# Worksheet: Speedup

## **Array Sum Speedup**

- Assume T(S,P) = WORK(G,S)/P + CPL(G,S) = (S-1)/P + log2(S) for the parallel array sum computation shown in slide 4 (using the upper bound)

- Assume S = 1024 ==> log2(S) = 10

- Compute for 10, 100, 1000 processors (round to 1 decimal place)
  T(S,P) = (S-1)/P + log2(S) = 1023/P + 10
  Speedup(10) = T(1)/T(10) =
  Speedup(100) = T(1)/T(100) =
  Speedup(1000) = T(1)/T(1000) =

- Why does the speedup not increase linearly in proportion to the number of processors?

# Worksheet solution

- Estimate T(S,P) ~ WORK(G,S)/P + CPL(G,S) = (S-1)/P + log2(S) for the parallel array sum computation shown in slide 4.
- Assume S = 1024 ==> log2(S) = 10
- Compute for 10, 100, 1000 processors
  — T(P) = 1023/P + 10, when P > 1
  — Speedup(10) = T(1)/T(10) = 1023/112.3 ~ 9.1
  — Speedup(100) = T(1)/T(100) = 1023/20.2 ~ 50.6
  — Speedup(1000) = T(1)/T(1000) = 1023/11.0 ~ 93.7
- Why does the speedup not increase linearly in proportion to the number of processors?
  — Because of the critical path length, log2(S), is a bottleneck

# Speedup Chart (linear scale)