

Computer System Architecture

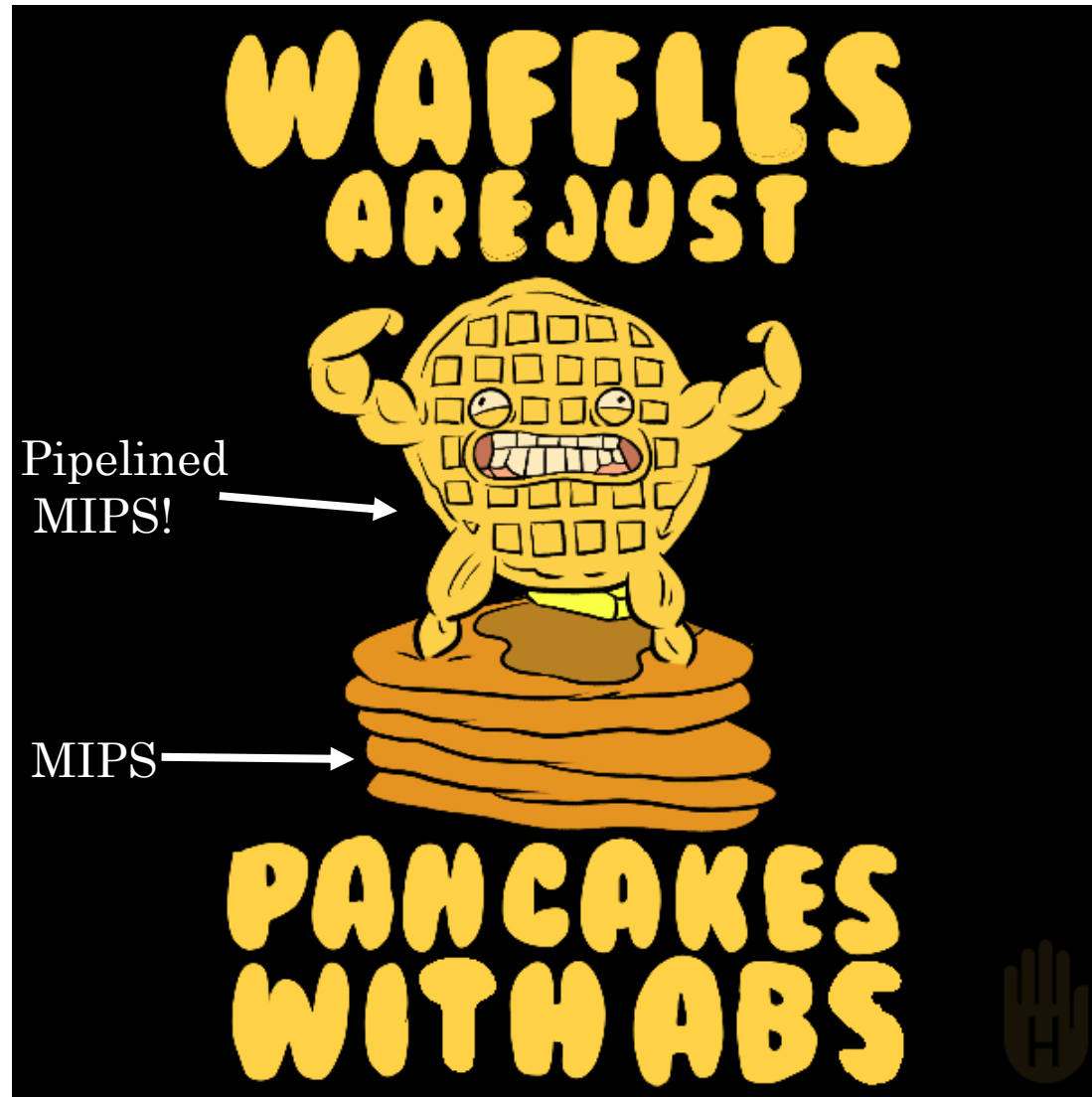
H. SOUBRA

Disclaimer

This course contains copyrighted material the use of which has not always been specifically authorized by the copyright owner. They are used strictly for educational purposes. The principle of fair use applies.

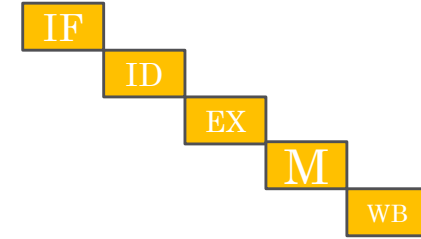
Lecture 9: Hardware Implementation

- Pipelined MIPS!

