3. Total instructions = 2000

$$\Sigma = \underset{(750 \times 1)}{\text{Arith}} + \underset{(250 \times 5)}{\text{Store}} + \underset{(500 \times 5)}{\text{Load}} + \underset{(500 \times 2)}{\text{Branch}}$$

$$= 750 + 1250 + 2500 + 1000$$

$$= 5500$$

$$\text{CPU Time} = \frac{5500}{2 \times 10^9}$$

$$= 2.75 \times 10^{-6} \text{ s}$$

$$= 2.75 \text{ μs}$$

$$\text{Avg. CPI} = \frac{5500}{2000} = 2.75$$

'Load' reduced by ½ :

Total instructions = 750 + 250 + 250 + 5000 = 1750

$$\Sigma = 750 + 1250 + (250 \times 5) + 1000$$

$$= 4250$$

$$\text{CPU Time} = \frac{4250}{2 \times 10^9}$$

$$= 2.125 \times 10^{-6}$$

$$\frac{P_B}{P_A} = \frac{2.75 \times 10^{-6}}{2.125 \times 10^{-6}} = 1.27 \text{ time speed up}$$

# Changed Portion

Average CPI

$$= \frac{4250}{1750}$$

$$= 2.429$$