Ans: 1

(a) $$T = \frac{(0.20 \times 2 + 0.40 \times 6 + 0.30 \times 5 + 0.10 \times 2) 2 \times 10^6}{200 \times 10^6}$$

$$= 0.045 \text{ sec}$$

$\frac{6}{3} = 2$

$\frac{5}{2} =$

(b)

OP	Freq	CPI
ALU	20%	2
Load	40%	[6-2] = 4
Store	30%	[5-3] = 2
Branch	10%	2

0.578

$$\text{Speed up} = \frac{1}{(1 - 0.4 - 0.3) + (\frac{0.4}{}}$$

$$= 1.66$$

$$T_{Load} = \frac{0.4 \times 2 \times 10^6 \times 6}{200 \times 10^6} = 0.024$$

$$F_{Load} = \frac{T_{Load}}{T}$$

~~$T_{en} = 0.028$~~

$$= \frac{0.024}{0.045} = 0.53$$

$$T_{stone} = \frac{0.30 \times 2 \times 10^6 \times 5}{200 \times 10^6} = \frac{6 \times 10^{-3}}{0.015}$$

$$F_{stone} = \frac{6 \times 10^{-3}}{0.028} = 0.21$$

$$F_{ston} = \frac{0.015}{0.045} = 0.33$$

$$\left[S = \frac{CPI}{CPI_{enhanced}}\right]$$

$$Speed\ up = \frac{1}{(1 - 0.53 - 0.33) + \left(\frac{0.53}{1.5}\right) + \left(\frac{0.33}{2.5}\right)}$$

$$= 1.4$$

$$= 1.6$$

$$T_{enhancement} = T_{old} \times (1 - 0.53 - 0.33) + \left(\frac{0.53}{1.5}\right) + \left(\frac{0.33}{2.5}\right)$$

$$= 0.045 \times 0.625$$

$$= 0.028$$

Ans

Ans :- 2

Total Execution time = 4 + 14 + 2 + 12 + 2

= 34 ms

new time for,

$A_{En} = 4 - 4 \times 0.15 = 3.4$

$C_{En} = 2 - 2 \times 0.15 = 1.7$

$E_{En} = 2 - 2 \times 0.15 = 1.7$

Improved Total = 3.4 + 14 + 1.7 + 12 + 1.7

= 32.8

$$\text{Speed up} = \frac{39}{32.8} = 1.036$$

Total Execution time will be reduced by (1/1.036) times ~~of Enhanced Execution time~~.

again,

$$B_{en} = 14 - 14 \times 10\%$$

$$= 12.6$$

$$T'_{en} = 4 + 12.6 + 2 + 12 + 2..$$

$$= 32.6$$

$$\text{Speed up}' = \frac{34}{32.6} = 1.04$$

So, Total execution time will be reduce by (1/1.04) again times.

$$D_{en} = 12 - 12 \times 0.10 = 10.8 \text{ ms}$$

$$T''_{en} = 4 + 14 + 2 + 10.8 + 2 = 32.8$$

$$\text{Speed up}'' = \frac{34}{32.8} = 1.036$$

So, Total execution time will be reduced by (1/1.036) times.

Ans

Ans 3

For Py program,

Inst.	C_i	CPI$_i$ (Assumed)	CPI$_e$ Enhanced
Type A	29%	1	$\frac{1}{7}$
Type B	71%	1	1

$IC = 35,450$

So, $C_1 = 35450 \times 0.29 = 10280.5$

$C_2 = 35450 \times 0.71 = 25169.5$

$$\text{Avg CPI} = \frac{10280.5 + 25169.5}{35450} = 1$$

$$T_{Py} = 35450 \times \frac{1}{3.1 \times 10^9} = 1.14 \times 10^{-5} s$$

$$= 11.4 \times 10^{-6} s$$

$$T_{Py\ Enhanced} = \frac{10280.5 \times \frac{1}{7} + 25169.5}{3.1 \times 10^9}$$

$$= 8.5929 \times 10^{-6} s$$

$$\text{Speed up} = \frac{11.4\ \mu s}{8.59\ \mu s} = 1.32$$

After enhancement P4 run 1.32 times faster than without enhancement.

So it will not run 2 times faster than previous.

Part B

$$F_{TypA} = \frac{T_{Type\ A}}{T_{P4}} = \frac{10280.5 \times 1 / 3.1 \times 10^9}{11.4 \times 10^{-6}} = 0.29$$

$$F_{TypeB} = \frac{T_{TypeB}}{T_{P4}} = \frac{25169.5 \times 1/3.1 \times 10^9}{11.4 \times 10^{-6}} = 0.71$$

Using Amdahl's Law,

According to the question.

$$\text{speedup} = 5.5 = \frac{1}{(1 - F_{TypeA})\left(\frac{F_{TypeA}}{S}\right)}$$

$$\Rightarrow \frac{1}{0.71 + \frac{0.29}{S}} = 5.5$$

$$\Rightarrow \frac{1}{\frac{0.71s+0.29}{s}} = 5.5$$

$$\Rightarrow s = 5.5(0.71s + 0.29)$$

$$\Rightarrow s = 3.9s + 1.595$$

$$\Rightarrow 3.9s - s = -1.595$$

$$\Rightarrow 2.95s = -1.59$$

$$\Rightarrow s = -\frac{1.59}{2.95} = -0.53$$

here the factor is negative so it is not possible to get 5.5 times faster than previous.

Ans

More Question

Last Part Ans :- 4

Given that Memory operation currently take 30% of execution time.

Soln,

$$F_{Memory} = 0.30$$

As two portion of F_{memory} are effected by two different factors ($S_1 = 4$, $S_2 = 2$) so we devided that into two fraction and named F'_{memory} and F''_{memory}.

Now according to the question,

$$F'_{memory} = 0.3 \times 0.8 = 0.24$$

and $$F''_{memory} = (0.3 - 0.24) = 0.06$$

So, using Amdahl's law,

$$\text{Speed up} = \frac{1}{(1 - F'_{memory} - F''_{memory}) + \left(\frac{F'_{memory}}{S_1}\right) + \left(\frac{F''_{memory}}{S_2}\right)}$$

$$= \frac{1}{(1 - 0.24 - 0.06) + \left(\frac{0.24}{4}\right) + \left(\frac{0.06}{2}\right)}$$

$$= 1.26 \quad \text{Ans}$$