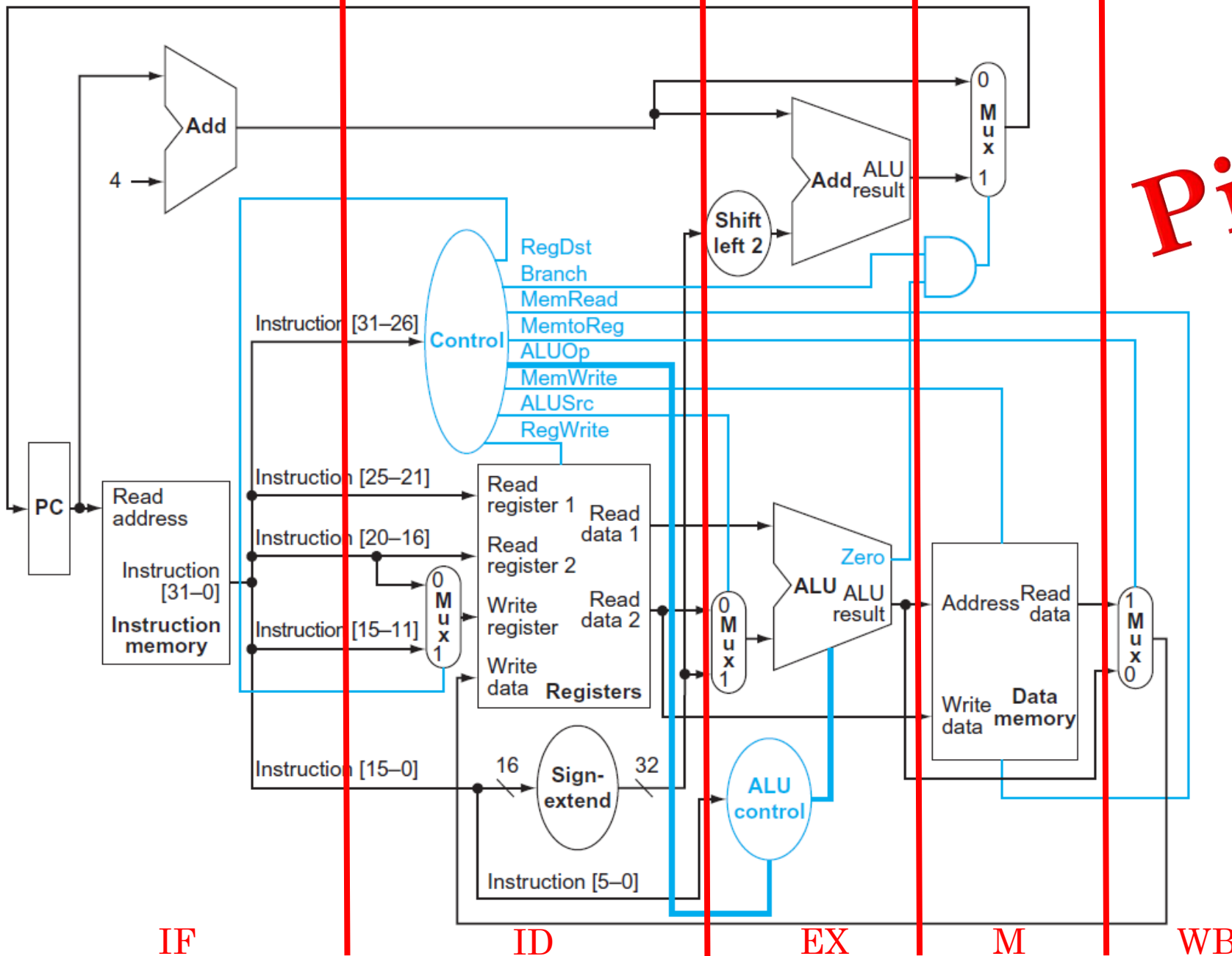


Pipeline stages from last time?

1. IF: Instruction fetch
2. ID: Instruction decode and register file read
3. EX: Execution or address calculation
4. M: Data memory access
5. WB: Write back



