U19CS076

CO Tutorial

1)

	A	B	C	D	
P1	1	2	3	3	2.5 GHz
P2	2	2	2	2	3 GHz

a)

Clock cycles for P1

$= 1 \times 1.0 \times 10^5 + 2 \times 1.9 \times 10^5 + 3 \times 5 \times 10^5 + 2.1 \times 3 \times 10^5$

$= \cancel{20}\ 26.1 \times 10^5 = 2.61 \times 10^6$ clock cycle

Clock cycles of P_2

$= 2 \times 10^5 + 2 \times 1.9 \times 10^5 + 2 \times 5 \times 10^5 + 2 \times 2.1 \times 10^5$

$= 2 \times 10^6$ clock cycles

Time taken P_1 = $2.61 \times 10^6 / 2.5 \times 10^5$

$= 1.044$ ms

Time taken P_2 = $2 \times 10^7 / 3 \times 10^5$

$= 0.666$ ms

$\rightarrow$ P_2 is faster than P_1

b) Total clock cycle P_1 = 2.61×10^6

Total clock cycle P_2 = 2×10^6

a) Global CPI for P_1 = 2.61

Global CPI for P_2 = 2

2)

	P_1	P_2	P_3
Clock rate	3	2.5	4
CPI	1.5	1	2.2

a) $IPS_1 = \frac{\text{Clock rate}}{CPI} = \frac{3\,GHz}{1.5}$

$= 2 \times 10^9$

$IPS_2 = \frac{2.5GHz}{1} = 2.5 \times 10^9$

$IPS_3 = \frac{4\,GHz}{2.2} = 1.82 \times 10^9$

$\Rightarrow IP_2$ is fastest $\rightarrow$ highest performance

b) CPU time $= 10$ s.

No. of instruction $= IPS \times CPU$ time

For $P1 = 2 \times 10^9 \times 10$

$= 2 \times 10^{10}$

For $P_2 = 2.5 \times 10^9 \times 10$

$= 2.5 \times 10^{10}$

For $P_3 = 1.82 \times 10^{10}$

clock cycles $=$ CPU time $\times$ clock rate

$P_1 \Rightarrow 10 \times 3\,GHz = 3 \times 10^{10}$

$P_2 \Rightarrow 2.5 \times 10^{10}$

$P_3 \Rightarrow 4 \times 10^{10}$

c) Executime time $= \frac{\text{instruction} \times CPI}{\text{clock rate}}$

$\text{Instruction}_{new} = \text{Instruction old}$

$\frac{CPI_{new}}{\text{Clock rate new}} = 0.7 \times \frac{\text{CPI old}}{\text{Clock rate old}}$

$\frac{1.2}{CR_{new}} = \frac{0.7}{CR_{old}}$

$$\text{Clock rate}_{new} = \frac{1.2}{0.71} \text{ clock rate}_{old}$$

$\Rightarrow$ Must be increased by 1.71 or 71%

6 . a) $CPI = \sum_{0}^{3} CPI \times P_i$

$$MIPS = \frac{f_{CPU}}{CPI \times 10^6}$$

For R_1

$CPI = 0.16 \times 6 + 0.1 \times 8 + 0.08 \times 10 + 0.66 \times 3 = 4.54$

$$MIPS = \frac{400 \times 10^6}{4.54 \times 10^6} = 88.1$$

$\Rightarrow$ 88100000 instruction/sec.

For R_2

$CPI = 0.16 \times 20 + 0.1 \times 32 + 0.08 \times 66 + 0.66 \times 3 = 13.66$

$$MIPS = \frac{400 \times 10^6}{13.66 \times 10^6} = 29.28$$

$\Rightarrow$ 29280000 instruction/sec

b) R_1 $$CPU_{time} = \frac{12000}{88.1 \times 10^6} = 136.2 \times 10^{-6} = 136.2 \mu s$$

R_2 $$CPU\ time = \frac{12000}{29.28 \times 10^6} = 410 \mu s$$

③ a) CPU time = instruction × CPI × cycle time

$$CPI_A = \frac{1.1s}{10^9 \times 10^{-9}} = 1.5s$$

$$CPI_B = \frac{1.5s}{1.2 \times 10^9 \times 10^{-9}} = 1.25$$

b) $\text{execution time} = \frac{\text{inst} \times CPI}{\text{clock rate}}$

$$\frac{\text{clock rate}_1}{\text{clock rate}_2} = \frac{\text{instruction}_1 \times CPI_2}{\text{instruction}_2 \times CPI_2}$$

$$= \frac{10^9 \times 1.1}{1.2 \times 10^9 \times 1.25}$$

$$= 0.73 \text{ clock rate}_2$$

=> 1 27% slower than 2

c) $\frac{\text{Perform}}{P_A} = \frac{1.1s}{0.66s} = 1.67$

$$\frac{P_C}{P_B} = \frac{1.5s}{0.66s} = 2.27$$

=> C is faster than A 1.67 times ~~slower~~ and B by 2.27

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