FDA125 Advanced Parallel Programming February 2007

Exercises for Topic I (Parallel Computer Architecture)

Exercise I.1

Show that a Butterfly-network connecting 2^k inputs to 2^k outputs uses $k2^{k-1}$ switches, for all $k \geq 1$.

Exercise I.2

Give formulas (depending on the number of processors) for the node degree and the diameter for the following network topologies:

- Bus
- Ring
- 2D-grid
- 2D-torus
- 3D-grid
- 3D-torus,
- complete binary tree (processors as tree nodes),
- complete binary tree (processors as leaves, switches as inner nodes)
- hypercube,
- butterfly
- crossbar.

What about node-connectivity and edge-connectivity for these topologies?

Exercise I.3

(a) Give an example for communication with indirect addressing.

(b) What are the advantages of a blocking send() operation?

(c) What are the advantages of asynchronous communication (non-blocking send() operation)?

(d) What are the advantages of rendezvous communication (blocking send and blocking receive)? What are the disadvantages?

(e) What are the advantages and disadvantages of buffered communication?