

HW0: Exchange Problem

Course: HONR219A
Title: Exchange Problem
Date Assigned: February 4, 2008
Date Due: February 11,2008

1 Problem statement

Input: An array $A = A(0), \dots, A(n-1)$ and another array $B = B(0), \dots, B(n-1)$ of elements (any kind).
Task: The exchange problem is to swap all elements of A and B. For example if $A = (1, 5, 7, 3)$ and $B = (2, 6, 4, 8)$, after exchange $A = (2, 6, 4, 8)$ and $B = (1, 5, 7, 3)$.

Serial algorithm with $3n$ operations, $3n$ steps, 1 space (X):

```
for i=1 to n do
  X = A[i];
  A[i] = B[i];
  B[i] = X;
```

Parallel algorithm (1) with $3n$ operations, 3 steps, n spaces ($X[1..n]$):

```
for i=1 to n pardo
  X[i] = A[i];
  A[i] = B[i];
  B[i] = X[i];
```

Parallel algorithm (2) with $4n$ operations, 2 steps, $2n$ spaces ($X[1..n], Y[1..n]$):

```
for i=1 to n pardo
  X[i] = A[i]; | B[i] = X[i];
  Y[i] = B[i]; | A[i] = Y[i];
```

2 Assignment

- Write XMTC programs realizing serial and both parallel algorithms.
- Discuss: Is the second parallel algorithm preferred to the first one?

Write XMTC programs realizing serial and both parallel algorithms. Is the second parallel algorithm preferred to the first one?

3 The program

You should name your XMTC files as follows: exchange.s.c (serial), exchange1.p.c (parallel 1), exchange2.p.c (parallel 2).

3.1 Setting up the environment

The header files and the binary files can be downloaded from `~george/xmtdata`. To get the data files, log in to your account in the class server and copy the `exchange.tgz` file from directory using the following commands:

```
$ cp ~george/xmtdata/exchange.tgz ~/
$ tar xzvf exchange.tgz
```

This will create the directory `exchange` with following folders: `data`, `src`, and `doc`. Data files are available in data directory.

3.2 Input format

You are given two arrays `A` and `B` that contains n integers.

int n	The size of the arrays
int A[n]	The array A
int B[n]	The array B

3.3 Data sets

Run all your programs (serial and parallel) using the following data files. You can directly include the header file into your XMTC code with `#include` or you can include the header file with the compile option `-include`. To run the compiled program you will need to specify the binary data with `-data-file` option.

Data Set	Header File	Binary file
n = 16	data/16/exchange.h	data/16/exchange.32b
n = 3200	data/3200/exchange.h	data/3200/exchange.32b
n = 16000	data/16000/exchange.h	data/16000/exchange.32b
n = 64000	data/64000/exchange.h	data/64000/exchange.32b

3.4 Output

Prepare and fill the following table: Create a text file named `table.txt` in `doc`. Remove any `printINT` and `printSTR` statements from your code while taking these measurements. `Printf` statements increase the clock and instruction count. Therefore the measurements with `printf` statements and may not reflect the actual time and work done. Is the second parallel algorithm preferred to the first one? After having filled the table, write your arguments.

Input size	n = 16	n = 3200	n = 16000	n = 64000
Serial Clock Cycles				
Parallel1 Clock Cycles				
Parallel2 Clock Cycles				

3.5 Submission

There is no submission required for this assignment. Its main purpose is to get you accustomed to the environment and understand how the system operates. Keep in mind that the following assignments will be more challenging, and being used to the system will allow you to focus on the actual work. We highly recommend that you complete this assignment before starting the next one.