

Midterm exam Parallel Algorithms (WISM459) October 17, 2007

Each of the five questions is worth 10 points. Total time is 45 minutes.

Question 1

What is a BSP superstep?

Question 2

Give the syntax of the `bsp_put` primitive from the BSPlib communications library. Explain the use of the parameters.

Question 3

Let \mathbf{x} be a given vector of length n , which is distributed by the cyclic distributions over p processors, with $n \bmod p = 0$. Give an efficient BSP algorithm for processor $P(s)$ (in the notation we learned) for the computation of the sum $\sum_{i=0}^{n-1} x_i^4$. On output, every processor has to know the result. Analyse the BSP cost.

Question 4

Let p, n be positive integers, with $n \bmod p = 0$. Define a permutation σ by $\sigma(i) = (i + 51) \bmod n$, for $0 \leq i < n$. What is the exact communication cost of permuting a block distributed vector \mathbf{x} by σ , i.e., assigning $y_{\sigma(i)} = x_i$? The length of the input and output vectors is n . The number of processors is p .

Question 5

Let \mathbf{x} be an array of odd length $n = 2k + 1$ containing numerical values x_i . Assume that all values are different. We want to find the *median* of the values, i.e., the array value x_j such that k array values are higher than x_j and k are lower. Our aim is to do this in parallel, using the block distribution. On output, every processor has to know the median. Give an efficient BSP algorithm for processor $P(s)$ for the median computation. Analyse the BSP cost; if necessary, make additional assumptions in your analysis.