

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)			
L.D	F2,44(R3)			
MUL.D	F0,F2,F4			
SUB.D	F8,F2,F6			
DIV.D	F10,F0,F6			
ADD.D	F6,F8,F2			

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2							
Add1							
Add2							
Add3							
Mult1							
Mult2							

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi							

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓		
L.D	F2,44(R3)			
MUL.D	F0,F2,F4			
SUB.D	F8,F2,F6			
DIV.D	F10,F0,F6			
ADD.D	F6,F8,F2			

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2							
Add1							
Add2							
Add3							
Mult1							
Mult2							

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi				Load1			

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	
L.D	F2,44(R3)	✓		
MUL.D	F0,F2,F4			
SUB.D	F8,F2,F6			
DIV.D	F10,F0,F6			
ADD.D	F6,F8,F2			

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2	Y	Load					44+R[3]
Add1							
Add2							
Add3							
Mult1							
Mult2							

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi		Load2		Load1			

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	
L.D	F2,44(R3)	✓	✓	
MUL.D	F0,F2,F4	✓		
SUB.D	F8,F2,F6			
DIV.D	F10,F0,F6			
ADD.D	F6,F8,F2			

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2	Y	Load					44+R[3]
Add1							
Add2							
Add3							
Mult1	Y	MUL		F[4]	Load2		
Mult2							

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1	Load2		Load1			

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	
L.D	F2,44(R3)	✓	✓	
MUL.D	F0,F2,F4	✓		
SUB.D	F8,F2,F6	✓		
DIV.D	F10,F0,F6			
ADD.D	F6,F8,F2			

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2	Y	Load					44+R[3]
Add1	Y	SUB			Load2	Load1	
Add2							
Add3							
Mult1	Y	MUL		F[4]	Load2		
Mult2							

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1	Load2		Load1	Add1		

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	
L.D	F2,44(R3)	✓	✓	
MUL.D	F0,F2,F4	✓		
SUB.D	F8,F2,F6	✓		
DIV.D	F10,F0,F6	✓		
ADD.D	F6,F8,F2			

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2	Y	Load					44+R[3]
Add1	Y	SUB			Load2	Load1	
Add2							
Add3							
Mult1	Y	MUL		F[4]	Load2		
Mult2	Y	DIV			Multi1	Load1	

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1	Load2		Load1	Add1	Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	
L.D	F2,44(R3)	✓	✓	
MUL.D	F0,F2,F4	✓		
SUB.D	F8,F2,F6	✓		
DIV.D	F10,F0,F6	✓		
ADD.D	F6,F8,F2	✓		

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2	Y	Load					44+R[3]
Add1	Y	SUB			Load2	Load1	
Add2	Y	ADD			Add1	Load2	
Add3							
Mult1	Y	MUL		F[4]	Load2		
Mult2	Y	DIV			Mult1	Load1	

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1	Load2		Add2	Add1	Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	
L.D	F2,44(R3)	✓	✓	
MUL.D	F0,F2,F4	✓		
SUB.D	F8,F2,F6	✓		
DIV.D	F10,F0,F6	✓		
ADD.D	F6,F8,F2	✓		

WAW and WAR hazards are broken

Real dependencies are preserved

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1	Y	Load					32+R[2]
Load2	Y	Load					44+R[3]
Add1	Y	SUB			Load2	Load1	
Add2	Y	ADD			Add1	Load2	
Add3							
Mult1	Y	MUL		F[4]	Load2		
Mult2	Y	DIV			Multi1	Load1	

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1	Load2		Add2	Add1	Mult2	

Register renaming



# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	✓
L.D	F2,44(R3)	✓	✓	
MUL.D	F0,F2,F4	✓		
SUB.D	F8,F2,F6	✓		
DIV.D	F10,F0,F6	✓		
ADD.D	F6,F8,F2	✓		

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2	Y	Load					44+R[3]
Add1	Y	SUB		M[32+R[2]]	Load2		
Add2	Y	ADD			Add1	Load2	
Add3							
Mult1	Y	MUL		F[4]	Load2		
Mult2	Y	DIV		M[32+R[2]]	Multi1		

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1	Load2		Add2	Add1	Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	✓
L.D	F2,44(R3)	✓	✓	✓
MUL.D	F0,F2,F4	✓	✓	
SUB.D	F8,F2,F6	✓	✓	
DIV.D	F10,F0,F6	✓		
ADD.D	F6,F8,F2	✓		

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2							
Add1	Y	SUB	M[44+R[3]]	M[32+R[2]]			
Add2	Y	ADD		M[44+R[3]]	Add1		
Add3							
Mult1	Y	MUL	M[44+R[3]]	F[4]			
Mult2	Y	DIV		M[32+R[2]]	Multi1		

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1			Add2	Add1	Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	✓
L.D	F2,44(R3)	✓	✓	✓
MUL.D	F0,F2,F4	✓	✓	
SUB.D	F8,F2,F6	✓	✓	✓
DIV.D	F10,F0,F6	✓		
ADD.D	F6,F8,F2	✓	✓	

Out of order execution

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2							
Add1							
Add2	Y	ADD	F[8]	M[44+R[3]]			
Add3							
Mult1	Y	MUL	M[44+R[3]]	F[4]			
Mult2	Y	DIV		M[32+R[2]]	Multi1		

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi	Mult1			Add2		Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	✓
L.D	F2,44(R3)	✓	✓	✓
MUL.D	F0,F2,F4	✓	✓	✓
SUB.D	F8,F2,F6	✓	✓	✓
DIV.D	F10,F0,F6	✓	✓	
ADD.D	F6,F8,F2	✓	✓	✗

If more than one instructions finish at the same time, only one of them can access the common data bus and complete

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2							
Add1							
Add2	Y	ADD	F[8]	M[44+R[3]]			
Add3							
Mult1							
Mult2	Y	DIV	F[0]	M[32+R[2]]			

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi				Add2		Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	✓
L.D	F2,44(R3)	✓	✓	✓
MUL.D	F0,F2,F4	✓	✓	✓
SUB.D	F8,F2,F6	✓	✓	✓
DIV.D	F10,F0,F6	✓	✓	
ADD.D	F6,F8,F2	✓	✓	✓

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2							
Add1							
Add2							
Add3							
Mult1							
Mult2	Y	DIV	F[0]	M[32+R[2]]			

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi						Mult2	

# Example

Instruction Status

Instruction		Iss.	Exe.	Wr.
L.D	F6,32(R2)	✓	✓	✓
L.D	F2,44(R3)	✓	✓	✓
MUL.D	F0,F2,F4	✓	✓	✓
SUB.D	F8,F2,F6	✓	✓	✓
DIV.D	F10,F0,F6	✓	✓	✓
ADD.D	F6,F8,F2	✓	✓	✓

Reservation Station

Name	Busy	Op	Vj	Vk	Qj	Qk	A
Load1							
Load2							
Add1							
Add2							
Add3							
Mult1							
Mult2							

Register Status

Field	F0	F2	F4	F6	F8	F10	F12
Qi							