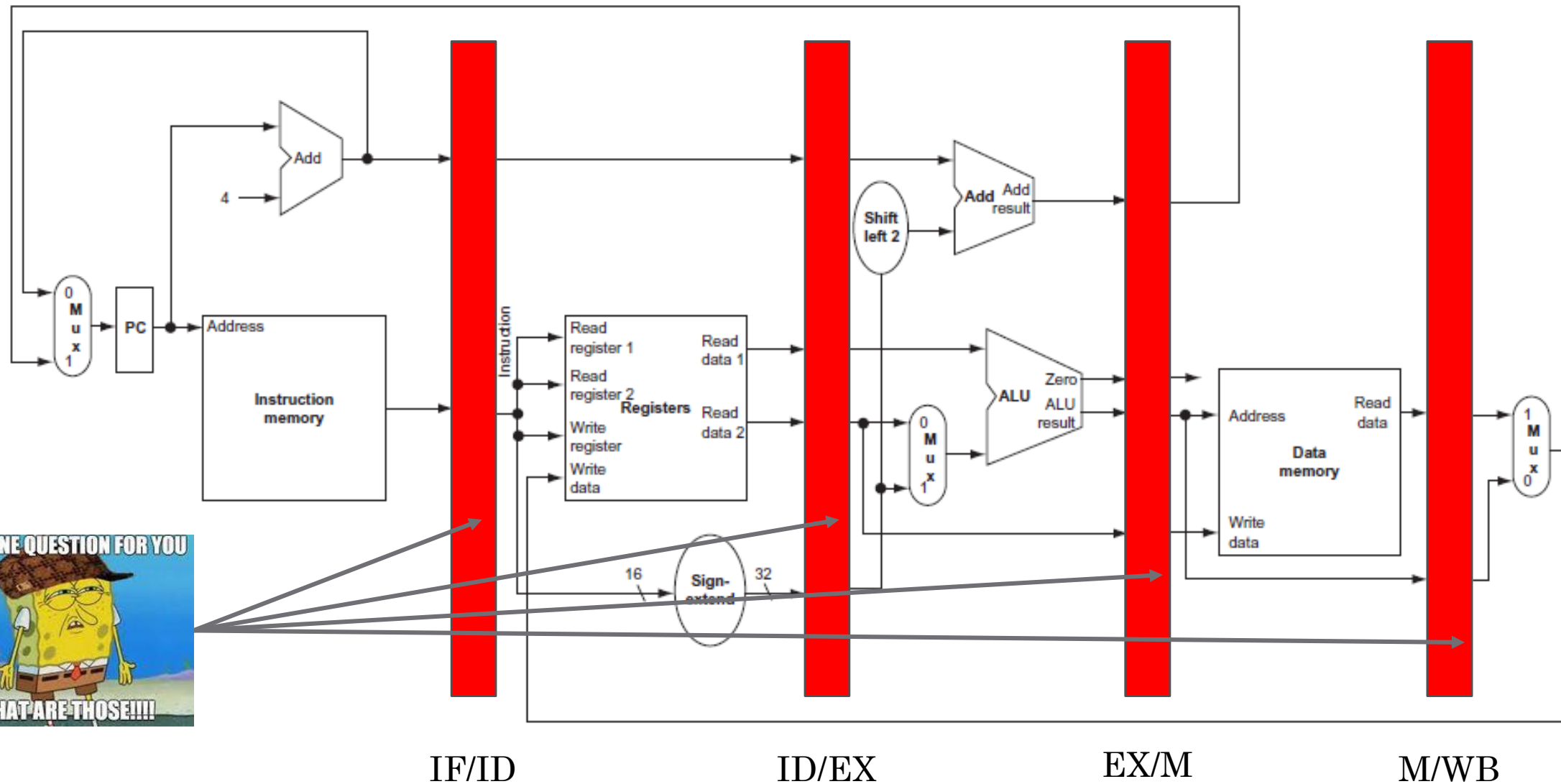
Full Simple Hardware Implementation



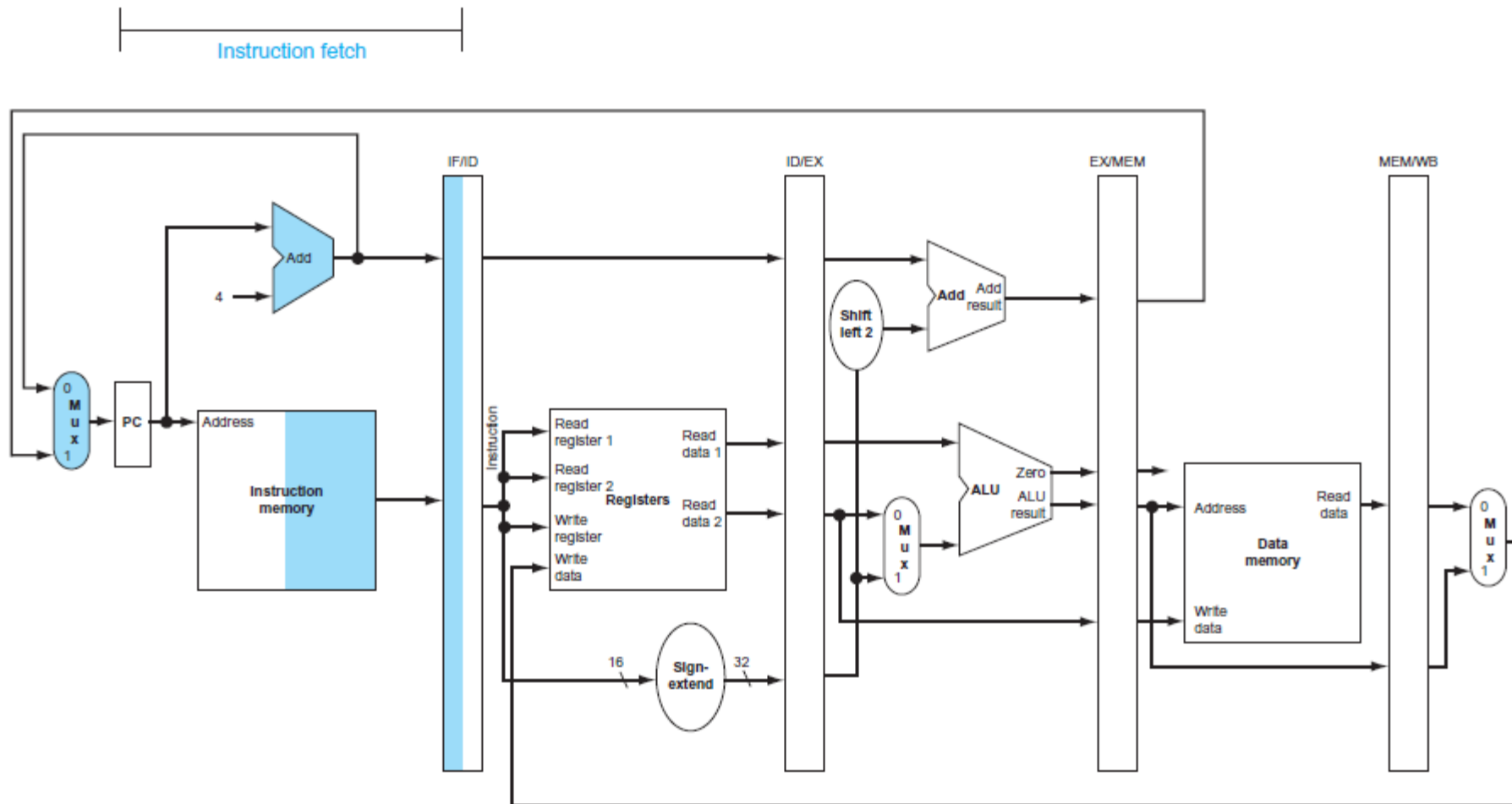
Pipeline it!

What can be noticed?

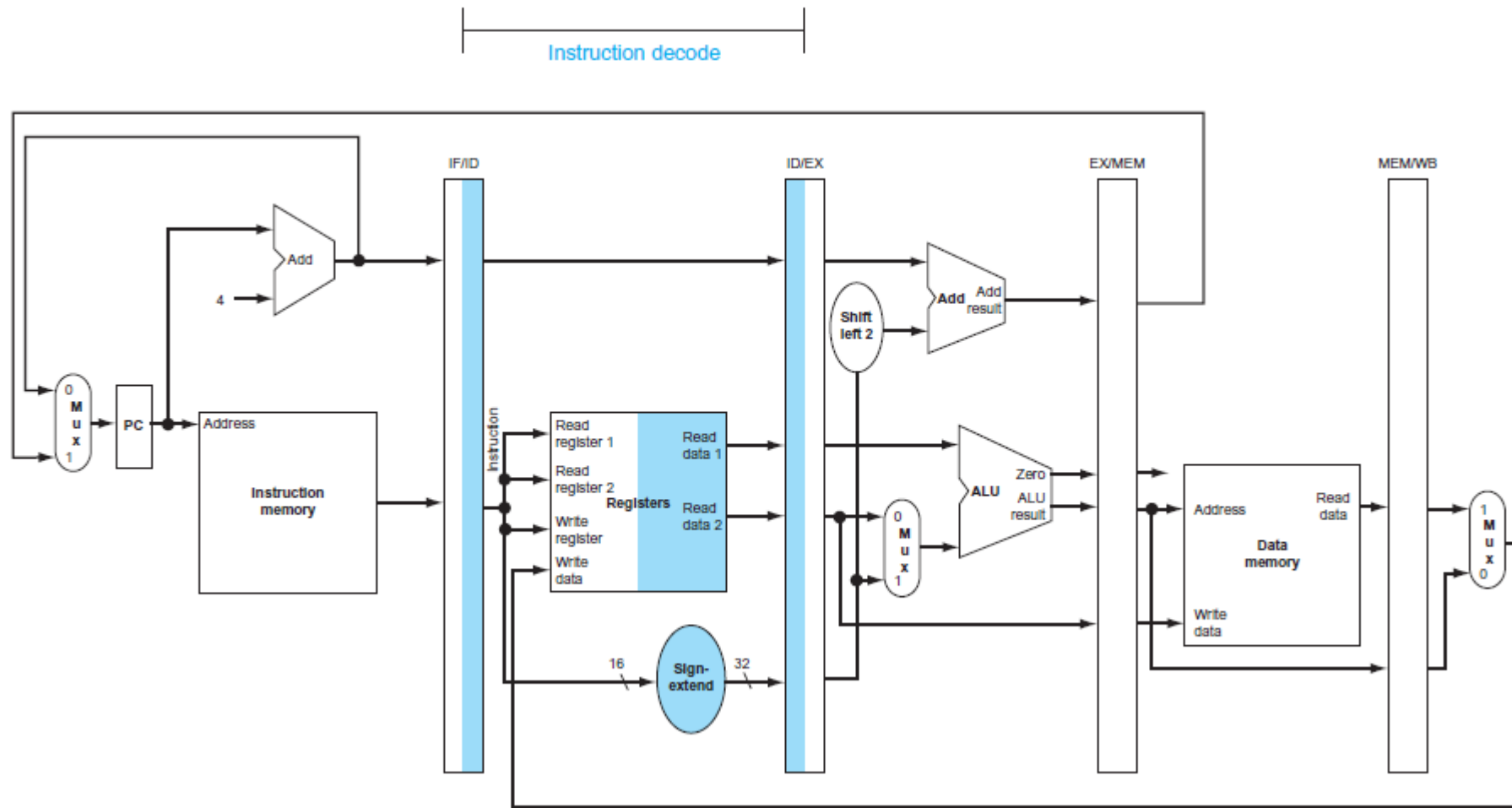
Pipelined version (no control)



