

# Pipeline Hazard Performance

LOOP: LD R1, 0(R2)  
 DADDI R1, R1, #1  
 SD R1, 0(R2)  
 DADDI R2, R2, #4  
 DSUB R4, R3, R2  
 BNEZ R4, LOOP

①  
②  
③  
④  
⑤  
⑥

Assume 99 iterations

Assume

branch delay = 3

Stall data + control hazards:

①  
②  
③  
④  
⑤  
⑥  
①

F R X M W

F - - R X M W

F - - R X M W

F R X M W

F - - R X M W

F - - R X M W

- - - F R X M W

17 cycles / iteration

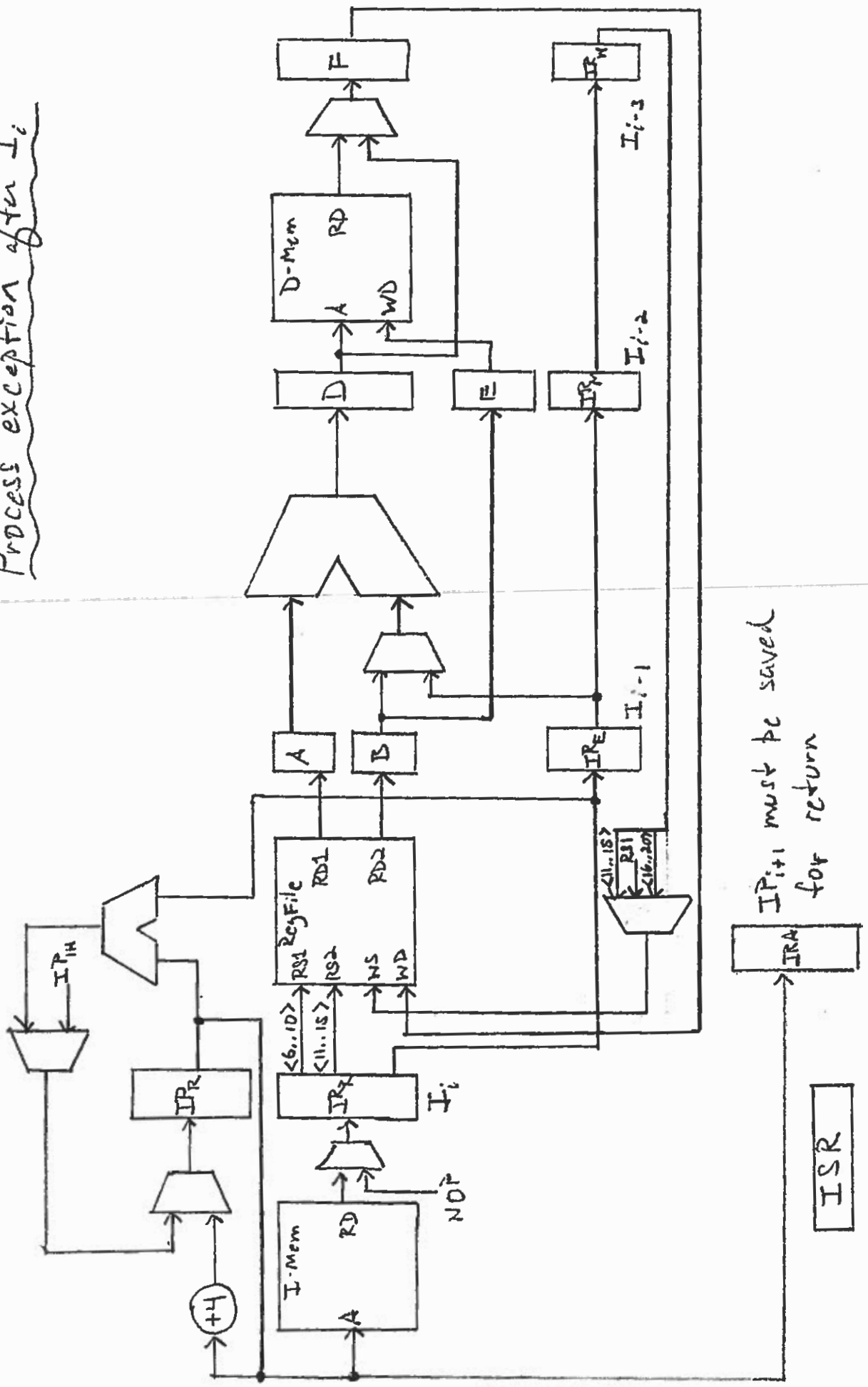
18 cycles last iteration

$$(17 \cdot 98) + 18 = 1684 \text{ cycles}$$



# Asynchronous Exception - Slide 1

Process exception after  $I_i$



# Asynchronous Exception - Slide 2

- ① Flush Pipeline
- ② Enter handler

