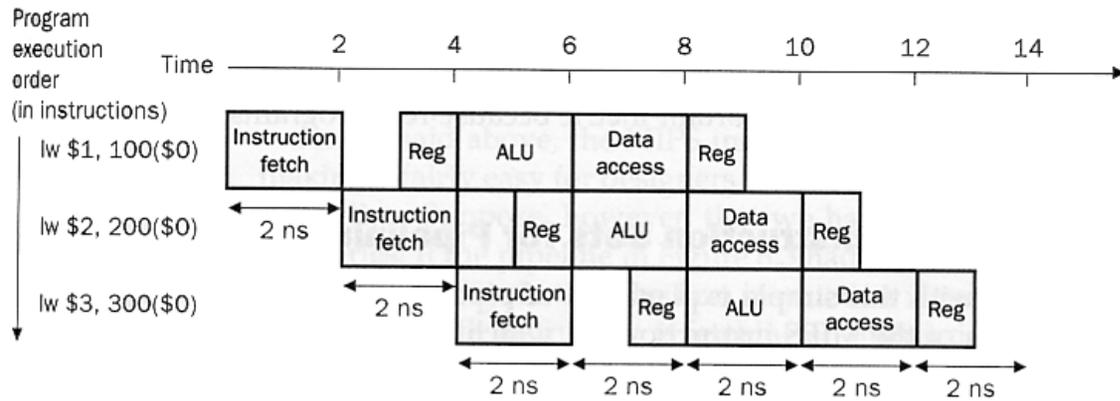
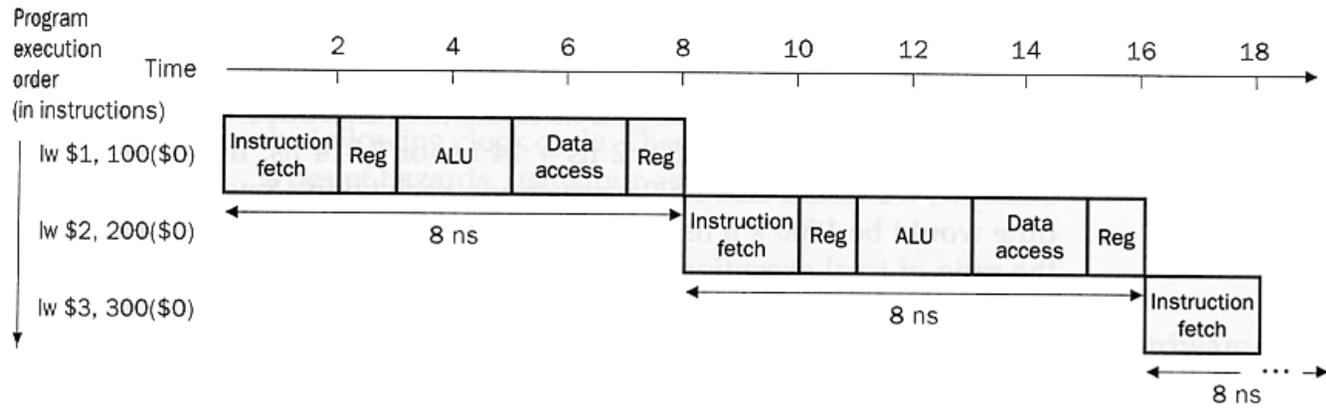
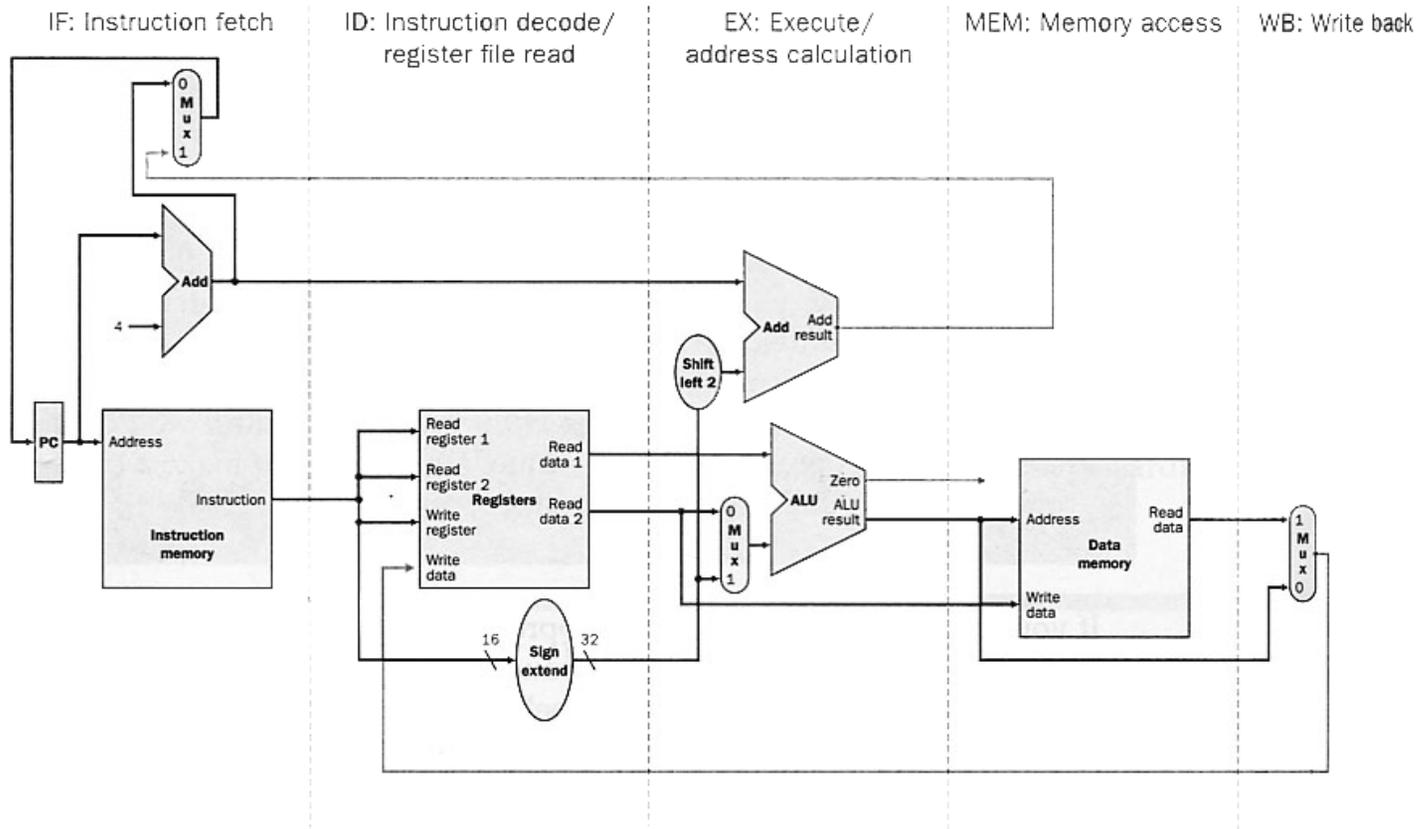
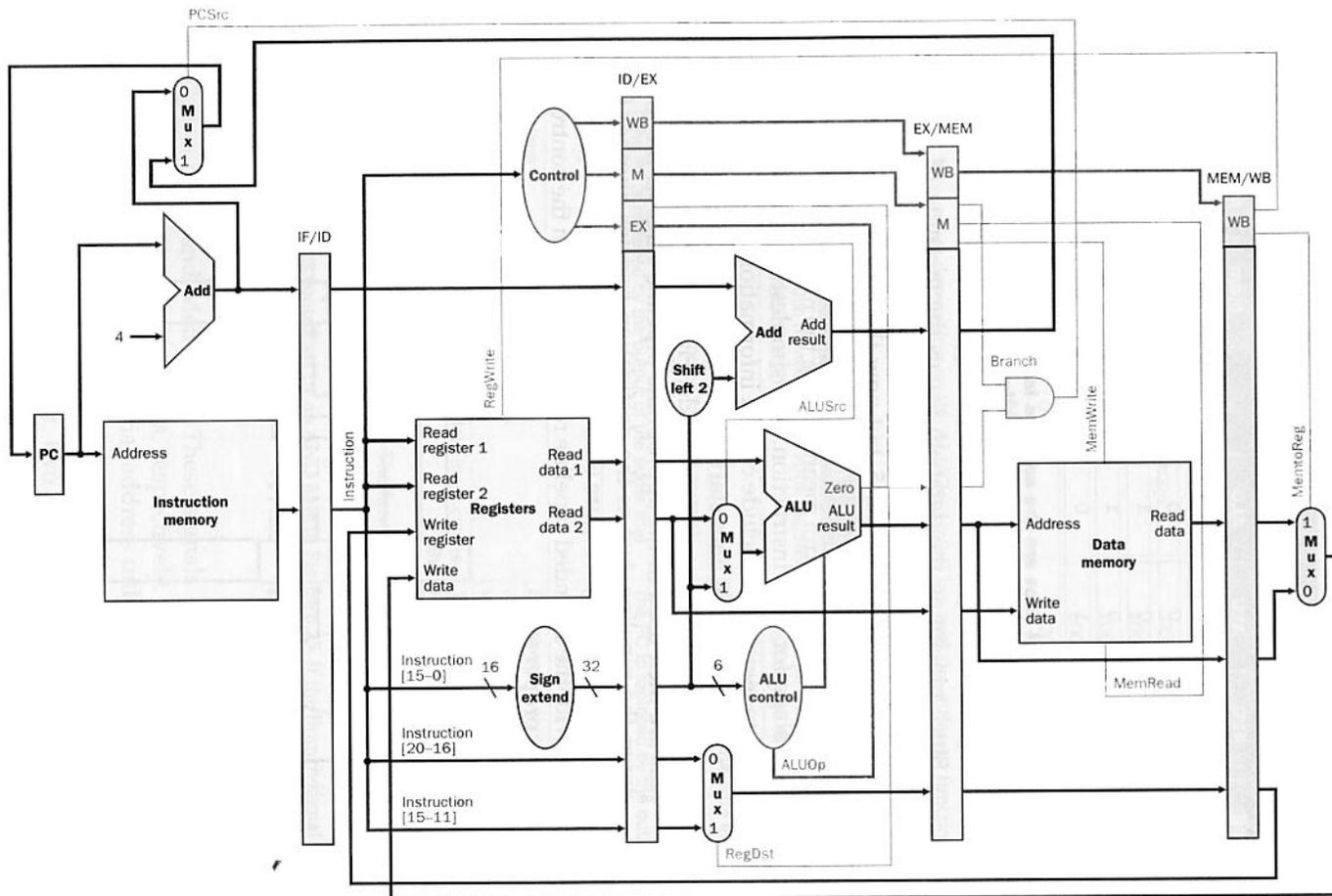


Pipelining

- What is it?
- Why does it improve performance?
- Basic data path
- Control
- What's so hard about this?







- Structural Hazards
 - A component is required to do more than one thing at a time

- Control Hazards
 - Hey, I wanted to branch!

```
        beq    $t0, $t1, skip
        addi   $t0, 1
skip:   lw     $t1, N
```

- Data Hazards
 - dependencies

read-after-write (RAW)

```
        addi   $t0, $t0, 1
        add    $t2, $t0, $t1
```

write-after-read (WAR)

write-after-write (WAW)