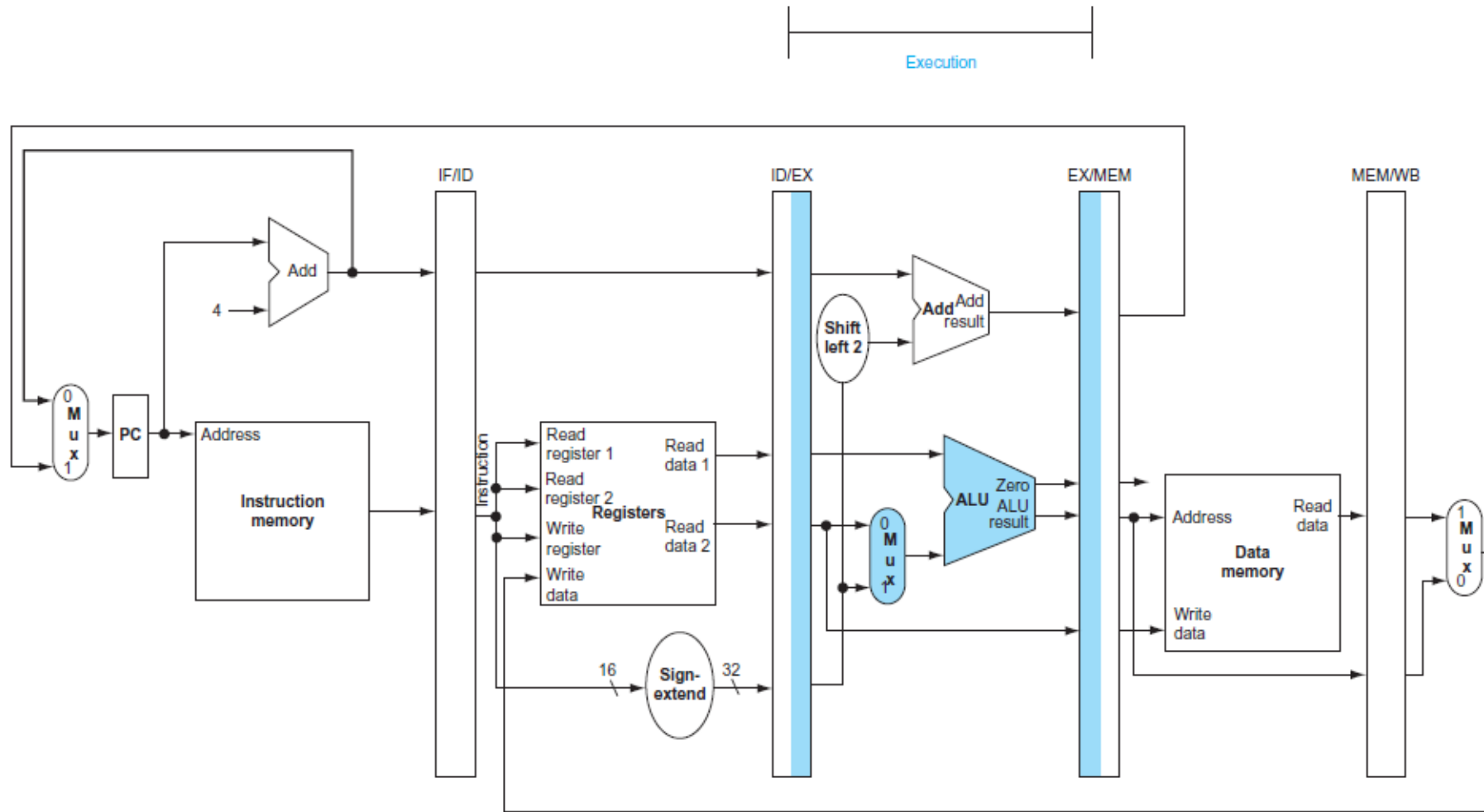
Walk-through of the Pipeline:IF



Walk-through of the Pipeline: ID

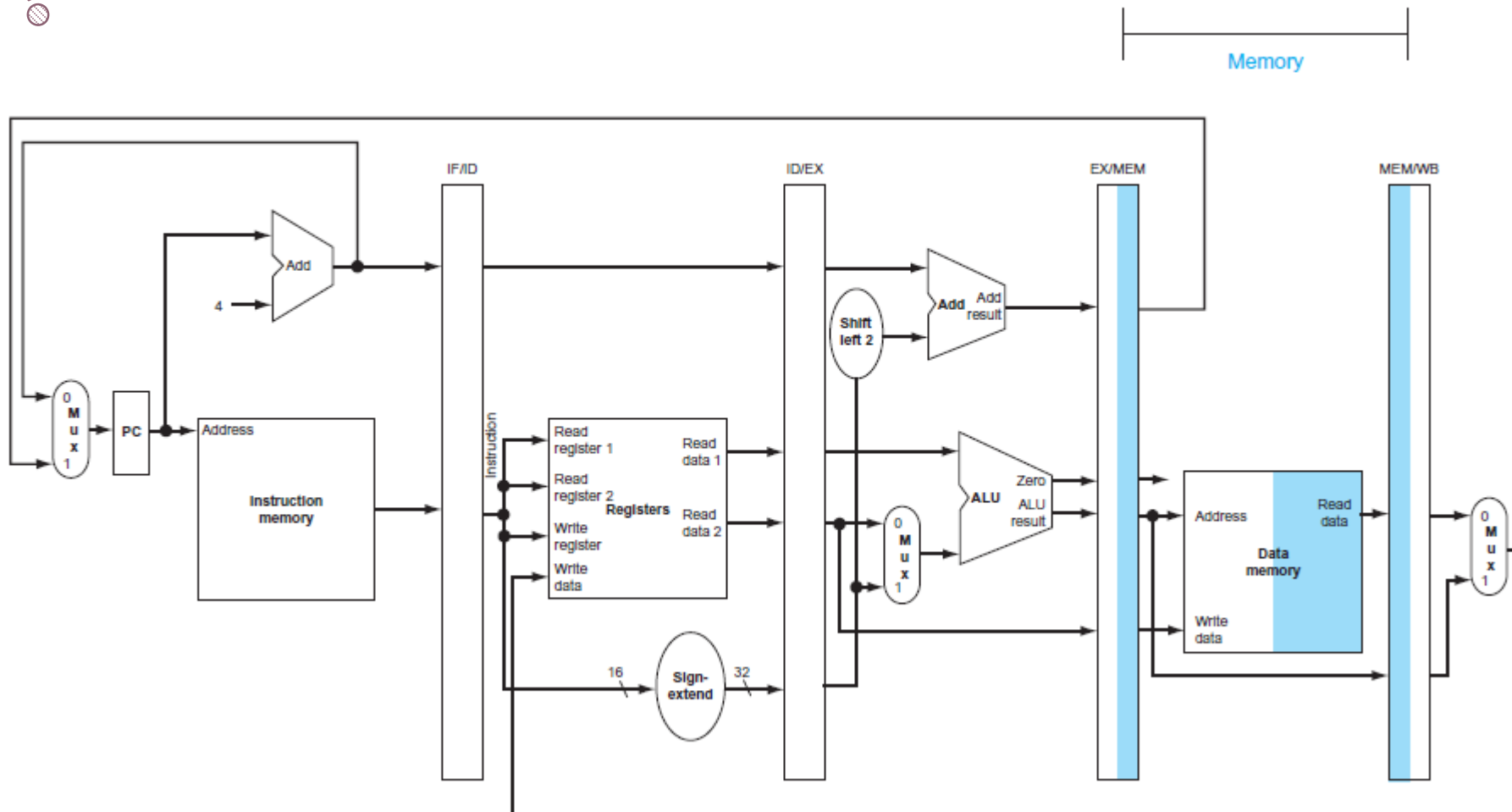


Walk-through of the Pipeline: EX



