CMPEN331 – Quiz 1

1.

$(CPUTime)_A = (Instruction\ count)_A * (CPI)_A * (Clock\ cycle\ Time)_A$
$= (100{,}000)*(1.3)/(600*10^6)\ ns$
$(CPUTime)_B = (Instruction\ count)_B * (CPI)_B * (Clock\ cycle\ Time)_B$
$= (I)_B *(2.5)/(750*10^6)\ ns$
Since $(CPUTime)_A = (CPUTime)_B$,

we have to solve for (I)B and get 65000

Or you can solve it that way:

$$\begin{cases} CPI_A = 1.3 \\ Instruction\ Number_A = 10^5 \rightarrow Execution\ time\ for\ A = \dfrac{CPI_A * Instruction\ Number_A}{F_A} = \dfrac{13}{6} * 10^{-4} \\ Ferequency_A = 600\ MHz \end{cases}$$

$$Execution\ Time\ A = Execution\ Time\ B \rightarrow \frac{CPI_B * Instruction\ Number_B}{F_B} = \frac{13}{6} * 10^{-4}$$

$$\rightarrow \frac{2.5 * nstruction\ Number_B}{750 * 10^6} = \frac{13}{6} * 10^{-4} \rightarrow Instruction\ Number_B = 65000$$

2.

For running program with efficient divide time will be:

$$\text{Execution Time}_{\text{Divide}} = \frac{0.2 * \text{T}_{\text{Total}}}{3} + 0.8 * \text{T}_{\text{Total}} = 0.8\bar{6} * \text{T}_{\text{Total}} \rightarrow 1.15\text{x faster}$$

For running program with efficient multiply time will be:

$$\text{Execution Time}_{\text{Multiply}} = \frac{0.5 * \text{T}_{\text{Total}}}{8} + 0.5 * \text{T}_{\text{Total}} = 0.5625 * \text{T}_{\text{Total}} \rightarrow \quad 1.\bar{7}\text{x faster}$$

We cannot meet management's goal with only one improvement.

Another way that we will assume it is correct:

Assuming initially that the floating point multiply, floating point divide and the other instructions had the same CPI,
Execution time after Improvement with Divide = (20)/3 + (50 + 30) = 86.67
Execution time after Improvement with Multiply = (50)/8 + (20 + 30) = 56.67
The management's goal can't be met by making the improvement with Multiply alone.