# Lab 1

## Exercise 3

- $i = 1$: `calculate_pi.s`
- $i = 2$: `insertion_sort.s`
- $i = 3$: `program_1.s`
- $i = 4$: `program_2.s`
- $i = 5$: `program_3.s`

### Istruzioni completate

1. $I_1 = 1066$
2. $I_2 = 10686$
3. $I_3 = 13$
4. $I_4 = 126$
5. $I_5 = 594$

### CPI

1. $CPI_1 = 2.842$
2. $CPI_2 = 1.268$
3. $CPI_3 = 1.769$
4. $CPI_4 = 1.238$
5. $CPI_5 = 1.335$

### Periodo di clock

$$T_{clk} = \frac{1}{f} = \frac{1}{1750} s$$

## Initial scenario

$$w_1 = w_2 = w_3 = w_4 = w_5 = w = 0.20$$

$$t_i = I_i \cdot CPI_i \cdot T_{clk} \cdot w$$

1. $t_1 = I_1 \cdot CPI_1 \cdot T_{clk} \cdot w = 1066 \cdot 2.842 \cdot \frac{1}{1750}\ s \cdot 0.2 = 0.346\ s$
2. $t_2 = I_2 \cdot CPI_2 \cdot T_{clk} \cdot w = 10686 \cdot 1.268 \cdot \frac{1}{1750}\ s \cdot 0.2 = 1.549\ s$
3. $t_3 = I_3 \cdot CPI_3 \cdot T_{clk} \cdot w = 13 \cdot 1.769 \cdot \frac{1}{1750}\ s \cdot 0.2 = 0.003\ s$
4. $t_4 = I_4 \cdot CPI_4 \cdot T_{clk} \cdot w = 126 \cdot 1.238 \cdot \frac{1}{1750}\ s \cdot 0.2 = 0.018\ s$
5. $t_5 = I_5 \cdot CPI_5 \cdot T_{clk} \cdot w = 594 \cdot 1.335 \cdot \frac{1}{1750}\ s \cdot 0.2 = 0.091\ s$

$$T = \sum_{i=1}^{5} t_i = 0.346\ s + 1.549\ s + 0.003\ s + 0.018\ s + 0.091\ s = 2.007\ s$$

## Scenario 1

1. $w_1 = 0.25 \Rightarrow t_1 = 0.25 \cdot 1.731\ s = 0.4328\ s$
2. $w_2 = 0.11 \Rightarrow t_2 = 0.11 \cdot 7.743\ s = 0.8517\ s$
3. $w_3 = 0.01 \Rightarrow t_3 = 0.01 \cdot 0.013\ s = 0.0001\ s$
4. $w_4 = 0.50 \Rightarrow t_4 = 0.50 \cdot 0.089\ s = 0.0445\ s$
5. $w_5 = 0.13 \Rightarrow t_5 = 0.13 \cdot 0.453\ s = 0.0589\ s$

$$T = \sum_{i=1}^{5} t_i = 0.4328\ s + 0.8517\ s + 0.0001\ s + 0.0445\ s + 0.0589\ s = 1.3880\ s$$

## Scenario 2

1. $w_1 = 0.10 \Rightarrow t_1 = 0.10 \cdot 1.731\ s = 0.1731\ s$
2. $w_2 = 0.25 \Rightarrow t_2 = 0.25 \cdot 7.743\ s = 1.9358\ s$
3. $w_3 = 0.10 \Rightarrow t_3 = 0.10 \cdot 0.013\ s = 0.0013\ s$
4. $w_4 = 0.05 \Rightarrow t_4 = 0.05 \cdot 0.089\ s = 0.0045\ s$

5. $w_5 = 0.50 \Rightarrow t_5 = 0.50 \cdot 0.453\ s = 0.2265\ s$

$$T = \sum_{i=1}^{5} t_i = 0.1731\ s + 1.9358\ s + 0.0013\ s + 0.0045\ s + 0.2265\ s = 2.3412\ s$$

## Scenario 3

1. $w_1 = 0.314 \Rightarrow t_1 = 0.314 \cdot 1.731\ s = 0.5435\ s$
2. $w_2 = 0.167 \Rightarrow t_2 = 0.167 \cdot 7.743\ s = 1.2931\ s$
3. $w_3 = 0.200 \Rightarrow t_3 = 0.200 \cdot 0.013\ s = 0.0026\ s$
4. $w_4 = 0.300 \Rightarrow t_4 = 0.300 \cdot 0.089\ s = 0.0267\ s$
5. $w_5 = 0.019 \Rightarrow t_5 = 0.019 \cdot 0.453\ s = 0.0086\ s$

$$T = \sum_{i=1}^{5} t_i = 0.5435\ s + 1.2931\ s + 0.0026\ s + 0.0267\ s + 0.0086\ s = 1.8745\ s$$