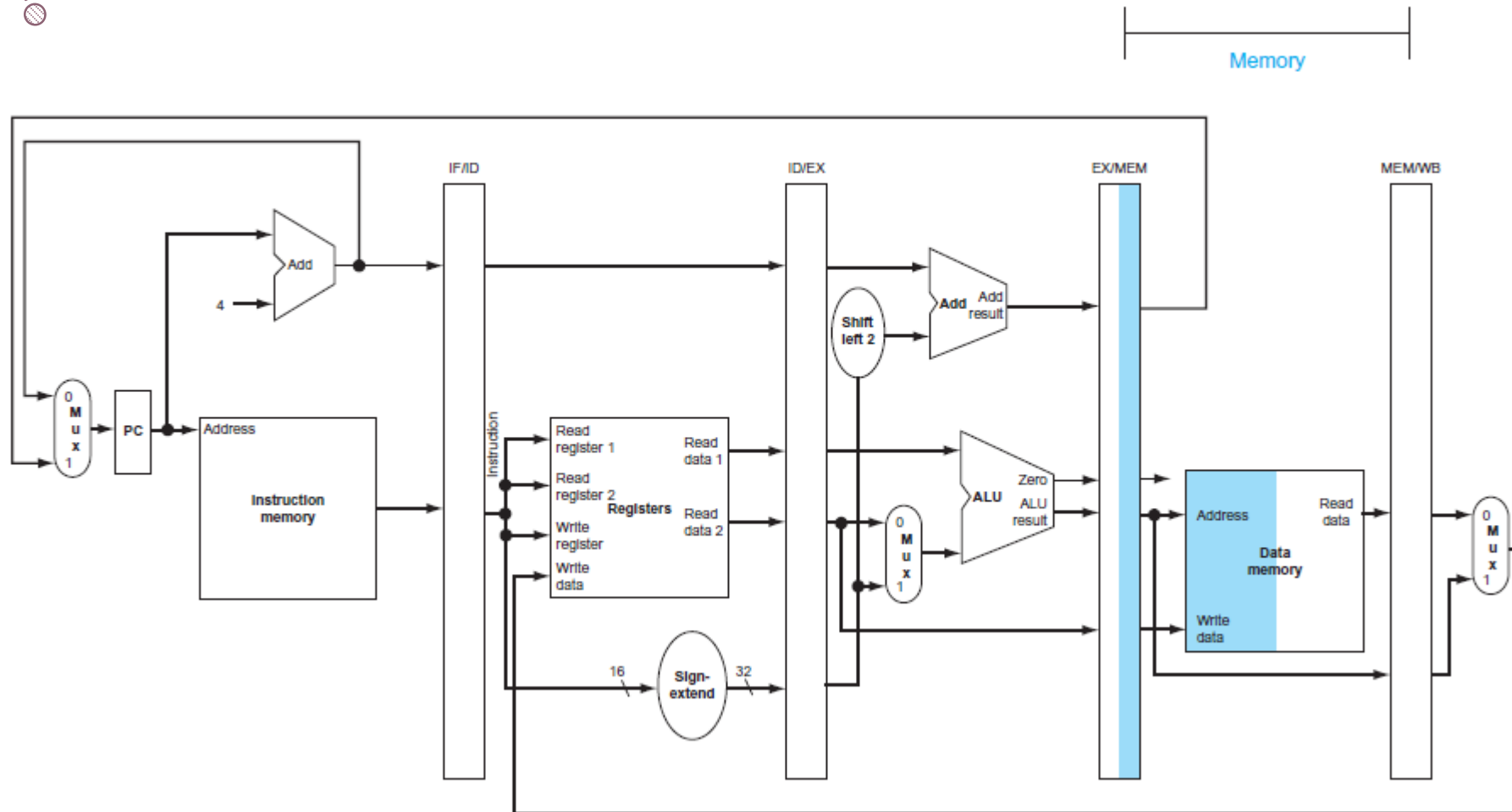
Walk-through of the Pipeline: M1

LW!



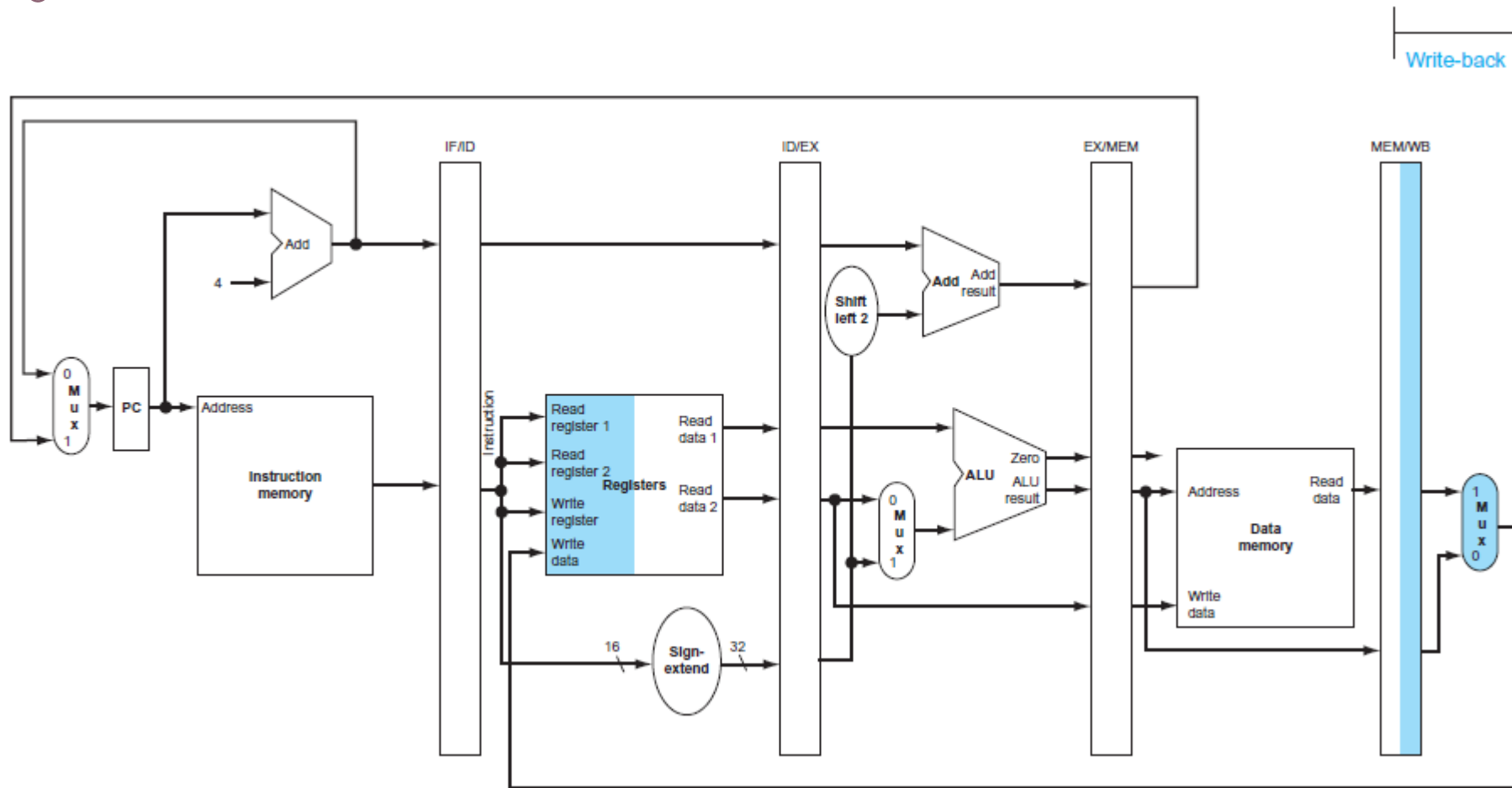
Walk-through of the Pipeline: M2

SW!

