNEZ R1 foo

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2			
ADD.D	F2	F0	F6	2				

	Busy	Address
Load1		
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1			
Store2			
Store3			
Store4			
Store5			

Res. Stations		Busy	Op	Vj	Vk	Qj	Qk
Clock 2	Time						
	Name						
	Add1						
	Add2						
	Add3						
	Add4						
	Mul1						
	Mul2						
	Mul3						
	Mul4						
	Int1						
	Int2						
	Int3						
	Int4						
	Int5						

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi						

```

foo: L.D      F0      0(R1)
      ADD.D   F2      F0      F6
      MUL.D   F4      F0      F2
      DIV.D   F6      F0      F8
      ADD.D   F8      F0      F8
      S.D     F4      1024(R1)
      DADDI   R1      R1      #-4
      BNEZ    R1      foo
  
```

Instruction

		j	k
L.D	F0	0	R1
ADD.D	F2	F0	F6
MUL.D	F4	F0	F2

	IF	ID	IS	EX	WB
	1	2	3		
	2	3			
	3				

	Busy	Address
Load1	Yes	(0+R1)
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1			
Store2			
Store3			
Store4			
Store5			

Clock	Time	Res. Stations
3		

Name	Busy	Op	Vj	Vk	Qj	Qk
Add1						
Add2						
Add3						
Add4						
Mul1						
Mul2						
Mul3						
Mul4						
Int1						
Int2						
Int3						
Int4						
Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	Load1					

Instruction

		j	k
L.D	F0	0	R1
ADD.D	F2	F0	F6
MUL.D	F4	F0	F2
DIV.D	F6	F0	F8

	IF	ID	IS	EX	WB
	1	2	3	4 - 4	
	2	3	4		
	3	4			
	4				

	Busy	Address
Load1	Yes	(0+R1)
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1			
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
4		Add1	Yes	ADD.D		R[F6]	Load1	
		Add2						
		Add3						
		Add4						
		Mul1						
		Mul2						
		Mul3						
		Mul4						
		Int1						
		Int2						
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	Load1	Add1				

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4		
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5			
ADD.D	F8	F0	F8	5				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1			
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
5	5	Add1	Yes	ADD.D	(0+R1)	R[F6]		
		Add2						
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]		Add1	
		Mul2						
		Mul3						
		Mul4						
		Int1						
		Int2						
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul1			

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6	
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6		
ADD.D	F8	F0	F8	5	6			
S.D	F4	1024(R1)		6				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1			
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
6	4	Add1	Yes	ADD.D	(0+R1)	R[F6]		
		Add2						
		Add3						
		Add4						
	15	Mul1	Yes	MUL.D	R[F0]			Add1
		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1						
		Int2						
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul1	Mul2		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4-4	5
ADD.D	F2	F0	F6	2	3	4	6	
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7		
S.D	F4	1024(R1)		6	7			
DADDI	R1	R1	#-4	7				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1			
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
7	3	Add1	Yes	ADD.D	(0+R1)	R[F6]		
	5	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	14	Mul1	Yes	MUL.D	R[F0]			Add1
		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1						
		Int2						
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul1	Mul2	Add2	

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6	
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8	
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8			
BNEZ	R1	foo		8				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
8	2	Add1	Yes	ADD.D	(0+R1)	R[F6]		
	4	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	13	Mul1	Yes	MUL.D	R[F0]			Add1
		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1						
		Int2						
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

- η 2η ADD μπορεί να αρχίσει (Fp-Add pipelined 1cc)

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul1	Mul2	Add2	

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6	
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8	
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9		
BNEZ	R1	foo		8	9			

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
9	1	Add1	Yes	ADD.D	(0+R1)	R[F6]		
	3	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]			Add1
12		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1	Yes	DADDI	R[R1]	-4		
		Int2						
	Int3							
	Int4							
	Int5							

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul1	Mul2	Add2	Int1

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8	
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	
BNEZ	R1	foo		8	9	10		

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
10	0	Add1	Yes	ADD.D	(0+R1)	R[F6]		
	2	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]			Add1
11		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1	Yes	DADDI	R[R1]	-4		
		Int2	Yes	BNEZ				Int1
	Int3							
	Int4							
	Int5							

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul1	Mul2	Add2	Int1

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8	
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	
BNEZ	R1	foo		8	9	10		

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
11	1	Add1	No					
		Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
10	10	Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1	Yes	DADDI	R[R1]	-4		
		Int2	Yes	BNEZ				Int1
Int3								
Int4								
Int5								

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

- CDB conflict για την DADDI

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul1	Mul2	Add2	Int1

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10		

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

- η 1η MUL.D δεν μπορεί να αρχίσει
 (Fp Mul/Div occupied)

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
12	0	Add1	No					
		Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
9	9	Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1	No					
		Int2	Yes	BNEZ	R[R1]			
Int3								
Int4								
Int5								

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul1	Mul2	Add2	

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
13	8	Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
	Mul2	Yes	DIV.D	R[F0]	R[F8]			
	Mul3							
	Mul4							
	Int1	No						
	Int2	Yes	BNEZ	R[R1]				
	Int3							
	Int4							
	Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul1	Mul2		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
14	7	Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3						
		Mul4						
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul1	Mul2		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6 - 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 - 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 - 10	12
BNEZ	R1	foo		8	9	10	13 - 13	14
L.D	F0	0	R1	14	15			
ADD.D	F2	F0	F6	15				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
15	6	Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
	Mul2	Yes	DIV.D	R[F0]	R[F8]			
	Mul3							
	Mul4							
	Int1	No						
	Int2	No						
	Int3							
	Int4							
	Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul1	Mul2		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16		
ADD.D	F2	F0	F6	15	16			
MUL.D	F4	F0	F2	16				

	Busy	Address
Load1	Yes	(0+R1)
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
16	5	Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
	Mul2	Yes	DIV.D	R[F0]	R[F8]			
	Mul3							
	Mul4							
	Int1	No						
	Int2	No						
	Int3							
	Int4							
	Int5							

