# Assignment 2

**Due: 5pm, 30 Nov 2011**

1. (20 points) Given eight processors with data 1, 3, 2, 4, 5, 3, 1, 8 respectively, show the messages sent at each step of the all-gather operation, and the data present in each processor at the end of each step.

2. (20 points) Assume that array *A[n][n][n]* is stored in column major order. Show an ordering of loops which will print all elements of *A* with $O(n^3/L)$ cache complexity, in the ideal cache model. (Hint: If you are unsure about column major ordering in three dimensions, first think about the order in which indices change in two dimensions, with column major ordering. Then, extend this to three dimensions.)

3. (20 points) Consider the following linear recurrence: $x_{i+3} = a_{i+3} \, x_i + b_{i+3} \, x_{i+1} + c_{i+3} \, x_{i+2}$, where $x_0$, $x_1$, and $x_2$ are given. Formulate the solution of this recurrence as a prefix computation and give the parallel time complexity, speedup, and efficiency if parallel prefix is used to solve it.

4. (20 points) Consider a strict quadratic program with 0-1 constraints on the variables. Convert it to an equivalent strict quadratic program without any 0-1 constraints, and prove that the two are equivalent.

5. (20 points) Formulate the vertex cover problem with weights on the vertices as a strict quadratic program (without any integer constraints) and show its relaxation to a vector program. Write the vector program as an equivalent semi-definite program.