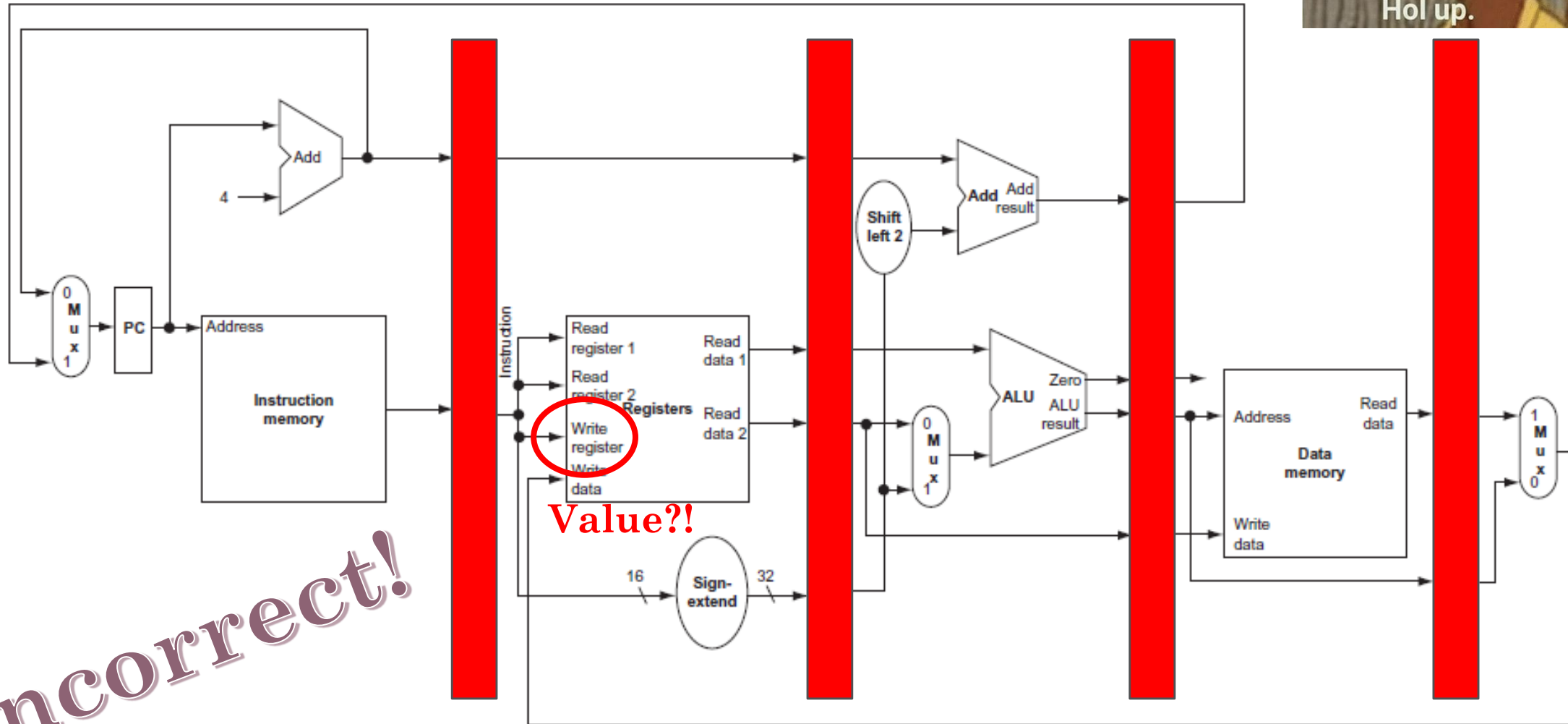


Walk-through of the Pipeline: WB

LW!

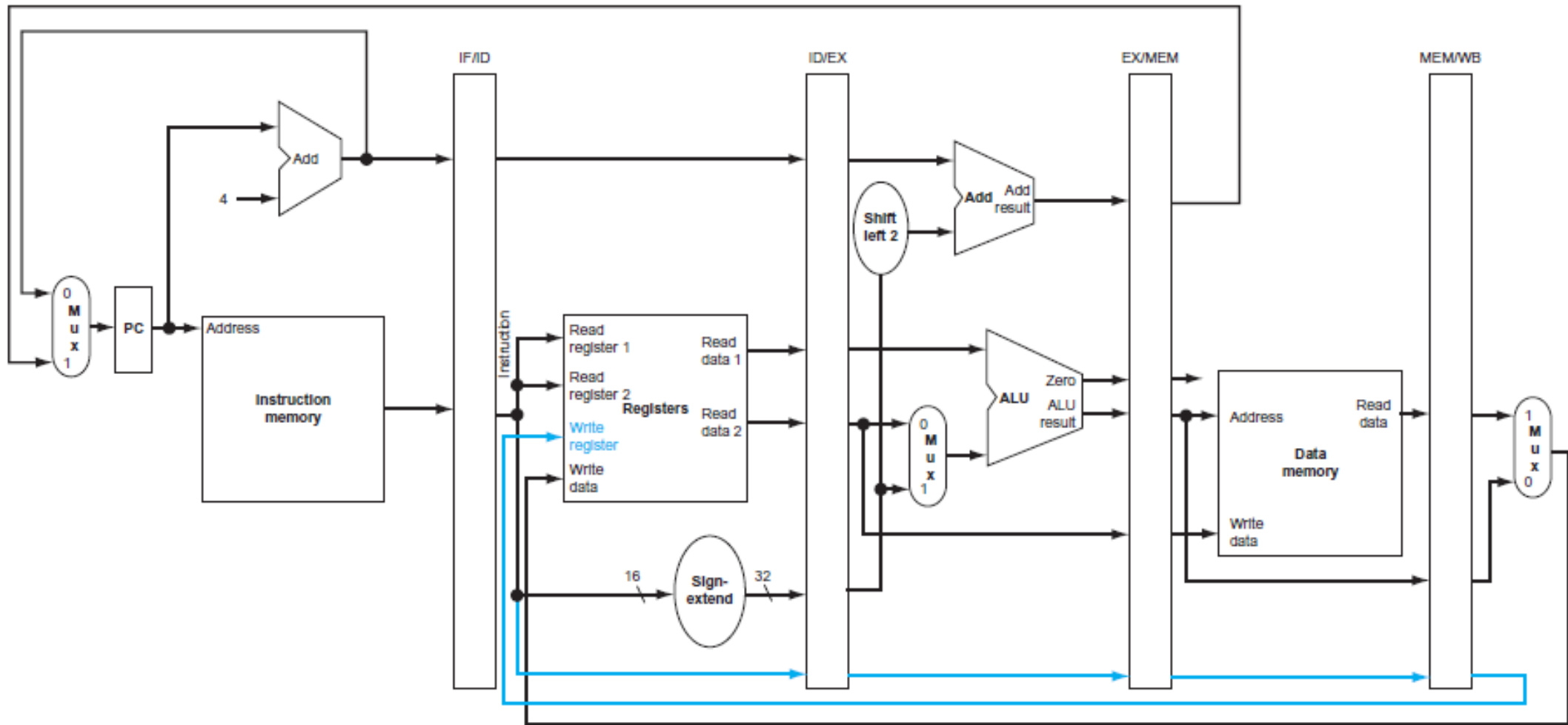


Pipelined version (no control)



