exercises corresponding to the first three lectures

The exercises below are ordered chronologically. A good understanding of the lecture notes (what was written on the blackboard in class) should suffice to find the answers.

exercises after Lecture 1

0) Visit www.top500.org.

1) How many processors whose clock speed runs at 3.0GHz does one need to build a supercomputer which achieves a theoretical peak performance of at least 4 Tera Flops? Justify your answer.

2) Suppose we have a program where 2% of the operations must be executed sequentially. According to Amdahl's law, what is the maximum speedup which can be achieved using 64 processors? Assuming we have an unlimited number of processors, what is the maximal speedup possible?

exercises after Lecture 2

3) Benchmarking of a program running on a 64-processor machine shows that 2% of the operations are done sequentially, i.e.: that 2% of the time only one single processor is working while the rest is idle. Use Gustafson's law to compute the scaled speedup.

4) Derive a formula for the number of links in a hypercube with $p = 2^k$ processors, for some positive number k.

exercises after Lecture 3

5) Consider a network of 16 nodes, organized in a 4-by-4 mesh with connecting loops to give it the topology of a torus (or doughnut). Can you find a mapping of the nodes which give it the topology of a hypercube? If so, use 4 bits to assign labels to the nodes. If not, explain why.

6) In class we derived an omega network for eight processors (see figure 1.14 on page 21 of the textbook). Give an example of a configuration of the switches which is blocking, i.e.: a case for which the switch configurations prevent some nodes from communicating with each other.