1.5 Lecture Summary

1 Task-level Parallelism

1.5 Amdahl's Law

Lecture Summary: In this lecture, we studied a simple observation made by Gene Amdahl in 1967: if $q \leq 1$ is the fraction of *WORK* in a parallel program that must be executed *sequentially*, then the best speedup that can be obtained for that program for any number of processors, P, is $Speedup(P) \leq 1/q$.

This observation follows directly from a lower bound on parallel execution time that you are familiar with, namely $T_P \geq SPAN(G)$. If fraction q of $WORK(G)$ is sequential, it must be the case that $SPAN(G) \geq q \times WORK(G)$. Therefore, $Speedup(P) = T_1/T_P$ must be $\leq WORK(G)/(q \times WORK(G)) = 1/q$ since $T_1 = WORK(G)$ for greedy schedulers.

Amdahl's Law reminds us to watch out for sequential bottlenecks both when designing parallel algorithms and when implementing programs on real machines. As an example, if $q = 10\%$, then Amdahl's Law reminds us that the best possible speedup must be ≤ 10 (which equals $1/q$), regardless of the number of processors available.

Optional Reading:

1. Wikipedia article on Amdahl's law.

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