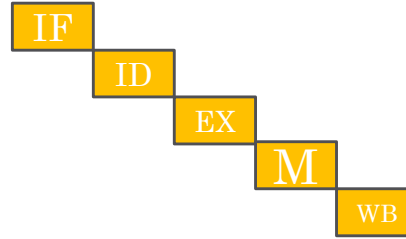
Incorrect!

Pipelined version -corrected



Let's play a game!

- lw \$10, 20(\$1)
- sub \$11, \$2, \$3
- add \$12, \$3, \$4
- lw \$13, 24(\$1)
- add \$14, \$5, \$6

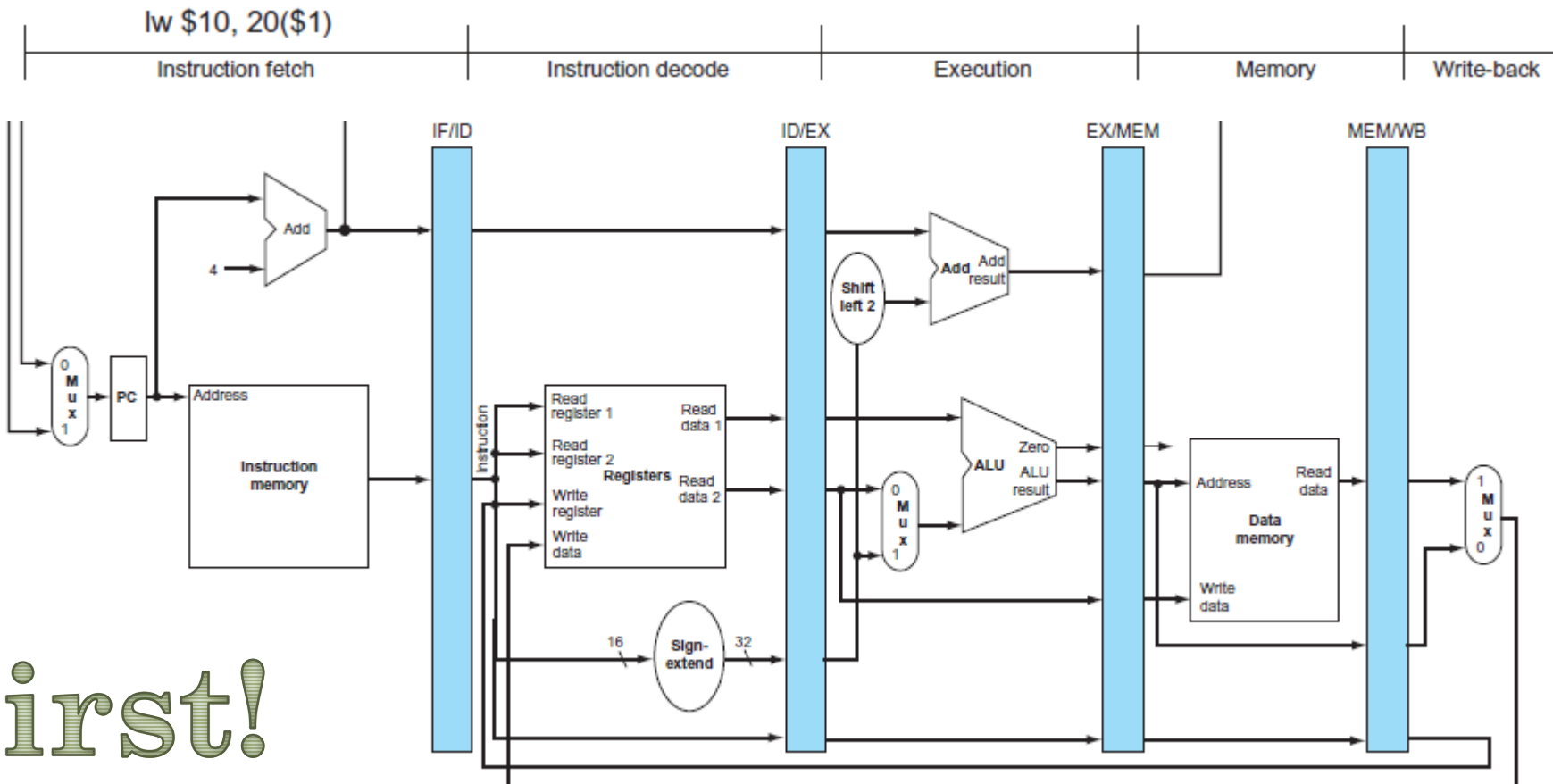


How many cycles to finish up?

Guess, in the next slides, in which cycle we are



Let's play a game!