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	Load1		Mul1	Mul2		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	
ADD.D	F2	F0	F6	15	16	17		
MUL.D	F4	F0	F2	16	17			
DIV.D	F6	F0	F8	17				

	Busy	Address
Load1	Yes	(0+R1)
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
17	4	Add1	Yes	ADD.D			Load1	Mul2
		Add2	No					
		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
	Mul2	Yes	DIV.D	R[F0]	R[F8]			
	Mul3							
	Mul4							
	Int1	No						
	Int2	No						
	Int3							
	Int4							
	Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	Load1	Add1	Mul1	Mul2		

Instruction

		j	k
L.D	F0	0	R1
ADD.D	F2	F0	F6
MUL.D	F4	F0	F2
DIV.D	F6	F0	F8
ADD.D	F8	F0	F8
S.D	F4	1024(R1)	
DADDI	R1	R1	#-4
BNEZ	R1	foo	
L.D	F0	0	R1
ADD.D	F2	F0	F6
MUL.D	F4	F0	F2
DIV.D	F6	F0	F8
ADD.D	F8	F0	F8

IF	ID	IS	EX	WB
1	2	3	4 - 4	5
2	3	4	6 - 10	11
3	4	5		
4	5	6	7	
5	6	7	8 - 12	13
6	7	8		
7	8	9	10 - 10	12
8	9	10	13 - 13	14
14	15	16	17 - 17	18
15	16	17		
16	17	18		
17	18			
18				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
18		Add1	Yes	ADD.D	R[F0]			Mul2
		Add2	No					
		Add3						
		Add4						
	3	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4						
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

ο F4 μετονομάζεται σε Mul3

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul2		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17		
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19			
S.D	F4	1024(R1)		19				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

Clock	Time	Res. Stations	Name	Res. Stations					
				Busy	Op	Vj	Vk	Qj	Qk
19			Add1	Yes	ADD.D	R[F0]			Mul2
			Add2	No					
			Add3						
			Add4						
			Mul1	Yes	MUL.D	R[F0]	R[F2]		
		2	Mul2	Yes	DIV.D	R[F0]	R[F8]		
			Mul3	Yes	MUL.D	R[F0]			Add1
			Mul4	Yes	DIV.D	R[F0]	R[F8]		
			Int1	No					
			Int2	No					
			Int3						
			Int4						
			Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

ο F6 μετονομάζεται σε Mul4

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi	Add1		Mul3	Mul4		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17		
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20		
S.D	F4	1024(R1)		19	20			
DADDI	R1	R1	#-4	20				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2			
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	
20	5	Add1	Yes	ADD.D	R[F0]			Mul2	
		Add2	Yes	ADD.D	R[F0]	R[F8]			
		Add3							
		Add4							
1	1	Mul1	Yes	MUL.D	R[F0]	R[F2]			
		Mul2	Yes	DIV.D	R[F0]	R[F8]			
		Mul3	Yes	MUL.D	R[F0]			Add1	
		Mul4	Yes	DIV.D	R[F0]	R[F8]			
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4	Add2	

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5		
DIV.D	F6	F0	F8	4	5	6	7 – 21	
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17		
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21	
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21			
BNEZ	R1	foo		21				

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
21		Add1	Yes	ADD.D	R[F0]			Mul2
	4	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	0	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	Yes	DIV.D	R[F0]	R[F8]		
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4	Add2	

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6 - 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 - 21	22
ADD.D	F8	F0	F8	5	6	7	8 - 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 - 10	12
BNEZ	R1	foo		8	9	10	13 - 13	14
L.D	F0	0	R1	14	15	16	17 - 17	18
ADD.D	F2	F0	F6	15	16	17		
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21	
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22		
BNEZ	R1	foo		21	22			

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
22	5	Add1	Yes	ADD.D	R[F0]	R[F6]		
	3	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	14	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	Yes	DADDI	R[R1]	-4		
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4	Add2	Int1

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23	
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21	
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	
BNEZ	R1	foo		21	22	23		

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
23	4	Add1	Yes	ADD.D	R[F0]	R[F6]		
	2	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	13	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	Yes	DADDI	R[R1]	-4		
		Int2	Yes	BNEZ			Int1	
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4	Add2	Int1

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23	
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21	
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23		

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
24	3	Add1	Yes	ADD.D	R[F0]	R[F6]		
	1	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	12	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	Yes	BNEZ	R[R1]			
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4	Add2	

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23	
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21 – 25	
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
25	2	Add1	Yes	ADD.D	R[F0]	R[F6]		
	0	Add2	Yes	ADD.D	R[F0]	R[F8]		
		Add3						
		Add4						
	11	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	Yes	BNEZ	R[R1]			
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4	Add2	

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23	
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
26	1	Add1	Yes	ADD.D	R[F0]	R[F6]		
		Add2	No					
10		Add3						
		Add4						
		Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
Int5								

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
27	0	Add1	Yes	ADD.D	R[F0]	R[F6]		
		Add2	No					
		Add3						
		Add4						
	9	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]			Add1
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		Add1	Mul3	Mul4		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
28		Add1	No					
		Add2	No					
		Add3						
		Add4						
	8	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3	Mul4		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19		
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	Mul1
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

- Fp Mul/Div free: θα την χρησιμοποιήσει η 2η DIV.D καθώς τη ζήτησε πρώτη

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
36		Add1	No					
		Add2	No					
		Add3						
		Add4						
	0	Mul1	Yes	MUL.D	R[F0]	R[F2]		
		Mul2	No					
		Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3	Mul4		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	37
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8		
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19	37	
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
37		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
	14	Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3	Mul4		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	37
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8	38 – 38	
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19	37	
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	Yes	(1024+R1)	
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
38		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
	13	Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3	Mul4		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6 - 10	11
MUL.D	F4	F0	F2	3	4	5	22 - 36	37
DIV.D	F6	F0	F8	4	5	6	7 - 21	22
ADD.D	F8	F0	F8	5	6	7	8 - 12	13
S.D	F4	1024(R1)		6	7	8	38 - 38	39
DADDI	R1	R1	#-4	7	8	9	10 - 10	12
BNEZ	R1	foo		8	9	10	13 - 13	14
L.D	F0	0	R1	14	15	16	17 - 17	18
ADD.D	F2	F0	F6	15	16	17	23 - 27	28
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19	37	
ADD.D	F8	F0	F8	18	19	20	21 - 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 - 23	24
BNEZ	R1	foo		21	22	23	25 - 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
39		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
	12	Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3	Mul4		

