Assignment 1. *Design a cost-optimal version of the prefix sums algorithm (Problem 5.10) for computing all prefix-sums of n numbers on p processing elements where $p < n$. Derive expressions for parallel runtime T_p, speedup S, efficiency E, cost c and the isoefficiency function W. Assuming that adding two numbers takes one unit of time and that communicating one number between two processing elements takes 10 units of time.*

Assignment 2. *Consider the simple matrix multiplication algorithm (Section 8.2.1) for multiplying two $n \times n$ matrices using p processes. Assume that the submatrices are multiplied using Strassen's algorithm at each process. Derive an expression for the parallel run time of this algorithm. Is the parallel algorithm cost-optimal?*

Strassen's method for matrix multiplication is an algorithm based on the divide-and-conquer technique. The sequential complexity of multiplying two $n \times n$ matrices using Strassen's algorithm is $O(n^{2.81})$.

Assignment 3. *Derive expression for minimal parallel runtime T_p^{min}, isoefficiency function W, and total overhead T_o for edge detection on images (book Example 5.6):*
a) 1-D edge detection
b) 2-D edge detection

Assignment 4. *Assume a parallel formulations of the bitonic sort algorithm. Let p be the number of processes and n be the number of elements to be sorted, such that $p < n$. Each process is assigned a block of n/p elements and cooperates with the other processes to sort them. Derive parallel runtime and the isoefficiency function. Assume a hyper cube architecture.*

Assignment 5. *The parallel runtime T_p of a parallel implementation of the FFT algorithm with p processing elements is given by $T_P = (n/p) \log n + t_w(n/p) \log p$ for an input sequence of length n (book Equation 13.4 with $ts = 0$). The maximum number of processing elements that the algorithm can use for an n-point FFT is n. What is the number of processors when T_p is minimal and what is the minimal T_p for $t_w = 10$?*