6.1)

a) $CPi = \frac{1}{IPC} = \frac{1}{4} = \boxed{0'25\ c/i.}$

b) $20c \cdot \frac{4\ i}{1c} = \boxed{80\ i.}$

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c) $CPi = 0'25 + 0'2 \cdot 20 = \boxed{4'25\ c/i}$

d) $0'25x = 4'25 \rightarrow x = 4 \cdot 4'25 = \boxed{17\ \text{veces mas lento}}$

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e) $CPi = 0'25 + 0'2 \cdot (1 - 0'95) \cdot 20 = \boxed{0'45\ c/i}$

f) $Speedup = \frac{4'25}{0'45} = x9'44 \rightarrow \boxed{8'44\ \text{veces más rapido}}$

6.2)

$m = 10^9\ i$

$c = 10^9\ c$

$opi = 4\ o/i$

a) $IPC_{VLIW} = \frac{10^9\ i}{10^9\ c} = \boxed{1\ i/c}$ $\quad OPC_{VLIW} = \frac{1\ i}{1\ c} \cdot \frac{4\ o}{1\ i} = \boxed{4\ o/c}$

b) RISC $\rightarrow IPC_{RISC} = OPC_{VLIW} = \boxed{4\ i/c.}$

c) $0'2 \cdot 10^9\ i$ (no memoria) $\}$ [CPI = IPC = 1]

$0'4 \cdot 10^9\ i$ (1 acceso) $\}$ x1 ciclo

$0'4 \cdot 10^9\ i$ (2 acceso) $\}$ x2 ciclos

$\Big\}\ 10^9 \cdot (0'2 + 0'4 + 0'4 \cdot 2) = \boxed{1'4 \cdot 10^9\ \text{ciclos}}$

d) $IPC = \frac{10^9}{1'4 \cdot 10^9} = \boxed{0'714\ i/c}$ $\quad OPC = ICP \cdot 4 = \boxed{2'86\ o/c}$

e) $P = \left(\frac{2}{4}\right)^2 = 0'25 \rightarrow 25\%$

f) $10^9 \cdot (0'2 + 0'4 + 0'4\,(0'25 \cdot 2 + 0'75) = 1'1 \cdot 10^9$ c

g) $IPC = \frac{10^9}{1'1 \cdot 10^9} = \boxed{0'909\ i/c}$ $\quad OPC = ICP \cdot 4 = \boxed{3'64\ o/c}$

6.3)

$T_e = 200$ horas

a) $speedup = \frac{200}{200 \cdot (0'05 + 0'1 + 0)} = \frac{1}{0'15} = \times 6'67 \rightarrow +567\%$

b) $T(N) = 200\left(0'15 + \frac{0'85}{N} + 0'005 \cdot N\right)$

$$\boxed{T(N) = 30 + \frac{170}{N} + N}$$

c) $T'(N) = -\frac{170}{N^2} + 1 = 0 \rightarrow \frac{170}{N^2} = 1 \rightarrow N = \sqrt{170} \approx 13$

d) $T(13) \approx 56h$ $(30 + 26)$ $\quad speedup = \frac{200}{56} = \times 3'57 \rightarrow +257\%$

e) $200\,(0'05 + 0'85) + \frac{0'1 \cdot 200}{10} = 180 + 2 = 182$

$speedup = \frac{200}{182} = 1'1$

f) RAID 5 → 4 discos de datos + paridades → $\frac{20h}{4} = 5h$

g) $\frac{200}{41} = \times 4'88$ $\qquad 10+26+5 = 41h$

h) MIPS = $648 \cdot 10^{13} / 10^6 \cdot 200 \cdot 3600 = 9000$ MIPS

MFLOPS = $72 \cdot 10^{13} / 10^6 \cdot 200 \cdot 3600 = 1000$ MFLOPS

i) MIPS = $648 \cdot 10^{13} / 10^6 \cdot 41 \cdot 3600 = 44\,783$ MIPS

MFLOPS = $72 \cdot 10^{13} / 10^6 \cdot 41 \cdot 3600 = 4878$ MFLOPS

j) $\frac{1000}{120} = 8'33$ MFLOPS/W

$\frac{4878}{30 \cdot 10 + 13 \cdot 90} = 3'32$ MFLOPS/W

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

Ganancia = $\frac{6}{3'32} = 1'81$