CMPSC 560, Spring 2007

Time: MWF 2:30—3:20, 112 Engineering B
Instructor: Dr. Piotr Berman
Office hours: 311 Whitmore, TR 1—3

Text: Cook, Cunningham, Pulleyblank and Schriver, *Combinatorial optimization*.

Grading principles: 6 homeworks, 50%

Exams: two take-home midterms, one take-home final, 50%. Two homeworks will be followed by a take-home exam, the idea being that it is encouraged to discuss problems whith others when you work on a homework, but not in the case of a take-home exam. The honesty rule for homework is: do not copy, write only what you understand. For take-homes: do not discuss, do not show your work, do not read other peoples work.

We will cover the following chapters of the text: 1, 2, (done), 3 to 8, skipping a few topics. Then we will cover networks suitable for the parallel computations and some algorithms that they can perform well: sorting, routing, matric multiplication, fast Fourrier transformation.

1. The next chapter to read: 3.
2. Homework due: February 2nd.

Homework due on March 9: problems 4.3, 4.8, 5.27 and one that will be posted on March 1.

Homework due on April 30:

Problem 1. A shuffle exachange graph cannot have a Hamiltonian cycle because it has two nodes of degree 1. After removing these two nodes, every node has degree at least 2, so a Hamiltonian cycle can exist.

Show such a cycle for a shuffle exchange graph, without degree 1 nodes, with 6, 14, 30 and 62 nodes.

Problem 2. If keys are arranged into two-dimensional matrix, we can attempt to sort them by sorting every row, then every column, and then every row again.

Show that this method may fail. Under what condition is it guaranteed to work?

Problem 3. Show how to route the following permutation on Benes network (hexadecimal notation): D, 2, 7, F, A, 4, E, 8, 1, 9, C, 0, 6, 5, 3, B.

Problem 4. Show how to pack packets from the following positions on a butterfly network: 1, 2, 5, 7, 8, 9, B, C, D, E.

Homework/Final due on May 11:

Problem 2. Consider a ‘‘wheel’’ with km nodes, of which k are *terminals*, set A, and each two terminals are separated by $k-1$ nonterminals, set $V-A$, and connect $V-A$terminals with a random matching. This matching is *good* of for every set $BsetA$ s.t. $|B| \le |A|/2$ there exists $|B|$ node-disjoint paths from B to $A-B$. Show that the probability that a matching is good converges to 1 as m increases. Parameter k is a constant of **your choice**.

I was calculating something very similar in *Efficient Amplifiers and Bounded Degree Optimization* with Karpinski, electronic version is easy to find on the web.

It may make your life easier to simplify the problem in two ways: (a) require that paths are edge disjoint, (b) ask for $0.95|B|$ paths. Even then you need to show enough of interesting calculations.

Point (a) may be particularly important. When the set B consists of so many pieces that the average piece size is 2 or less, just the edges on the wheel provide the necessary number of paths.