Instruction		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	37
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8	38 – 38	39
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18		
DIV.D	F6	F0	F8	17	18	19	37 – 51	
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
51		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
	0	Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	Yes	DIV.D	R[F0]	R[F8]		
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3	Mul4		

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6 - 10	11
MUL.D	F4	F0	F2	3	4	5	22 - 36	37
DIV.D	F6	F0	F8	4	5	6	7 - 21	22
ADD.D	F8	F0	F8	5	6	7	8 - 12	13
S.D	F4	1024(R1)		6	7	8	38 - 38	39
DADDI	R1	R1	#-4	7	8	9	10 - 10	12
BNEZ	R1	foo		8	9	10	13 - 13	14
L.D	F0	0	R1	14	15	16	17 - 17	18
ADD.D	F2	F0	F6	15	16	17	23 - 27	28
MUL.D	F4	F0	F2	16	17	18	52	
DIV.D	F6	F0	F8	17	18	19	37 - 51	52
ADD.D	F8	F0	F8	18	19	20	21 - 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 - 23	24
BNEZ	R1	foo		21	22	23	25 - 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
52		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
	14	Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	No					
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	Mul3					

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 - 4	5
ADD.D	F2	F0	F6	2	3	4	6 - 10	11
MUL.D	F4	F0	F2	3	4	5	22 - 36	37
DIV.D	F6	F0	F8	4	5	6	7 - 21	22
ADD.D	F8	F0	F8	5	6	7	8 - 12	13
S.D	F4	1024(R1)		6	7	8	38 - 38	39
DADDI	R1	R1	#-4	7	8	9	10 - 10	12
BNEZ	R1	foo		8	9	10	13 - 13	14
L.D	F0	0	R1	14	15	16	17 - 17	18
ADD.D	F2	F0	F6	15	16	17	23 - 27	28
MUL.D	F4	F0	F2	16	17	18	52 - 66	
DIV.D	F6	F0	F8	17	18	19	37 - 51	52
ADD.D	F8	F0	F8	18	19	20	21 - 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 - 23	24
BNEZ	R1	foo		21	22	23	25 - 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	Yes	(1024+R1)	Mul3
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
66		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
	0	Mul3	Yes	MUL.D	R[F0]	R[F2]		
		Mul4	No					
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			Mul3			

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	37
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8	38 – 38	39
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18	52 – 66	67
DIV.D	F6	F0	F8	17	18	19	37 – 51	52
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21		
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	Yes	(1024+R1)	
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
67		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
		Mul3	No					
		Mul4	No					
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	37
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8	38 – 38	39
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18	52 – 66	67
DIV.D	F6	F0	F8	17	18	19	37 – 51	52
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21	68 – 68	
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	Yes	(1024+R1)	
Store3			
Store4			
Store5			

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
68		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
		Mul3	No					
		Mul4	No					
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction

		j	k	IF	ID	IS	EX	WB
L.D	F0	0	R1	1	2	3	4 – 4	5
ADD.D	F2	F0	F6	2	3	4	6 – 10	11
MUL.D	F4	F0	F2	3	4	5	22 – 36	37
DIV.D	F6	F0	F8	4	5	6	7 – 21	22
ADD.D	F8	F0	F8	5	6	7	8 – 12	13
S.D	F4	1024(R1)		6	7	8	38 – 38	39
DADDI	R1	R1	#-4	7	8	9	10 – 10	12
BNEZ	R1	foo		8	9	10	13 – 13	14
L.D	F0	0	R1	14	15	16	17 – 17	18
ADD.D	F2	F0	F6	15	16	17	23 – 27	28
MUL.D	F4	F0	F2	16	17	18	52 – 66	67
DIV.D	F6	F0	F8	17	18	19	37 – 51	52
ADD.D	F8	F0	F8	18	19	20	21 – 25	26
S.D	F4	1024(R1)		19	20	21	68 – 68	69
DADDI	R1	R1	#-4	20	21	22	23 – 23	24
BNEZ	R1	foo		21	22	23	25 – 25	26

	Busy	Address
Load1	No	
Load2		
Load3		
Load4		
Load5		

	Busy	Address	Qi
Store1	No		
Store2	No		
Store3			
Store4			
Store5			

foo: L.D F0 0(R1)
 ADD.D F2 F0 F6
 MUL.D F4 F0 F2
 DIV.D F6 F0 F8
 ADD.D F8 F0 F8
 S.D F4 1024(R1)
 DADDI R1 R1 #-4
 BNEZ R1 foo

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk
69		Add1	No					
		Add2	No					
		Add3						
		Add4						
		Mul1	No					
		Mul2	No					
		Mul3	No					
		Mul4	No					
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Λύση 3ης άσκησης

**Αλγόριθμος Tomasulo με ROB
+ 2-way superscalar**

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1					
ADD.D	F2	F0	F6	1					
MUL.D	F4	F0	F2						
DIV.D	F6	F0	F8						
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							
L.D	F0	0	R1						
ADD.D	F2	F0	F6						
MUL.D	F4	F0	F2						
DIV.D	F6	F0	F8						
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1			
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1				
Store2				
Store3				
Store4				
Store5				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
1		Add1							
		Add2							
		Add3							
		Add4							
		Mul1							
		Mul2							
		Mul3							
		Mul4							
		Int1							
		Int2							
		Int3							
		Int4							
		Int5							

