# Out of Order Execution: Tomasulo

## 1. Einführung

### Phasen der Abarbeitung einer Instruktion

fetch - decode - execute - write back

decode issue dispatch

write terminate

Ziel: Schnelle Abarbeitung der Instruktionen

# Out of Order Execution: Tomasulo

## Sequentielle Abarbeitung

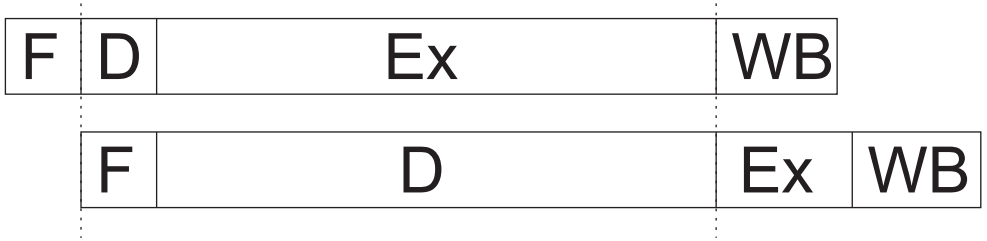
① `R1 = R1 / R2`

`R3 = R2 + R3`

## Abarbeitung mit Pipeline

② `R1 = R1 / R2`

`R3 = R2 + R3`

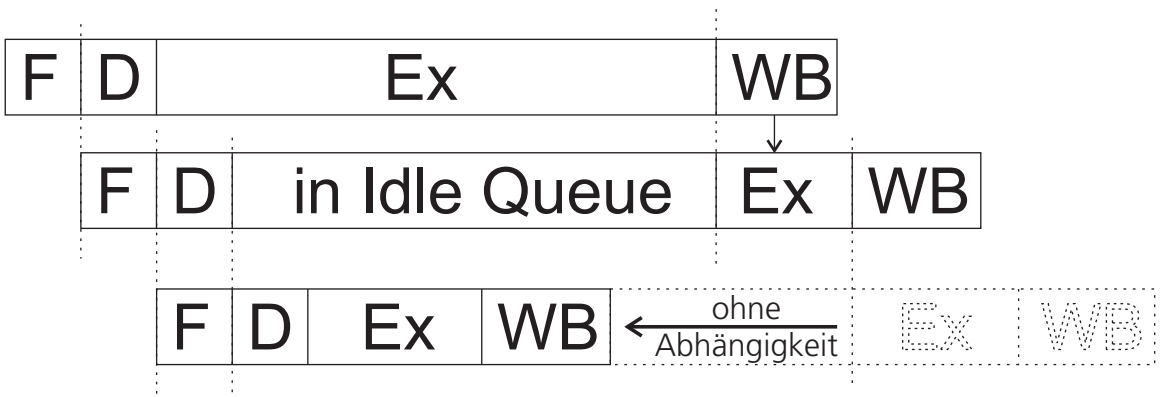



## Out of Order Execution

③ `R1 = R1 / R2`

`R3 = R1 + R3`

`R4 = R4 * R4`



## 2. Grundlagen Algorithmus von Tomasulo

### Beispiel zur Verwendung des CDB:

`R1 = R2 + R3` (R2=9, R3=11)

| t | CDB | | Reservation Station 10, Addierer | | | | | | | | | Register File | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Operand 1 | | | Operand 2 | | | R1 | | | R2 | | | R3 | | |
| | Data | Tag | Busy | Op | Dest | Data | Tag | Valid | Data | Tag | Valid | Data | Tag | Valid | Data | Tag | Valid | Data | Tag | Valid |
| 0 | - | - | 0 | + | R1 | 9 | 0 | 1 | - | 8 | 0 | - | 10 | 0 | 9 | 0 | 1 | - | 8 | 0 |
| 1 | 11 | 8 | 0 | + | R1 | 9 | 0 | 1 | 11 | 0 | 1 | - | 10 | 0 | 9 | 0 | 1 | 11 | 0 | 1 |
| 2 | - | - | 1 | + | R1 | 9 | 0 | 1 | 11 | 0 | 1 | - | 10 | 0 | 9 | 0 | 1 | 11 | 0 | 1 |
| 3 | - | - | 1 | + | R1 | 9 | 0 | 1 | 11 | 0 | 1 | - | 10 | 0 | 9 | 0 | 1 | 11 | 0 | 1 |
| 4 | - | - | 1 | + | R1 | 9 | 0 | 1 | 11 | 0 | 1 | - | 10 | 0 | 9 | 0 | 1 | 11 | 0 | 1 |
| 5 | - | - | 1 | + | R1 | 9 | 0 | 1 | 11 | 0 | 1 | - | 10 | 0 | 9 | 0 | 1 | 11 | 0 | 1 |
| 6 | 20 | 10 | 0 | + | R1 | 9 | 0 | 1 | 11 | 0 | 1 | 20 | 0 | 1 | 9 | 0 | 1 | 11 | 0 | 1 |