

CS60026: Parallel and Distributed Algorithms

Tutorial 1

August 5, 2016

1. Design a parallel algorithm that finds the maximum number in a sequence x_1, x_2, \dots, x_n integers in the range 1 to n . Your algorithm should run in constant time on a CRCW Priority RAM with n processors. In a CRCW priority PRAM, each processor has a unique positive integer identifier, and in the case of write conflicts, the value written is the value that the processor with the lowest identifier is trying to write.
2. Design a parallel algorithm that finds the maximum number in a sequence x_1, x_2, \dots, x_n of (not necessarily distinct) integers. Your algorithm should run in time $O(\log \log n)$ on a CRCW Common PRAM with n processors.
3. Given an array of 0-1 numbers, we need to compute the position of the first one. For example, consider the array (0001010), the first one is located at the index 4 (consider the first number of the array is 1). Design a suitable parallel algorithm for the above considering the following machines:
 - Provide an optimal CREW algorithm for the above which runs in $O(\log n)$ time. What is the run time on an EREW machine?
 - Provide a common-CRCW algorithm using $O(n^2)$ processors which computes the above in $O(1)$ time.
 - Can the above be achieved on the common-CRCW PRAM using $O(n)$ processors in $O(1)$ time? [Hint: Define another CRCW algorithm to determine whether there is a one in a segment in $O(1)$]

4. Develop an algorithm that given a string representing a mixture of text and numbers returns a t (true) wherever a character corresponds to a number and a f (false) otherwise. The string can contain letters ([a..z]), digits ([0..9]) or spaces. The trick is that digits that follow a letter are part of text and not a number. For example: `parseNums("foo22 711")`

```
it = [f, f, f, f, f, f, t, t, t] : [bool]
```

since 771 belong to a number but 22 does not.