	Dest	Value	Inst	Ready
ROB1				
ROB2				
ROB3				
ROB4				
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2				
ADD.D	F2	F0	F6	1	2				
MUL.D	F4	F0	F2	2					
DIV.D	F6	F0	F8	2					
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							
L.D	F0	0	R1						
ADD.D	F2	F0	F6						
MUL.D	F4	F0	F2						
DIV.D	F6	F0	F8						
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1			
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1				
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1				
ROB2				
ROB3				
ROB4				
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
2	Add1							
	Add2							
	Add3							
	Add4							
2	Mul1							
	Mul2							
	Mul3							
	Mul4							
2	Int1							
	Int2							
	Int3							
	Int4							
	Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3			
ADD.D	F2	F0	F6	1	2	3			
MUL.D	F4	F0	F2	2	3				
DIV.D	F6	F0	F8	2	3				
ADD.D	F8	F0	F8	3					
S.D	F4	1024(R1)		3					
DADDI	R1	R1	#-4						
BNEZ	R1	foo							
L.D	F0	0	R1						
ADD.D	F2	F0	F6						
MUL.D	F4	F0	F2						
DIV.D	F6	F0	F8						
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1	Yes	(0+R1)	#1
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1				
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F0		L.D F0,0(R1)	No
ROB2	F2		ADD.D F2,F0,F6	No
ROB3				
ROB4				
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
3		Add1	Yes	ADD.D		R[F6]	#1		#2
		Add2							
		Add3							
		Add4							
		Mul1							
		Mul2							
		Mul3							
		Mul4							
		Int1							
		Int2							
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	#1	#2				

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 - 4		
ADD.D	F2	F0	F6	1	2	3			
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4			
ADD.D	F8	F0	F8	3	4				
S.D	F4	1024(R1)		3	4				
DADDI	R1	R1	#-4	4					
BNEZ	R1	foo		4					
L.D	F0	0	R1						
ADD.D	F2	F0	F6						
MUL.D	F4	F0	F2						
DIV.D	F6	F0	F8						
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1	Yes	(0+R1)	#1
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1				
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F0		L.D F0,0(R1)	No
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
4		Add1	Yes	ADD.D		R[F6]	#1		#2
		Add2							
		Add3							
		Add4							
		Mul1	Yes	MUL.D			#1	#2	#3
		Mul2	Yes	DIV.D		R[F8]	#1		#4
		Mul3							
		Mul4							
		Int1							
		Int2							
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	#1	#2	#3	#4		

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4-4	5	
ADD.D	F2	F0	F6	1	2	3			
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4			
ADD.D	F8	F0	F8	3	4	5			
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5				
BNEZ	R1	foo		4	5				
L.D	F0	0	R1	5					
ADD.D	F2	F0	F6	5					
MUL.D	F4	F0	F2						
DIV.D	F6	F0	F8						
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
5	5	Add1	Yes	ADD.D	(0+R1)	R[F6]			#2
		Add2	Yes	ADD.D	R[F0]	R[F8]			#5
		Add3							
		Add4							
	15	Mul1	Yes	MUL.D	(0+R1)		#2		#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3							
		Mul4							
		Int1							
		Int2							
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#2	#3	#4	#5	

- και οι 2 ADD.D έχουν έτοιμα τα ορίσματα η 2η όμως θα πρέπει να περιμένει 1 κύκλο

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6		
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5			
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6			
BNEZ	R1	foo		4	5	6			
L.D	F0	0	R1	5	6				
ADD.D	F2	F0	F6	5	6				
MUL.D	F4	F0	F2	6					
DIV.D	F6	F0	F8	6					
ADD.D	F8	F0	F8						
S.D	F4	1024(R1)							
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1				
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	No
ROB8			BNEZ R1,foo	No
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
6	4	Add1	Yes	ADD.D	(0+R1)	R[F6]			#2
	5	Add2	Yes	ADD.D	R[F0]	R[F8]			#5
		Add3							
		Add4							
	14	Mul1	Yes	MUL.D	(0+R1)			#2	#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3							
		Mul4							
		Int1	Yes	DADDI	R[R1]	#-4			#7
		Int2	Yes	BNEZ			#7		#8
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#2	#3	#4	#5	#7

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6		
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7		
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7		
BNEZ	R1	foo		4	5	6			
L.D	F0	0	R1	5	6	7			
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7				
DIV.D	F6	F0	F8	6	7				
ADD.D	F8	F0	F8	7					
S.D	F4	1024(R1)		7					
DADDI	R1	R1	#-4						
BNEZ	R1	foo							

	Busy	Address	Dest
Load1	Yes	(0+R1)	#9
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

Res. Stations		Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 7	3	Add1	Yes	ADD.D	(0+R1)	R[F6]				#2
	4	Add2	Yes	ADD.D	R[F0]	R[F8]				#5
		Add3	Yes	ADD.D				#9	#4	#10
		Add4								
		Mul1	Yes	MUL.D	(0+R1)				#2	#3
	13	Mul2	Yes	DIV.D	(0+R1)	R[F8]				#4
		Mul3								
		Mul4								
		Int1	Yes	DADDI	R[R1]	#-4				#7
		Int2	Yes	BNEZ				#7		#8
		Int3								
		Int4								
		Int5								

	Dest	Value	Inst	Ready
ROB1				
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	No
ROB8			BNEZ R1,foo	No
ROB9	F0		L.D F0,0(R1)	No
ROB10	F2		ADD.D F2,F0,F6	No
ROB11				
ROB12				

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi	#9	#10	#3	#4	#5	#7

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6		
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7		
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6			
L.D	F0	0	R1	5	6	7			
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8				
S.D	F4	1024(R1)		7	8				
DADDI	R1	R1	#-4	8					
BNEZ	R1	foo		8					

	Busy	Address	Dest
Load1	Yes	(0+R1)	#9
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1				
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	No
ROB9	F0		L.D F0,0(R1)	No
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

		Res. Stations							
Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
8	2	Add1	Yes	ADD.D	(0+R1)	R[F6]			#2
	3	Add2	Yes	ADD.D	R[F0]	R[F8]			#5
		Add3	Yes	ADD.D			#9	#4	#10
		Add4							
		Mul1	Yes	MUL.D	(0+R1)			#2	#3
	12	Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D			#9	#10	#11
		Mul4	Yes	DIV.D			#9	#5	#12
		Int1	No						
		Int2	Yes	BNEZ	R[R1]				#8
		Int3							
		Int4							
		Int5							

