

1. Consider this 8-stage pipeline: IF | DE | RR | AL | AL | DM | DM | RW

For each of the following pairs of instructions, how many stalls will the second instruction experience without bypassing? With bypassing?

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- 1 ADD R1 + R2 -> R3
 2 ADD R3 + R4 -> R5
-

5 without bypassing

IF	DE	RR	AL	AL	DM	DM	RW						
	IF	DE	-	-	-	-	-	RR	AL	AL	DM	DM	RW

1 with bypassing:

IF	DE	RR	AL	AL	DM	DM	RW		
	IF	DE	RR	-	AL	AL	DM	DM	RW

-
- 1 LD [R1] -> R2
 2 ADD R2 + R3 -> R4
-

5 without bypassing (see above)

3 with bypassing:

IF	DE	RR	AL	AL	DM	DM	RW				
	IF	DE	RR	-	-	-	AL	AL	DM	DM	RW

-
- 1 LD [R1] -> R2
 2 SD [R2] <- R3
-

5 without bypassing (see above)

3 with bypassing:

IF	DE	RR	AL	AL	DM	DM	RW				
	IF	DE	RR	-	-	-	AL	AL	DM	DM	RW

-
- 1 LD [R1] -> R2
 2 SD [R3] <- R2
-

5 without bypassing (see above)

1 with bypassing:

IF	DE	RR	AL	AL	DM	DM	RW		
	IF	DE	RR	AL	AL	-	DM	DM	RW