Solution to

CpE 313 – Fall 2004
Quiz 02

Assume that the engineers at MBI Computers are trying to redesign their ReWop-2 computer to make it run very fast a particular program from MBI's biggest customer. The customer's program has the following typical instruction mix.

Frequency of floating point instructions = 10%
Average CPI of floating point instructions = 10

Average CPI of integer instructions = 1.25

Frequency of *floating point divide* instruction = 2%
Average CPI of *floating point divide* instruction = 40

One design team argues that it can build a new *floating point divide* unit that can reduce the average CPI for all *floating point divide* operations to 4.

Another team argues that it can build a new floating point unit that will reduce the average CPI of all floating point operations to 2.5.

Both teams have demanded identical resources to do their jobs. Which project would you approve as a manager?

$$CPI_{original} = 10 \times 0.1 + 1.25 \times 0.9$$
$$= 2.125$$

$$CPI(\text{divide unit}) = 2.125 - 2\%(\text{"÷" CPI old} - \text{"÷" CPI new})$$
$$= 2.125 - 0.02(40 - 4)$$
$$= 1.405$$

$$CPI(\text{FP unit}) = 2.125 - 10\%(\text{FP CPI old} - \text{FP CPI new})$$
$$= 2.125 - 0.1(10 - 2.5)$$
$$= 1.375$$

Because FP unit gives a LOWER new CPI, we will approve FP unit.

Please note that there is no need to calculate the speed-up's, but if you do, the answers are:

$$\text{Speedup (divide unit)} = \frac{2.125}{1.405} = 1.512$$

$$\text{Speedup (FP unit)} = \frac{2.125}{1.375} = 1.545$$