Reg. res.status		F0	F2	F4	F6	F8	R1
Qi		#9	#10	#11	#12	#5	

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6		
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7		
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9		
L.D	F0	0	R1	5	6	7	9-9		
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9			
S.D	F4	1024(R1)		7	8				
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	Yes	(0+R1)	#9
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

Res. Stations		Busy	Op	Vj	Vk	Qj	Qk	Dest	
Clock 9	1	Add1	Yes	ADD.D	(0+R1)	R[F6]		#2	
	2	Add2	Yes	ADD.D	R[F0]	R[F8]		#5	
		Add3	Yes	ADD.D			#9	#4	#10
		Add4	Yes	ADD.D			#9	#5	#1
		Mul1	Yes	MUL.D	(0+R1)			#2	#3
	11	Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D			#9	#10	#11
		Mul4	Yes	DIV.D			#9	#5	#12
		Int1	No						
		Int2	Yes	BNEZ	R[R1]				#8
		Int3							
		Int4							
		Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	No
ROB9	F0		L.D F0,0(R1)	No
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

- ROB full: η 2η S.D δεν κάνει issue

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi	#9	#10	#11	#12	#1	

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10		
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7		
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9			
S.D	F4	1024(R1)		7	8				
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

Res. Stations		Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 10	0	Add1	Yes	ADD.D	(0+R1)	R[F6]		#2
	1	Add2	Yes	ADD.D	R[F0]	R[F8]		#5
		Add3	Yes	ADD.D	(0+R1)		#4	#10
		Add4	Yes	ADD.D	(0+R1)		#5	#1
	10	Mul1	Yes	MUL.D	(0+R1)		#2	#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]		#4
		Mul3	Yes	MUL.D	(0+R1)		#10	#11
		Mul4	Yes	DIV.D	(0+R1)		#5	#12
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2	F2		ADD.D F2,F0,F6	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

- OK να κάνουν ταυτόχρονα WB οι BNEZ και L.D

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12	#1	

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7-11		
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9			
S.D	F4	1024(R1)		7	8				
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
11		Add1	No						
	0	Add2	Yes	ADD.D	R[F0]	R[F8]			#5
		Add3	Yes	ADD.D	(0+R1)			#4	#10
		Add4	Yes	ADD.D	(0+R1)			#5	#1
	9	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D	(0+R1)			#10	#11
		Mul4	Yes	DIV.D	(0+R1)			#5	#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2	F2		ADD.D F2,F0,F6	Yes
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	No
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12	#1	

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	
BNEZ	R1	foo		4	5	6	9 – 9	10	
L.D	F0	0	R1	5	6	7	9 – 9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9			
S.D	F4	1024(R1)		7	8				
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2				
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2				
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

- η 2η DIV.D έχει έτοιμα τα ορίσματά της, και θα ξεκινήσει πρώτη μόλις απελευθερωθεί η μονάδα

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
12		Add1	No						
		Add2	No						
	5	Add3	Yes	ADD.D	(0+R1)			#4	#10
		Add4	Yes	ADD.D	(0+R1)	R[F8]			#1
	8	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D	(0+R1)			#10	#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12	#1	

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13		
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 13			Add1	No						
			Add2	No						
		4	Add3	Yes	ADD.D	(0+R1)			#4	#10
			Add4	Yes	ADD.D	(0+R1)	R[F8]			#1
		7	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
			Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
			Mul3	Yes	MUL.D	(0+R1)			#10	#11
			Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
			Int1	No						
			Int2	No						
			Int3							
			Int4							
			Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

- η 2η S.D μπορεί τώρα να γίνει issue

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12	#1	

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13		
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 14			Add1	No						
			Add2	No						
		3	Add3	Yes	ADD.D	(0+R1)			#4	#10
			Add4	Yes	ADD.D	(0+R1)	R[F8]			#1
		6	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
			Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
			Mul3	Yes	MUL.D	(0+R1)			#10	#11
			Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
			Int1	No						
			Int2	No						
			Int3							
			Int4							
			Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

- η 2η S.D μπορεί τώρα να γίνει issue

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12	#1	

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13-17		
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 17			Add1	No						
			Add2	No						
		0	Add3	Yes	ADD.D	(0+R1)			#4	#10
			Add4	Yes	ADD.D	(0+R1)	R[F8]			#1
		3	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
			Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
			Mul3	Yes	MUL.D	(0+R1)			#10	#11
			Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
			Int1	No						
			Int2	No						
			Int3							
			Int4							
			Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	No
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12	#1	

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
18		Add1	No						
		Add2	No						
		Add3	Yes	ADD.D	(0+R1)			#4	#10
		Add4	No						
	2	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D	(0+R1)			#10	#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12		

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6		
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	
BNEZ	R1	foo		4	5	6	9 – 9	10	
L.D	F0	0	R1	5	6	7	9 – 9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
19		Add1	No						
		Add2	No						
		Add3	Yes	ADD.D	(0+R1)			#4	#10
		Add4	No						
	1	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
		Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D	(0+R1)			#10	#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4			
DIV.D	F6	F0	F8	2	3	4	6-20		
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	No
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
20		Add1	No						
		Add2	No						
		Add3	Yes	ADD.D	(0+R1)			#4	#10
		Add4	No						
	15	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
	0	Mul2	Yes	DIV.D	(0+R1)	R[F8]			#4
		Mul3	Yes	MUL.D	(0+R1)			#10	#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4	21		
DIV.D	F6	F0	F8	2	3	4	6-20	21	
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7			
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 21			Add1	No						
			Add2	No						
		5	Add3	Yes	ADD.D	(0+R1)	R[F6]			#10
			Add4	No						
		14	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
			Mul2	No						
			Mul3	Yes	MUL.D	(0+R1)			#10	#11
			Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
			Int1	No						
			Int2	No						
			Int3							
			Int4							
			Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	Yes
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4	21		
DIV.D	F6	F0	F8	2	3	4	6-20	21	
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7	22		
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 22	Time							
		Name						
		Add1	No					
		Add2	No					
	4	Add3	Yes	ADD.D	(0+R1)	R[F6]		#10
		Add4	No					
	13	Mul1	Yes	MUL.D	(0+R1)	R[F2]		#3
		Mul2	No					
		Mul3	Yes	MUL.D	(0+R1)		#10	#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]		#12
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	Yes
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4	21		
DIV.D	F6	F0	F8	2	3	4	6-20	21	
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7	22-26		
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Busy	Op	Vj	Vk	Qj	Qk	Dest
Clock 26	Time	Name						
		Add1	No					
		Add2	No					
	0	Add3	Yes	ADD.D	(0+R1)	R[F6]		#10
		Add4	No					
	9	Mul1	Yes	MUL.D	(0+R1)	R[F2]		#3
		Mul2	No					
		Mul3	Yes	MUL.D	(0+R1)		#10	#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]		#12
		Int1	No					
		Int2	No					
		Int3						
		Int4						
		Int5						