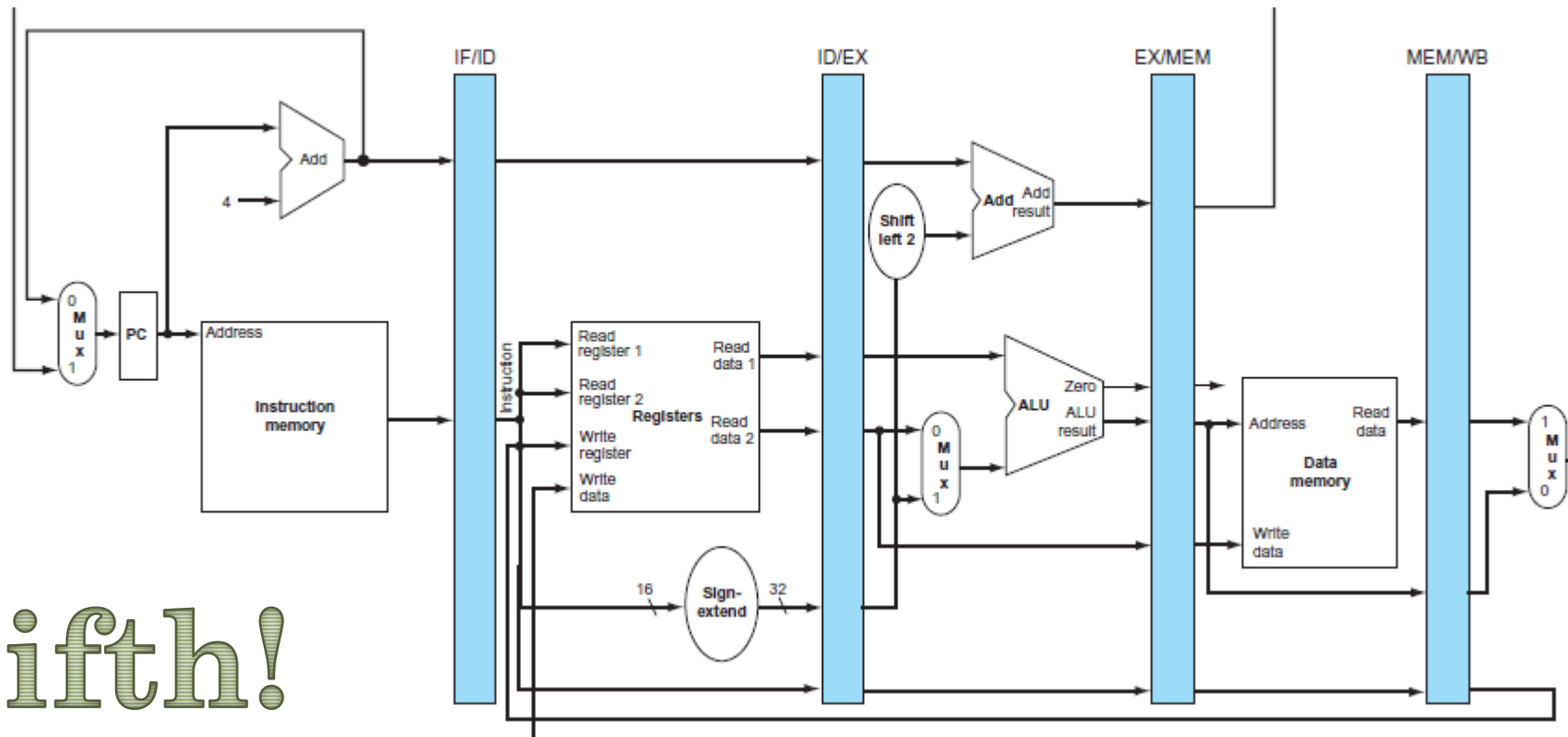
lw \$10, 20(\$1)
sub \$11, \$2, \$3
add \$12, \$3, \$4
lw \$13, 24(\$1)
add \$14, \$5, \$6

First!

Let's play a game!



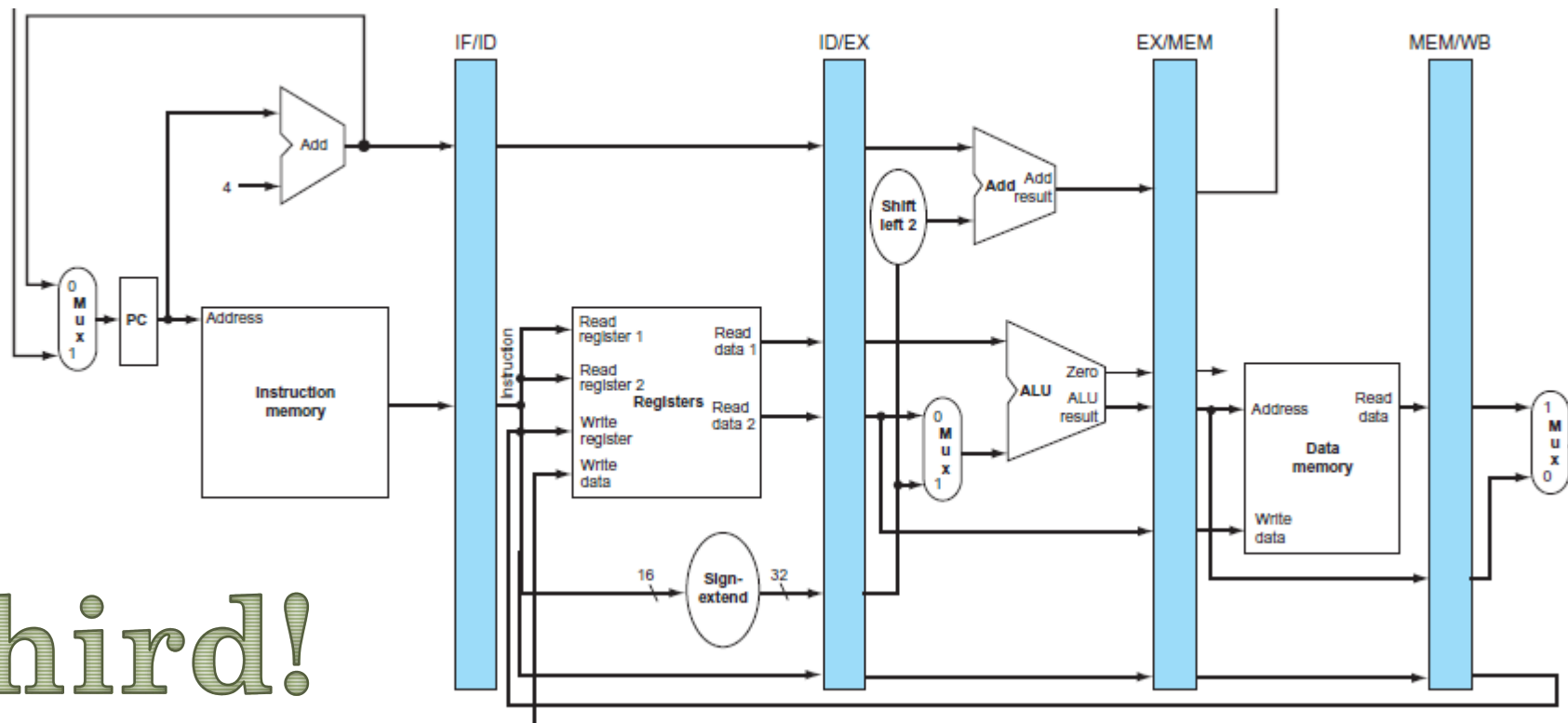
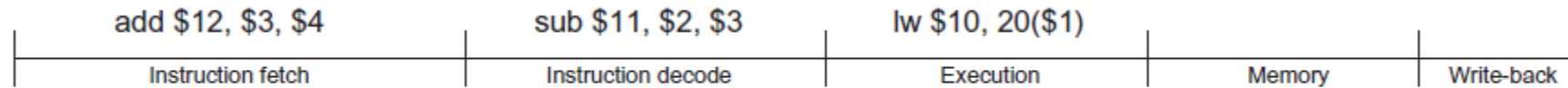
add \$14, \$5, \$6	lw \$13, 24(\$1)	add \$12, \$3, \$4	sub \$11, \$2, \$3	lw \$10, 20(\$1)
Instruction fetch	Instruction decode	Execution	Memory	Write-back



lw \$10, 20(\$1)
 sub \$11, \$2, \$3
 add \$12, \$3, \$4
 lw \$13, 24(\$1)
 add \$14, \$5, \$6

Fifth!

Let's play a game!



lw \$10, 20(\$1)
 sub \$11, \$2, \$3
 add \$12, \$3, \$4
 lw \$13, 24(\$1)
 add \$14, \$5, \$6

Third!

Research

- How much technology has influenced time spent in the different components?