

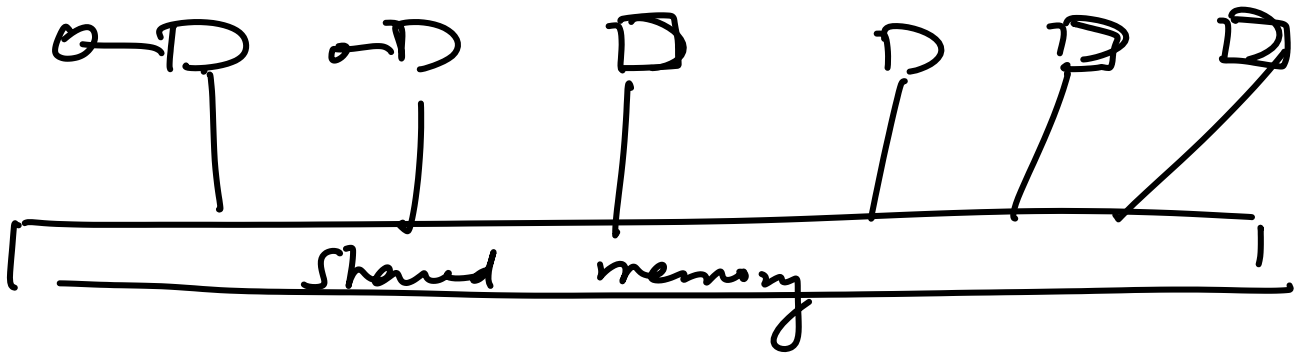
Models : what is the computational environment
 Algorithm design is an interplay between a given problem and the computational environment

Multiple processors are available so that one can speed up execution. Multicore architecture

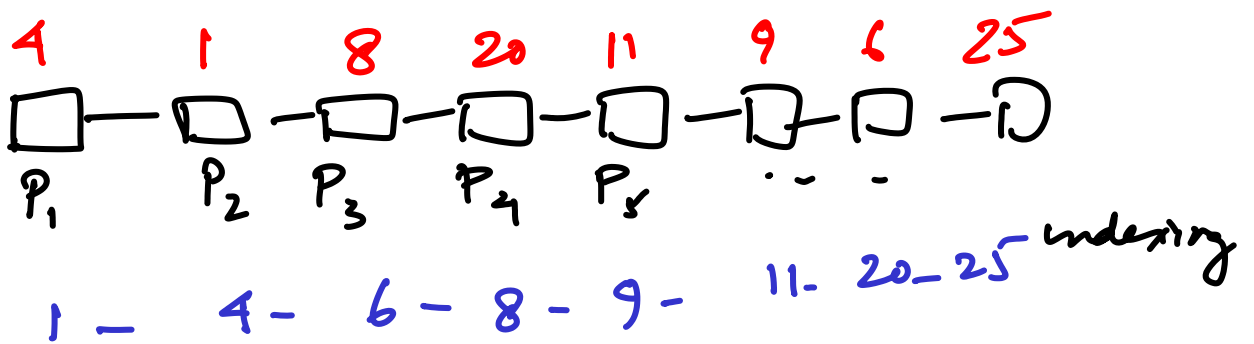
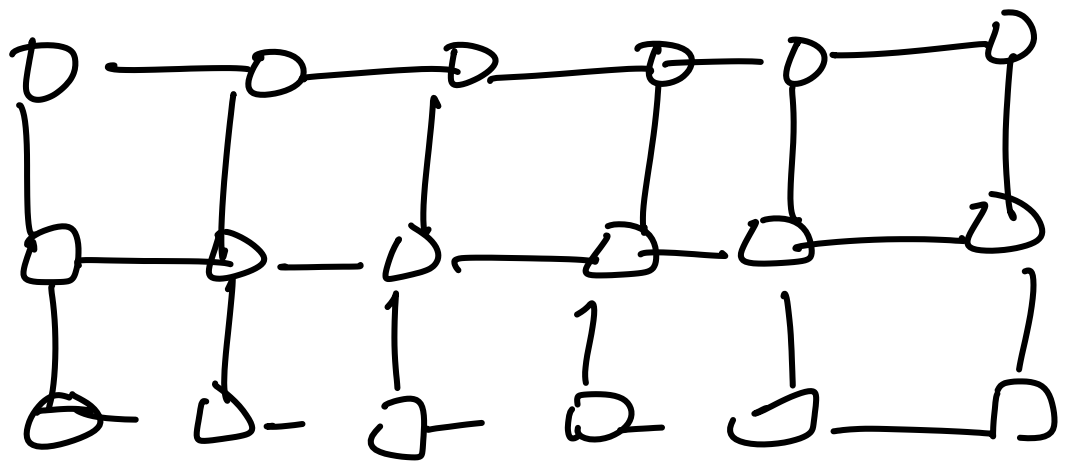
Suppose we have $p > 1$ processors available, - then ideally we should aim for a p -fold speed up

If $T(n)$ is the sequential running time then we should target $\frac{T(n)}{p}$ parallel running time

when p is also large $\sim \sqrt{n}$



Parallel RAM model (PRAM)



- Each processor can communicate its data to a neighboring processor on unit-line
- A liberate computation - communication cycle

- These steps are synchronised (global clock)

Basic step is compare-exchange

Odd-even transposition sort

Compare odd-even and even-odd pairs

for \boxed{k} iterations?

$$k = \frac{n}{2} ?$$

Overall we have sorted n elements
in n parallel steps using
 n processors

0-1 principle : If any
sorting algorithm sorts all
combinations of $\{0, 1\}^n$ correctly, then
it sorts any arbitrary input correctly
(comparison based)

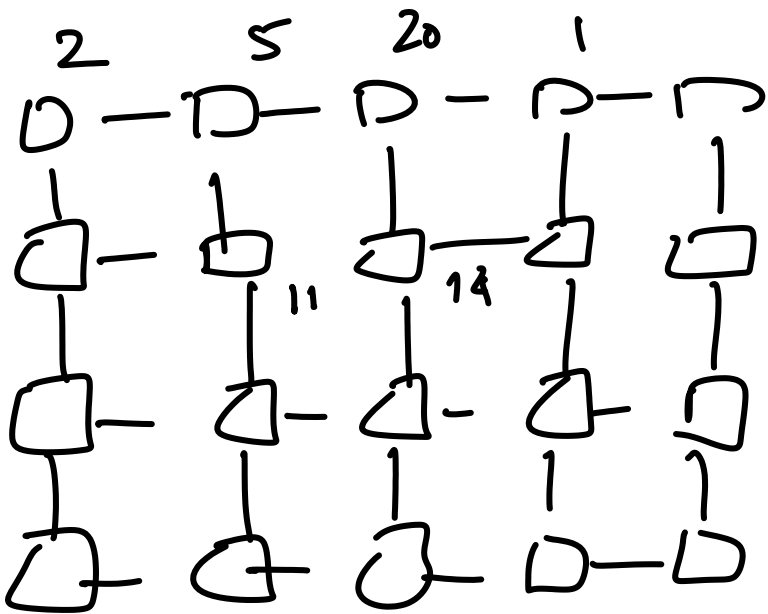
0 0 1 0 1 0 1 1 ✓

0 1 1 0 1 1 1 1 ✓

If we can show that all the 2^n possibilities are sorted correctly then the algorithm works for any input

A sorted 0-1 output looks like

0 0 0 0 1 1 1 1 1 1 1 1



\sqrt{n}

\sqrt{n}