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	Yes
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	No
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi		#10	#11	#12		

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21		
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	
BNEZ	R1	foo		4	5	6	9 – 9	10	
L.D	F0	0	R1	5	6	7	9 – 9	10	
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations		Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest	
Clock 27	8	Add1	No								
		Add2	No								
		Add3	No								
		Add4	No								
		Mul1	Yes	MUL.D	(0+R1)	R[F2]					#3
		Mul2	No								
		Mul3	Yes	MUL.D	(0+R1)	R[F2]					#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]					#12
		Int1	No								
		Int2	No								
		Int3									
		Int4									
		Int5									

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	Yes
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 – 35		
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	
BNEZ	R1	foo		4	5	6	9 – 9	10	
L.D	F0	0	R1	5	6	7	9 – 9	10	
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8			
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)	#3	#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	No
ROB4	F6		DIV.D F6,F0,F8	Yes
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
35		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
	0	Mul1	Yes	MUL.D	(0+R1)	R[F2]			#3
		Mul2	No						
		Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 – 35	36	
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	
S.D	F4	1024(R1)		3	4	5			
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	
BNEZ	R1	foo		4	5	6	9 – 9	10	
L.D	F0	0	R1	5	6	7	9 – 9	10	
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8	36		
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)		#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	F4		MUL.D F4,F0,F2	Yes
ROB4	F6		DIV.D F6,F0,F8	Yes
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

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Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
36		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	14	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4	21-35	36	37
DIV.D	F6	F0	F8	2	3	4	6-20	21	37
ADD.D	F8	F0	F8	3	4	5	7-11	12	
S.D	F4	1024(R1)		3	4	5	37-37		
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7	22-26	27	
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8	36		
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9				
BNEZ	R1	foo		8	9				

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	Yes	1024(R1)		#6
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
37		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	13	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3				
ROB4				
ROB5	F8		ADD.D F8,F0,F8	Yes
ROB6			S.D F4,1024(R1)	No
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4	21-35	36	37
DIV.D	F6	F0	F8	2	3	4	6-20	21	37
ADD.D	F8	F0	F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)		3	4	5	37-37	38	
DADDI	R1	R1	#-4	4	5	6	7-7	8	
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7	22-26	27	
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8	36		
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9	38			
BNEZ	R1	foo		8	9	38			

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	No
ROB4			BNEZ R1,foo	No
ROB5				
ROB6			S.D F4,1024(R1)	Yes
ROB7	R1		DADDI R1,R1,-4	Yes
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
38		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	12	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	Yes	DADDI	R[R1]	#-4			#3
		Int2	Yes	BNEZ			#3		
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		#3

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4-4	5	6
ADD.D	F2	F0	F6	1	2	3	6-10	11	12
MUL.D	F4	F0	F2	2	3	4	21-35	36	37
DIV.D	F6	F0	F8	2	3	4	6-20	21	37
ADD.D	F8	F0	F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)		3	4	5	37-37	38	39
DADDI	R1	R1	#-4	4	5	6	7-7	8	39
BNEZ	R1	foo		4	5	6	9-9	10	
L.D	F0	0	R1	5	6	7	9-9	10	
ADD.D	F2	F0	F6	5	6	7	22-26	27	
MUL.D	F4	F0	F2	6	7	8			
DIV.D	F6	F0	F8	6	7	8	36		
ADD.D	F8	F0	F8	7	8	9	13-17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9	38	39-39		
BNEZ	R1	foo		8	9	38			

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	No
ROB4			BNEZ R1,foo	No
ROB5				
ROB6				
ROB7				
ROB8			BNEZ R1,foo	Yes
ROB9	F0	(0+R1)	L.D F0,0(R1)	Yes
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
39		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
		Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
	11	Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	Yes	DADDI	R[R1]	#-4			#3
		Int2	Yes	BNEZ			#3		
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		#3

Instruction	j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0 R1	1	2	3	4-4	5	6
ADD.D	F2	F0 F6	1	2	3	6-10	11	12
MUL.D	F4	F0 F2	2	3	4	21-35	36	37
DIV.D	F6	F0 F8	2	3	4	6-20	21	37
ADD.D	F8	F0 F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)	3	4	5	37-37	38	39
DADDI	R1	R1 #-4	4	5	6	7-7	8	39
BNEZ	R1	foo	4	5	6	9-9	10	40
L.D	F0	0 R1	5	6	7	9-9	10	40
ADD.D	F2	F0 F6	5	6	7	22-26	27	
MUL.D	F4	F0 F2	6	7	8			
DIV.D	F6	F0 F8	6	7	8	36		
ADD.D	F8	F0 F8	7	8	9	13-17	18	
S.D	F4	1024(R1)	7	8	13			
DADDI	R1	R1 #-4	8	9	38	39-39	40	
BNEZ	R1	foo	8	9	38			

