

Sessió 13 ex. 1, 2, 3 ← Tema 6

① a) 4 inst./cicle b) $20 \cdot 4 \text{ i/c} = 80 \text{ instruccions}$

$\text{CPI} = 1/4 \text{ i/c} = 0.25 \text{ c/i}$

c) $\text{CPI} = 0.25 + 0.2 \cdot 20 = 4.25 \text{ c/i}$ d) $\frac{4.25}{0.25} = 17 \text{ vegades més lent}$

e) $\text{CPI} = 0.25 + 0.05 \cdot 0.2 \cdot 20 = 0.45 \text{ c/i}$ f) $\text{Speedup} = \frac{4.25}{0.45} = 9.44 \rightarrow (9.44 - 1) \cdot 100 = 844\%$

② a) $\text{IPC} = \frac{10^9 \text{ inst.}}{10^9 \text{ cicles}} = 1 \text{ i/c} \parallel \text{OPC} = \frac{4 \cdot 10^9 \text{ op.}}{10^9 \text{ cicles}} = 4 \text{ o/c}$

b) $\frac{4 \cdot 10^9 \text{ inst.}}{10^9 \text{ cicles}} = 4 \text{ i/c}$ c) 10^9 inst.
 $\begin{cases} \rightarrow 20\% \text{ no accedeix a memòria} \\ \rightarrow 40\% \text{ 1 accés a memòria} \\ \rightarrow 40\% \text{ 2 accés a memòria simultànies} \end{cases}$

$0.6 \cdot 10^9 + 0.4 \cdot 10^9 \cdot 2 = 1.4 \cdot 10^9 \text{ cicles}$

d) $\text{IPC} = \frac{10^9 \text{ inst.}}{1.4 \cdot 10^9 \text{ cicles}} = 0.714 \text{ i/c} \parallel \text{OPC} = \frac{4 \cdot 10^9 \text{ op.}}{1.4 \cdot 10^9 \text{ cicles}} = 2.86 \text{ o/c}$

e) $4/16 = 0.25$ f) $0.6 \cdot 10^9 + 0.25 \cdot 0.4 \cdot 10^9 \cdot 2 + 0.75 \cdot 0.4 \cdot 10^9 = 1.1 \cdot 10^9 \text{ cicles}$

g) $\text{IPC} = \frac{10^9 \text{ inst.}}{1.1 \cdot 10^9 \text{ cicles}} = 0.909 \text{ i/c} \parallel \text{OPC} = \frac{4 \cdot 10^9 \text{ op.}}{1.1 \cdot 10^9 \text{ cicles}} = 3.63 \text{ o/c}$

③ a) $\text{Guany max} = \frac{200}{0.09 \cdot 200 + 0.1 \cdot 200} = \frac{200}{30} = 6.67$ b) $t(N) = 30 + \frac{170}{N} + N$

c) $0 = 30 + \frac{170}{N} + N$; $0 = 1 - \frac{170}{N^2}$; $N = \sqrt{170} = 13 \text{ processadors}$

d) $\text{Guany} = \frac{200}{30 + 26} = 3.57$

e) $\text{Guany} = \frac{200}{180 + \frac{20}{10}} = 1.1$

f) 5 horres

g) $\text{Guany} = \frac{200}{10 + 26 + 5} = 4.88$

h) $\text{MIPS} = \frac{648 \cdot 10^{13}}{10^6 \cdot 200 \cdot 3600} = 9000 \parallel \text{MFLOPS} = \frac{72 \cdot 10^{13}}{10^6 \cdot 200 \cdot 3600} = 1000$

i) $\text{MIPS} = \frac{648 \cdot 10^{13} + 13 \cdot 10^{13}}{10^6 \cdot (10 + 26 + 5) \cdot 3600} = 44783 \parallel \text{MFLOPS} = \frac{72 \cdot 10^{13}}{10^6 \cdot (10 + 26 + 5) \cdot 3600} = 4.878$

j) $\text{PC reducció} = \frac{1000 \text{ MFLOPS}}{120 \text{ w}} = 8.33 \text{ MFLOPS/w} \parallel \text{supercomputador} = \frac{4.878 \text{ MFLOPS}}{(30 \cdot 10 + 13 \cdot 90)} = 3.32 \text{ MFLOPS/w}$

k) $\frac{4878 \text{ MFLOPS}}{\left(\frac{90 \cdot 13 \cdot 26}{41} + \frac{90 \cdot 1 \cdot 15}{41} + \frac{30 \cdot 10 \cdot 5}{41} \right)} = 6 \text{ MFLOPS/w}$

$\text{Guany} = \frac{6}{3.32} = 1.81$