Measuring Performance

"Computer X is n times faster than computer Y"

\[
\frac{\text{Execution time}_y}{\text{Execution time}_x} = n
\]

\[
n = \frac{\text{Execution time}_y}{\text{Execution time}_x} = \frac{\text{Performance}_x}{\text{Performance}_y}
\]
Benchmarks

1. Real Applications
2. Modified (or scripted) applications
3. Kernels
4. Toy benchmarks
5. Synthetic benchmarks
Quantitative Principles

1. Make the Common Case Fast
Quantitative Principles

2. Amdahl's Law

\[
\text{Speedup} = \frac{\text{Total Performance using an enhancement}}{\text{Total Performance without the enhancement}}
\]
Quantitative Principles

3. CPU Performance Equations

\[ \text{CPU Time} = \text{CPU cycles for a program} \times \text{Clock Cycle Time} \]

or

\[ \text{CPU time} = \frac{\text{CPU cycles for a program}}{\text{Clock Rate}} \]

\[ \text{CPI} = \frac{\text{CPU cycles for a program}}{\text{Instruction Count}} \]
Quantitative Principles

4. Principle of locality
   - Temporal Locality
   - Spacial Locality