4.13	detection, insert nops to ensure correct
	ADD RS RD RI
	ADD RS, RZ, RI NOP
	NOP 1 W R3, 4 (R5)
	LW $R3$ , $4$ $(RS)LW$ $R2$ , $0$ $(R3)$
	NOP OR R3, R5, R3
	NOP
	Nop Sw R3, O(R5)
	SW IS, SI
17	

413,2 Repent 4.13:1 but now use nops only when a hazard cannot be avoided by changing on headlanging there instances You can assume sogleton R7 can be to hald temperary values in your modified eads. We can use RZ to eliminate WER/WAW dependences. We are move by swapping instruction ANS with other no -dependency instructions 11: Add R5, R2, R1 I3: LW R2, 0 (R2) NOP IZ: LW R3, 4 (R5) NOP NOP IL: OR R3, R5, R3 NOP NOP IS: SW R3, O(R5)

Classmate

Date
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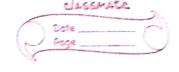
4,13.3

Il professor processor has Jarwarding but we jarged to implement the hazard detection unit, what happens when this code exertes.

Ars)

with forwarding, the horzard detection unit is still needed because it most insert a pre-cyle stall whenever the load supplies a value to the instruction. That follows that load.

The se instruction depends on immediately preceding load gets the stale value the register had before the load instruction, without the hazard detection me



If there is forwarding for the first free y cycles during the exount in of this code specify which signals are code specify which signals are parassented in each cycle by hazard detection of forwarding vinits
Instructions First five cycles  12345  ALL ALLS
Add RS, R2, R1 IF ID Ex MEM WB 1: PCWx, te=1:X X  LW R3, 4 (R5) IF ID Ex MEM 2: 1 x  LW R2, O(R2) IF ID Ex 3: 1 0  CR R3, R5, R3 IF ID 4: 1 1  SW R3, O(R5) IF S: 1 0
The outputs are Pc write [F/ TD write I JD) Exzero (which controls the Mux after the output of the Control unit)  Alors  The outputs of forwarding unit is ALVIA  I PLUINZ, which controls Muxes that  solact the first & second input of the ALV



4,13.5 Il there is no forwarding what new inputs & output signals do we pred for the hazard detection unit in Fig. 4.60? Using this instruction sequence as an example explain why each signal is needed. Ans) The instruction in ID stage convenily

peeds to be stalled if it depends on

a value produced by the instruction in

the Ex or the instruction in memoratory. we check destinution may of these We need to Check Rd for R-type irst

For Exstage we med to take For MEM stage the destination steg The aditional in pot to hazard
input detection unit. are Rd from
the Ed /Ex pipeline register & the
output number of the output register
from the Ex/MEM 2 eg. No additional pipeline is perded

for new hozard detection unit from 13.6 it asserts in each of the first five egeles during the execution of this eade . Signals First five cycles 2 notreent IF TO EX MED WB 1: POWNites Add RS. R2, R1 LW R3, 4(R5) JF JD \* + \* \* 2: PCWrite= 1 LW R2, O(R2) IF XXX # 3: PCWnite=1 OR R3, R5, R3 \*\* 9 : PCW1+e=0 SW B3, O(RS) 5: 11 = 0