2 Amdahl's and Gustafson's Law

Assuming a program consists of 50% non-parallelizable code.

a) Compute the speed-up when using 2 and 4 processors according to Amdahl's law.

$$S_2 = \frac{1}{0.5 + \frac{1 - 0.5}{2}} = \frac{1}{\frac{3}{4}} = \frac{4}{3} \approx 1.33$$

$$S_{4} = \frac{\Lambda}{C.57, \frac{\Lambda}{4}} = \frac{1}{C.627} = \frac{8}{5} = 1.6$$

b) Now assume that the parallel work per processor is fixed. Compute the speed-up when using 2 and 4 processors according to Gustafson's law.

$$S_2 = 0.5 + 2(1-0.5) = 1.5$$

c) Explain why both speed-up results are different.

3 Amdahl's and Gustafson's Law II

a) The analysis of a program has shown a speedup of 3 when running on 4 cores. What is the serial fraction according to Gustafson's law?

$$S_4 = 3 = f + (n - f) \cdot 4$$

 $\Rightarrow 3 = -3f + 4 \Rightarrow -n = -3f \Rightarrow f = \frac{1}{3}$

b) The analysis of a program has shown a speedup of 3 when running on 4 cores. What is the serial fraction according to Amdahl's law (assuming best possible speedup)?

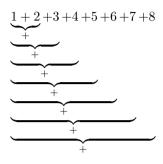
$$S_4 = 3 = \frac{1}{f + \frac{1 - f}{4}} \Rightarrow \frac{1}{3} = f + \frac{1 - f}{4}$$

3

$$\Rightarrow \frac{4}{3} = 3(+1) \Rightarrow \frac{4}{3} = 36 \Rightarrow (=\frac{1}{3})$$

4 Task Graph

Assuming you want to add eight numbers, then two options to do this are



and

$$\underbrace{1 + 2 + 3 + 4}_{+} + \underbrace{5 + 6 + 7 + 8}_{+}$$

a) Given those two variants, determine the length of the critical path for both computations.

b) For a sequence of length n, determine the length of the critical path using the two approaches from above (accumulator method and Divide and Conquer).