



# Architecture

## Solutions pour étudiants

### Exercices Architecture des ordinateurs

## 1 | Architecture

### 1.1 Stack-Architecture

- a) -
- b) 7 explicit fetch and none implicit
- c) 7 explicit fetch, 4 implicit fetch, 4 implicit store

*arc/stack-01*

### 1.2 Stack-Architecture

- a) -
- b) 7 explicit fetch
- c) 7 explicit fetch (with compiler optimizations)  
7 explicit fetch, 1 implicit store, 1 implicit fetch (without compiler optimizations)
- d) 7 explicit fetch, 3 implicit store, 3 implicit fetch (without compiler optimizations)

*arc/stack-02*

## 2 | Single-Cycle RISC-V

### 2.1 Fonctionnement du processeur à cycle unique

```
PCScr = '0'  
RegWrite = '1'  
ImmScr[1:0] = "xx"  
ALUSrc = '0'  
ALUControl[2:0] = "010"  
MemWrite = '0'  
ResultScr = '0'
```

*arc/scr-01*



## 2.2 Prolonger le mono-cycle avec l'instruction **jal**

```
PCScr = '0'  
RegWrite = '1'  
ImmScr[1:0] = "xx"  
ALUSrc = '0'  
ALUControl[2:0] = "010"  
MemWrite = '0'  
ResultScr = '0'
```

*arc/scr-02*

## 2.3 Performance du processeur à mono-cycle

$$T_{\text{program\_single\_cycle}} = 75\text{sec} \quad (1)$$

*arc/scr-03*

# 3 | Multi-Cycle RISC-V

## 3.1 Performance du processeur à multi-cycle

$$\begin{aligned} \text{CPI}_{\text{load}} &= 5 \text{ cycles} \\ \text{CPI}_{\text{store}} &= 4 \text{ cycles} \\ \text{CPI}_{\text{branch}} &= 3 \text{ cycles} \\ \text{CPI}_{\text{jump}} &= 4 \text{ cycles} \\ \text{CPI}_{\text{alu}} &= 4 \text{ cycles} \\ \text{CPI}_{\text{average}} &= 4.14 \text{ cycles} \end{aligned} \quad (2)$$

*arc/mcr-01*

## 3.2 Performance du processeur à multi-cycle

$$T_{\text{program\_single\_cycle}} = 155.25\text{sec} \quad (3)$$

*arc/mcr-02*