

# Principles of Distributed Computing

## Exercise 5

### 1 Sorting Networks

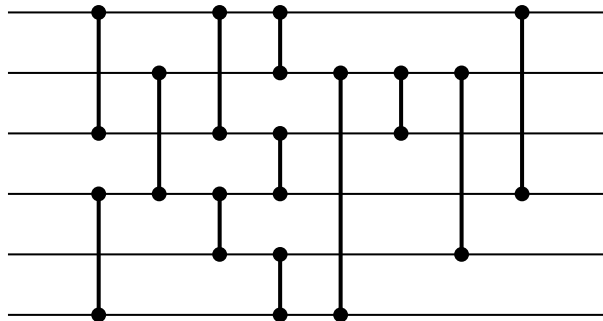


Figure 1: A Sorting Network?

For each of the following questions, prove or disprove the given claim.

**Hint:** Whenever you need to construct a network as counterexample, three wires will suffice.

- The network of 6 wires and 12 comparators in Figure 1 above is a sorting network, that is, it sorts each input sequence of numbers correctly.
- Given any correct sorting network, adding another comparator at the end destroys the sorting property.
- Given any correct sorting network, adding another comparator at the front does **not** destroy the sorting property.
- Every correct sorting network needs to have at least one comparator between each two consecutive wires.
- A network which contains all  $\binom{n}{2}$  comparators between any two of the  $n$  wires, in whatever order they are placed, is a correct sorting network.
- Given any correct sorting network, adding another comparator anywhere does not destroy the sorting property.
- Given any correct sorting network, inverting it (i.e., feeding the input into the output wires and traversing the network “from right to left”) results in another correct sorting network.