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations

Clock 40

Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
	Add1	No						
	Add2	No						
	Add3	No						
	Add4	No						
	Mul1	No						
	Mul2	No						
10	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
	Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
	Int1	No						
	Int2	Yes	BNEZ	R[R1]				
	Int3							
	Int4							
	Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	No
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10	F2		ADD.D F2,F0,F6	Yes
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0 R1	1	2	3	4-4	5	6
ADD.D	F2	F0 F6	1	2	3	6-10	11	12
MUL.D	F4	F0 F2	2	3	4	21-35	36	37
DIV.D	F6	F0 F8	2	3	4	6-20	21	37
ADD.D	F8	F0 F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)	3	4	5	37-37	38	39
DADDI	R1	R1 #-4	4	5	6	7-7	8	39
BNEZ	R1	foo	4	5	6	9-9	10	40
L.D	F0	0 R1	5	6	7	9-9	10	40
ADD.D	F2	F0 F6	5	6	7	22-26	27	41
MUL.D	F4	F0 F2	6	7	8			
DIV.D	F6	F0 F8	6	7	8	36		
ADD.D	F8	F0 F8	7	8	9	13-17	18	
S.D	F4	1024(R1)	7	8	13			
DADDI	R1	R1 #-4	8	9	38	39-39	40	
BNEZ	R1	foo	8	9	38	41-41		

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	No
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
41		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	9	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	Yes	BNEZ	R[R1]				
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0 R1	1	2	3	4-4	5	6
ADD.D	F2	F0 F6	1	2	3	6-10	11	12
MUL.D	F4	F0 F2	2	3	4	21-35	36	37
DIV.D	F6	F0 F8	2	3	4	6-20	21	37
ADD.D	F8	F0 F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)	3	4	5	37-37	38	39
DADDI	R1	R1 #-4	4	5	6	7-7	8	39
BNEZ	R1	foo	4	5	6	9-9	10	40
L.D	F0	0 R1	5	6	7	9-9	10	40
ADD.D	F2	F0 F6	5	6	7	22-26	27	41
MUL.D	F4	F0 F2	6	7	8			
DIV.D	F6	F0 F8	6	7	8	36		
ADD.D	F8	F0 F8	7	8	9	13-17	18	
S.D	F4	1024(R1)	7	8	13			
DADDI	R1	R1 #-4	8	9	38	39-39	40	
BNEZ	R1	foo	8	9	38	41-41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations

Clock 42

Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
	Add1	No						
	Add2	No						
	Add3	No						
	Add4	No						
	Mul1	No						
	Mul2	No						
8	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
	Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
	Int1	No						
	Int2	No						
	Int3							
	Int4							
	Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0 R1	1	2	3	4-4	5	6
ADD.D	F2	F0 F6	1	2	3	6-10	11	12
MUL.D	F4	F0 F2	2	3	4	21-35	36	37
DIV.D	F6	F0 F8	2	3	4	6-20	21	37
ADD.D	F8	F0 F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)	3	4	5	37-37	38	39
DADDI	R1	R1 #-4	4	5	6	7-7	8	39
BNEZ	R1	foo	4	5	6	9-9	10	40
L.D	F0	0 R1	5	6	7	9-9	10	40
ADD.D	F2	F0 F6	5	6	7	22-26	27	41
MUL.D	F4	F0 F2	6	7	8			
DIV.D	F6	F0 F8	6	7	8	36-50		
ADD.D	F8	F0 F8	7	8	9	13-17	18	
S.D	F4	1024(R1)	7	8	13			
DADDI	R1	R1 #-4	8	9	38	39-39	40	
BNEZ	R1	foo	8	9	38	41-41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
50		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	15	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
	0	Mul4	Yes	DIV.D	(0+R1)	R[F8]			#12
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	No

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11	#12		

Instruction	j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0 R1	1	2	3	4-4	5	6
ADD.D	F2	F0 F6	1	2	3	6-10	11	12
MUL.D	F4	F0 F2	2	3	4	21-35	36	37
DIV.D	F6	F0 F8	2	3	4	6-20	21	37
ADD.D	F8	F0 F8	3	4	5	7-11	12	38
S.D	F4	1024(R1)	3	4	5	37-37	38	39
DADDI	R1	R1 #-4	4	5	6	7-7	8	39
BNEZ	R1	foo	4	5	6	9-9	10	40
L.D	F0	0 R1	5	6	7	9-9	10	40
ADD.D	F2	F0 F6	5	6	7	22-26	27	41
MUL.D	F4	F0 F2	6	7	8	51		
DIV.D	F6	F0 F8	6	7	8	36-50	51	
ADD.D	F8	F0 F8	7	8	9	13-17	18	
S.D	F4	1024(R1)	7	8	13			
DADDI	R1	R1 #-4	8	9	38	39-39	40	
BNEZ	R1	foo	8	9	38	41-41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
51		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	14	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	Yes

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11			

Instruction	j	k	IF	ID	IS	EX	WB	CO	
L.D	F0	0	R1	1	2	3	4 - 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 - 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 - 35	36	37
DIV.D	F6	F0	F8	2	3	4	6 - 20	21	37
ADD.D	F8	F0	F8	3	4	5	7 - 11	12	38
S.D	F4	1024(R1)		3	4	5	37 - 37	38	39
DADDI	R1	R1	#-4	4	5	6	7 - 7	8	39
BNEZ	R1	foo		4	5	6	9 - 9	10	40
L.D	F0	0	R1	5	6	7	9 - 9	10	40
ADD.D	F2	F0	F6	5	6	7	22 - 26	27	41
MUL.D	F4	F0	F2	6	7	8	51 - 65		
DIV.D	F6	F0	F8	6	7	8	36 - 50	51	
ADD.D	F8	F0	F8	7	8	9	13 - 17	18	
S.D	F4	1024(R1)		7	8	13			
DADDI	R1	R1	#-4	8	9	38	39 - 39	40	
BNEZ	R1	foo		8	9	38	41 - 41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)	#11	#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11	F4		MUL.D F4,F0,F2	No
ROB12	F6		DIV.D F6,F0,F8	Yes

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
65		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
	0	Mul3	Yes	MUL.D	(0+R1)	R[F2]			#11
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi			#11			

