# CS6868: Concurrent Programming
# Spring 2014
# Assignment 1: Due 22 February 2014, 11:59 pm

### Problem 4:Graph colouring

## Approach

We want to speed up the graph coloring by doing the colouring in parallel. In this approach,there is a trade off between the time spent in colouring the graph and minimum no of graph colours since finding a coloring of a graph using the minimal number of colours is known to be an NP Hard problem.In greedy approximate algorithm,we choose any vertex in random and colour it using smallest color not in set of colors of all colored neighbors.We can improve appoxmation accuracy by sellecting vertex with higest degree frist.

In parallel version, We call parallelly decide uncoloured nodes with highest degree and colour them.

We can improve accuracy by running same algorithm repeatedly but using old colour as new degree.But it have less optimization rate compared to extra time taken.

## Cilkview Scalability Analyzer Output

Input 1(Big)

*Cilkview Scalability Analyzer V2.0.0, Build 3566*

*Whole Program Statistics*
*1) Parallelism Profile*

| | | |
|---|---|---|
| *Work :* | | *63,257,608 instructions* |
| *Span :* | | *9,491,355 instructions* |
| *Burdened span :* | | *113,368,068 instructions* |
| *Parallelism :* | *6.66* | |
| *Burdened parallelism :* | | *0.56* |
| *Number of spawns/syncs:* | | *162,432* |
| *Average instructions / strand :* | | *129* |
| *Strands along span :* | | *8,737* |

*Average instructions / strand on span : 1,086*
*Total number of atomic instructions : 164,034*
*Frame count : 325,599*

*2) Speedup Estimate*

| | |
|---|---|
| *2 processors:* | *0.49 - 2.00* |
| *4 processors:* | *0.39 - 4.00* |
| *8 processors:* | *0.36 - 6.66* |
| *16 processors:* | *0.34 - 6.66* |
| *32 processors:* | *0.34 - 6.66* |
| *64 processors:* | *0.33 - 6.66* |
| *128 processors:* | *0.33 - 6.66* |
| *256 processors:* | *0.33 - 6.66* |

*Cilk Parallel Region(s) Statistics - Elapsed time: 0.047 seconds*

*1) Parallelism Profile*

*Work : 55,426,173 instructions*
*Span : 1,659,920 instructions*
*Burdened span : 105,536,633 instructions*
*Parallelism : 33.39*
*Burdened parallelism : 0.53*
*Number of spawns/syncs: 162,432*
*Average instructions / strand : 113*
*Strands along span : 4,368*
*Average instructions / strand on span : 380*
*Total number of atomic instructions : 164,034*
*Frame count : 325,599*
*Entries to parallel region : 534*

*2) Speedup Estimate*

| | |
|---|---|
| *2 processors:* | *0.47 - 2.00* |
| *4 processors:* | *0.37 - 4.00* |
| *8 processors:* | *0.34 - 8.00* |
| *16 processors:* | *0.32 - 16.00* |
| *32 processors:* | *0.32 - 32.00* |
| *64 processors:* | *0.31 - 33.39* |
| *128 processors:* | *0.31 - 33.39* |
| *256 processors:* | *0.31 - 33.39* |

Input 2(Medium)

*Cilkview Scalability Analyzer V2.0.0, Build 3566*

*Whole Program Statistics*

*1) Parallelism Profile*

| | | |
|---|---|---|
| *Work :* | | *63,257,608 instructions* |
| *Span :* | | *9,491,355 instructions* |
| *Burdened span :* | | *113,368,068 instructions* |
| *Parallelism :* | *6.66* | |
| *Burdened parallelism :* | | *0.56* |
| *Number of spawns/syncs:* | | *162,432* |
| *Average instructions / strand :* | | *129* |
| *Strands along span :* | | *8,737* |
| *Average instructions / strand on span :* | | *1,086* |
| *Total number of atomic instructions :* | | *164,034* |
| *Frame count :* | | *325,599* |

