Comp 4300 Homework 1
Has0027

1.) For this we can use Amdahl's law:

$$speedup_{overall} = \frac{1}{(1 - \text{ frac }) + \frac{\text{frac}}{speedup_{enhanced}}}$$

Where $speedup_{overall} = 2$, frac = 0.75, and $speedup_{enhanced}$ is our unknown.

$$\Rightarrow 2 = \frac{1}{(1 - 0.75) + \frac{0.75}{speedup_{enhanced}}}$$

$$\Rightarrow 2\left((0.25) + \frac{0.75}{speedup_{enhanced}}\right) = 1$$

$$\Rightarrow speedup_{enhanced} = 1.5 + 0.5 = 2$$

So, by solving for $speedup_{enhanced}$ we see that the loads and stores were sped up by a **factor of 2**

2.) If loads and stores took no time at all then the $speedup_{enhanced}$ would be infinity meaning we would be left with:

$Speedup_{overall} = 1 / (1 – 0.75) =$ **4**

3.) The equation to find MTTF = Total hours of operation ÷ Total assets in use

- ⇨ MTTF = 365 / 3 (since each has an MTTF of 1 year)
- ⇨ **MTTF = 121.67**

4.) **a.** The average CPI can be calculated with: $CPI_{avg} = \sum frac_i * CPI_i$ (for i within instr)

- ⇨ 1(20/100) + 5(40/100) + 3(20/100) + 2(20/100) = 3.2

So, the average CPI for this particular computer = **3.2**

b. To get the speedup due to this optimization we can use the formula:

speedup = (old average CPI) / (new average CPI)

First, we must calculate the new CPI for load/store:

⇨ 2 + (10% * 2) = 2.2

Now we can calculate the new average CPI using the formula in part a:

⇨ 1(20/100) + 2.2(40/100) + 3(20/100) + 2(20/100) = 2.08

So, the speedup from this optimization will be 3.2 / 2.08 = **1.538**