ECSE 420 A1Q4 Ben Willetts 260610719

4.1

$$S = \frac{1}{(1-P) + \frac{P}{N}}$$

0.4 ↑ $P = 0.6$

$$\therefore S = \frac{1}{0.4 + \frac{0.6}{N}} \quad N \to \infty$$

$$S = \frac{1}{0.4} = \boxed{2.5}$$

4.2

$$S = \frac{1}{0.2 + \frac{0.8}{N}}$$

total time $t = 0.2 + \frac{0.8}{N}$

goal: $0.5t' > t$

where K is factor of decrease in sequential time

$$\frac{0.2}{2} + \frac{0.8}{2N} > \frac{0.2}{K} + \frac{0.8}{N}$$

$$0.1 + \frac{0.4}{N} > \frac{0.2}{K} + \frac{0.8}{N}$$

$$0.1 - \frac{0.4}{N} > \frac{0.2}{K}$$

$$\frac{0.1N - 0.4}{0.2N} > \frac{1}{K}$$

$$K > \frac{0.2N}{0.1N - 0.4}$$

where N is the # of processors

4.3

$$0.5t = \frac{S}{3} + \frac{P}{N}$$

$$0.5\left(0.2 + \frac{0.8}{N}\right) = \frac{S}{3} + \frac{1-S}{N}$$

$$0.1 + \frac{0.4}{N} = \frac{S}{3} + \frac{1}{N} - \frac{S}{N}$$

$$0.1 + \frac{0.4}{N} - \frac{1}{N} = S\left(\frac{1}{3} - \frac{1}{N}\right)$$

$$\frac{0.1 - \frac{0.6}{N}}{\frac{1}{3} - \frac{1}{N}} = S$$

$$S = \frac{0.1 - \frac{0.6}{N}}{\frac{N-3}{3N}}$$

$$S = \frac{3(0.1N - 0.6)}{N-3}$$

$$\boxed{S = \frac{0.3N - 1.8}{N-3}}$$