1. (10 points) If Floating point instructions are improved to run 10 times faster, while only 20% of actual instructions are FP, what is the overall speedup after this enhancement?

$FP \rightarrow 10x$

$FP \approx 20\%$ of instructions

$Speedup = \dfrac{1}{\frac{F}{N} + (1-F)} \Rightarrow \frac{0.2}{10} + (0.8) = 0.82$

$1/0.82 \approx 1.219$

2. (10 points) A program spends 80% time doing computing jobs, and the other 20% time on disk accesses. If we use a 10 times faster CPU, how much speedup we gain?

$Computing = 80\%$
$Disk = 20\%$
$CPU \rightarrow 10x$

$f = computing$
Parallel fraction

$Speedup = \dfrac{1}{\frac{0.8}{10} + (0.2)} = \dfrac{1}{0.28} \approx 3.57$

3. (10 points) Suppose 4x speedup from 8 processors. What fraction at most of the original program can be sequential?

$Speedup = \dfrac{1}{\frac{F}{N} + (1-F)} \Rightarrow 4 = \dfrac{1}{\frac{F}{8} + (1-F)}$

$4\left(\dfrac{F}{8} + (1-F)\right) = 1$

$\dfrac{F}{2} + 4(1-F) = 1 \Rightarrow F/2 + 4 - 4F = 1$

$\dfrac{1}{2}F + 3 = 4F \Rightarrow 3 = \dfrac{7}{2}F$

$F = \dfrac{6}{7}$ (parallel)

Sequential: $1 - F = \dfrac{1}{7}$
fraction