*2) Speedup Estimate*

| | |
|---|---|
| *2 processors:* | *0.49 - 2.00* |
| *4 processors:* | *0.39 - 4.00* |
| *8 processors:* | *0.36 - 6.66* |
| *16 processors:* | *0.34 - 6.66* |
| *32 processors:* | *0.34 - 6.66* |
| *64 processors:* | *0.33 - 6.66* |
| *128 processors:* | *0.33 - 6.66* |
| *256 processors:* | *0.33 - 6.66* |

*Cilk Parallel Region(s) Statistics - Elapsed time: 0.047 seconds*

*1) Parallelism Profile*

| | | |
|---|---|---|
| *Work :* | | *55,426,173 instructions* |
| *Span :* | | *1,659,920 instructions* |
| *Burdened span :* | | *105,536,633 instructions* |
| *Parallelism :* | *33.39* | |
| *Burdened parallelism :* | | *0.53* |
| *Number of spawns/syncs:* | | *162,432* |
| *Average instructions / strand :* | | *113* |
| *Strands along span :* | | *4,368* |
| *Average instructions / strand on span :* | | *380* |
| *Total number of atomic instructions :* | | *164,034* |
| *Frame count :* | | *325,599* |
| *Entries to parallel region :* | | *534* |

*2) Speedup Estimate*

| | |
|---|---|
| *2 processors:* | *0.47 - 2.00* |
| *4 processors:* | *0.37 - 4.00* |

*8 processors:* *0.34 - 8.00*
*16 processors:* *0.32 - 16.00*
*32 processors:* *0.32 - 32.00*
*64 processors:* *0.31 - 33.39*
*128 processors:* *0.31 - 33.39*
*256 processors:* *0.31 - 33.39*

Input 3(Small)

*Cilkview Scalability Analyzer V2.0.0, Build 3566*

*Whole Program Statistics*
*1) Parallelism Profile*
*Work :* *6,043,286 instructions*
*Span :* *4,725,768 instructions*
*Burdened span :* *15,758,730 instructions*
*Parallelism :* *1.28*
*Burdened parallelism :* *0.38*
*Number of spawns/syncs:* *4,094*
*Average instructions / strand :* *492*
*Strands along span :* *947*
*Average instructions / strand on span :* *4,990*
*Total number of atomic instructions :* *4,349*
*Frame count :* *8,281*

*2) Speedup Estimate*
*2 processors:* *0.37 - 1.28*
*4 processors:* *0.28 - 1.28*
*8 processors:* *0.25 - 1.28*
*16 processors:* *0.24 - 1.28*
*32 processors:* *0.23 - 1.28*
*64 processors:* *0.23 - 1.28*
*128 processors:* *0.23 - 1.28*
*256 processors:* *0.23 - 1.28*

*Cilk Parallel Region(s) Statistics - Elapsed time: 0.046 seconds*
*1) Parallelism Profile*
*Work :* *1,527,142 instructions*
*Span :* *209,624 instructions*

| | |
|---|---|
| *Burdened span :* | *11,242,586 instructions* |
| *Parallelism :* | *7.29* |
| *Burdened parallelism :* | *0.14* |
| *Number of spawns/syncs:* | *4,094* |
| *Average instructions / strand :* | *124* |
| *Strands along span :* | *473* |
| *Average instructions / strand on span :* | *443* |
| *Total number of atomic instructions :* | *4,349* |
| *Frame count :* | *8,281* |
| *Entries to parallel region :* | *85* |

*2) Speedup Estimate*

| | |
|---|---|
| *2 processors:* | *0.15 - 2.00* |
| *4 processors:* | *0.10 - 4.00* |
| *8 processors:* | *0.09 - 7.29* |
| *16 processors:* | *0.08 - 7.29* |
| *32 processors:* | *0.08 - 7.29* |
| *64 processors:* | *0.08 - 7.29* |
| *128 processors:* | *0.08 - 7.29* |
| *256 processors:* | *0.08 - 7.29* |