Instruction	j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0 R1	1	2	3	4 - 4	5	6
ADD.D	F2	F0 F6	1	2	3	6 - 10	11	12
MUL.D	F4	F0 F2	2	3	4	21 - 35	36	37
DIV.D	F6	F0 F8	2	3	4	6 - 20	21	37
ADD.D	F8	F0 F8	3	4	5	7 - 11	12	38
S.D	F4	1024(R1)	3	4	5	37 - 37	38	39
DADDI	R1	R1 #-4	4	5	6	7 - 7	8	39
BNEZ	R1	foo	4	5	6	9 - 9	10	40
L.D	F0	0 R1	5	6	7	9 - 9	10	40
ADD.D	F2	F0 F6	5	6	7	22 - 26	27	41
MUL.D	F4	F0 F2	6	7	8	51 - 65	66	
DIV.D	F6	F0 F8	6	7	8	36 - 50	51	
ADD.D	F8	F0 F8	7	8	9	13 - 17	18	
S.D	F4	1024(R1)	7	8	13			
DADDI	R1	R1 #-4	8	9	38	39 - 39	40	
BNEZ	R1	foo	8	9	38	41 - 41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)		#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11	F4		MUL.D F4,F0,F2	Yes
ROB12	F6		DIV.D F6,F0,F8	Yes

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
66		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
		Mul3	No						
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction

		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 – 35	36	37
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	37
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	38
S.D	F4	1024(R1)		3	4	5	37 – 37	38	39
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	39
BNEZ	R1	foo		4	5	6	9 – 9	10	40
L.D	F0	0	R1	5	6	7	9 – 9	10	40
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	41
MUL.D	F4	F0	F2	6	7	8	51 – 65	66	67
DIV.D	F6	F0	F8	6	7	8	36 – 50	51	67
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	
S.D	F4	1024(R1)		7	8	13	67 – 67		
DADDI	R1	R1	#-4	8	9	38	39 – 39	40	
BNEZ	R1	foo		8	9	38	41 – 41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	Yes	1024(R1)		#2
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1	F8		ADD.D F8,F0,F8	Yes
ROB2			S.D F4,1024(R1)	No
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
67		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
		Mul3	No						
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 – 35	36	37
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	37
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	38
S.D	F4	1024(R1)		3	4	5	37 – 37	38	39
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	39
BNEZ	R1	foo		4	5	6	9 – 9	10	40
L.D	F0	0	R1	5	6	7	9 – 9	10	40
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	41
MUL.D	F4	F0	F2	6	7	8	51 – 65	66	67
DIV.D	F6	F0	F8	6	7	8	36 – 50	51	67
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	68
S.D	F4	1024(R1)		7	8	13	67 – 67	68	
DADDI	R1	R1	#-4	8	9	38	39 – 39	40	
BNEZ	R1	foo		8	9	38	41 – 41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	No			
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1				
ROB2			S.D F4,1024(R1)	Yes
ROB3	R1		DADDI R1,R1,-4	Yes
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
68		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
		Mul3	No						
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 – 35	36	37
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	37
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	38
S.D	F4	1024(R1)		3	4	5	37 – 37	38	39
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	39
BNEZ	R1	foo		4	5	6	9 – 9	10	40
L.D	F0	0	R1	5	6	7	9 – 9	10	40
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	41
MUL.D	F4	F0	F2	6	7	8	51 – 65	66	67
DIV.D	F6	F0	F8	6	7	8	36 – 50	51	67
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	68
S.D	F4	1024(R1)		7	8	13	67 – 67	68	69
DADDI	R1	R1	#-4	8	9	38	39 – 39	40	69
BNEZ	R1	foo		8	9	38	41 – 41	42	

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	No			
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1				
ROB2				
ROB3				
ROB4			BNEZ R1,foo	Yes
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
69		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
		Mul3	No						
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

Instruction		j	k	IF	ID	IS	EX	WB	CO
L.D	F0	0	R1	1	2	3	4 – 4	5	6
ADD.D	F2	F0	F6	1	2	3	6 – 10	11	12
MUL.D	F4	F0	F2	2	3	4	21 – 35	36	37
DIV.D	F6	F0	F8	2	3	4	6 – 20	21	37
ADD.D	F8	F0	F8	3	4	5	7 – 11	12	38
S.D	F4	1024(R1)		3	4	5	37 – 37	38	39
DADDI	R1	R1	#-4	4	5	6	7 – 7	8	39
BNEZ	R1	foo		4	5	6	9 – 9	10	40
L.D	F0	0	R1	5	6	7	9 – 9	10	40
ADD.D	F2	F0	F6	5	6	7	22 – 26	27	41
MUL.D	F4	F0	F2	6	7	8	51 – 65	66	67
DIV.D	F6	F0	F8	6	7	8	36 – 50	51	67
ADD.D	F8	F0	F8	7	8	9	13 – 17	18	68
S.D	F4	1024(R1)		7	8	13	67 – 67	68	69
DADDI	R1	R1	#-4	8	9	38	39 – 39	40	69
BNEZ	R1	foo		8	9	38	41 – 41	42	70

	Busy	Address	Dest
Load1	No		
Load2			
Load3			
Load4			
Load5			

	Busy	Address	Qi	Dest
Store1	No			
Store2	No			
Store3				
Store4				
Store5				

	Dest	Value	Inst	Ready
ROB1				
ROB2				
ROB3				
ROB4				
ROB5				
ROB6				
ROB7				
ROB8				
ROB9				
ROB10				
ROB11				
ROB12				

Res. Stations

Clock	Time	Name	Busy	Op	Vj	Vk	Qj	Qk	Dest
70		Add1	No						
		Add2	No						
		Add3	No						
		Add4	No						
		Mul1	No						
		Mul2	No						
		Mul3	No						
		Mul4	No						
		Int1	No						
		Int2	No						
		Int3							
		Int4							
		Int5							

Reg. res.status

	F0	F2	F4	F6	F8	R1
Qi						

70 κύκλοι έναντι 69 στη single-issue περίπτωση
Bottleneck?