Introduction to Prallel Prefix

October 27, 2019

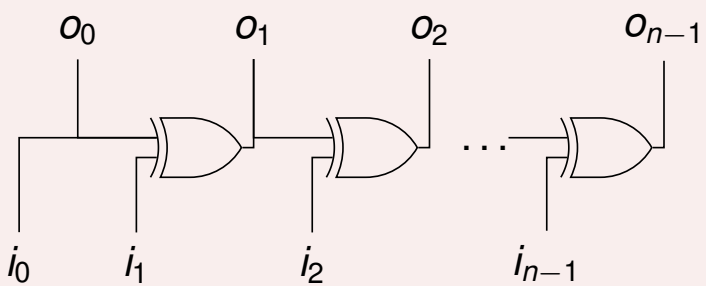
The Problem

Parallel Prefix Problem

Given n inputs $i_0 \ldots i_{n-1}$ and n outputs $o_0 \ldots o_{n-1}$, compute:

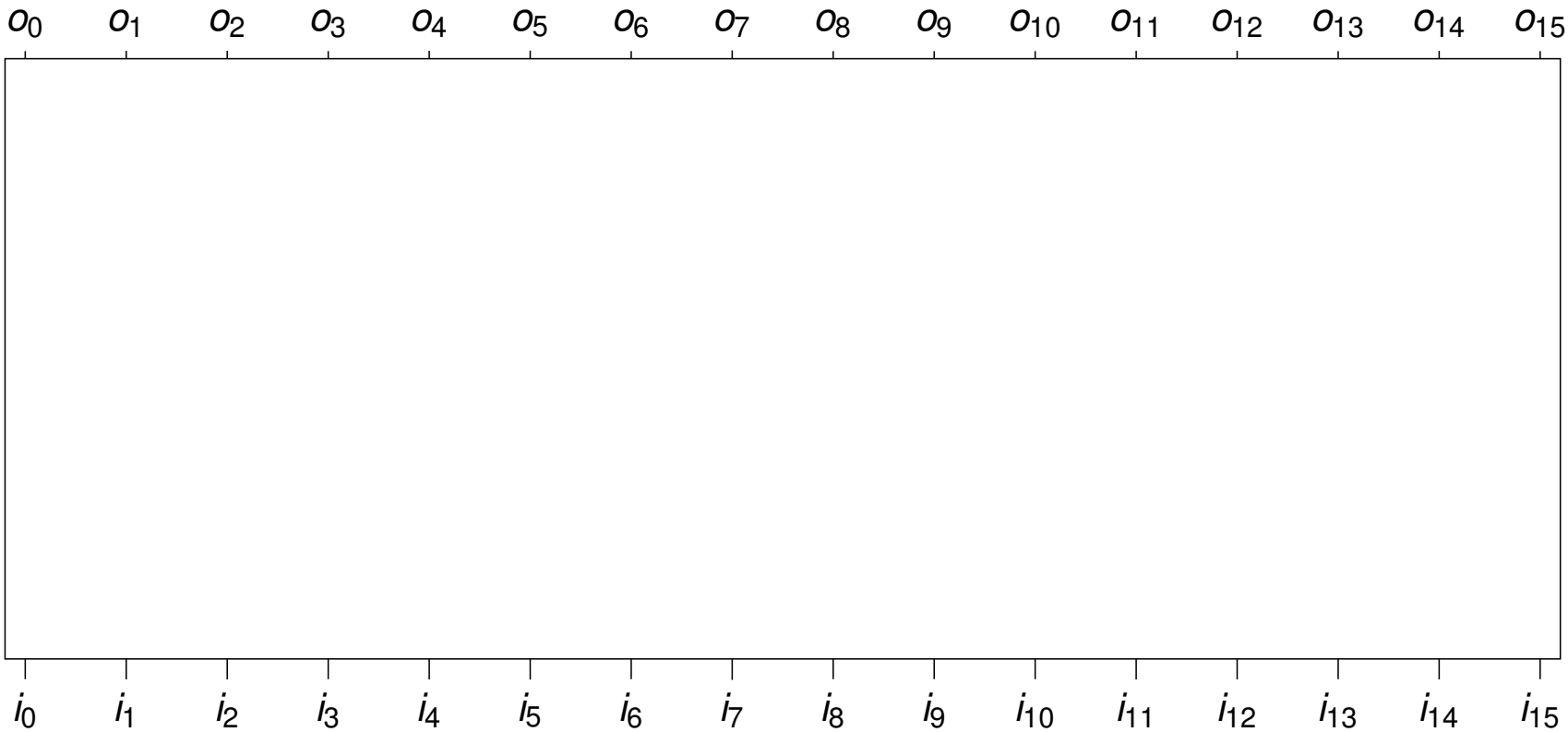
$$o_0 = i_0$$
$$o_1 = i_0 \oplus i_1$$
$$o_2 = i_0 \oplus i_1 \oplus i_2$$
$$\vdots$$
$$o_{n-1} = i_0 \oplus i_1 \oplus i_{n-1}$$

One Solution

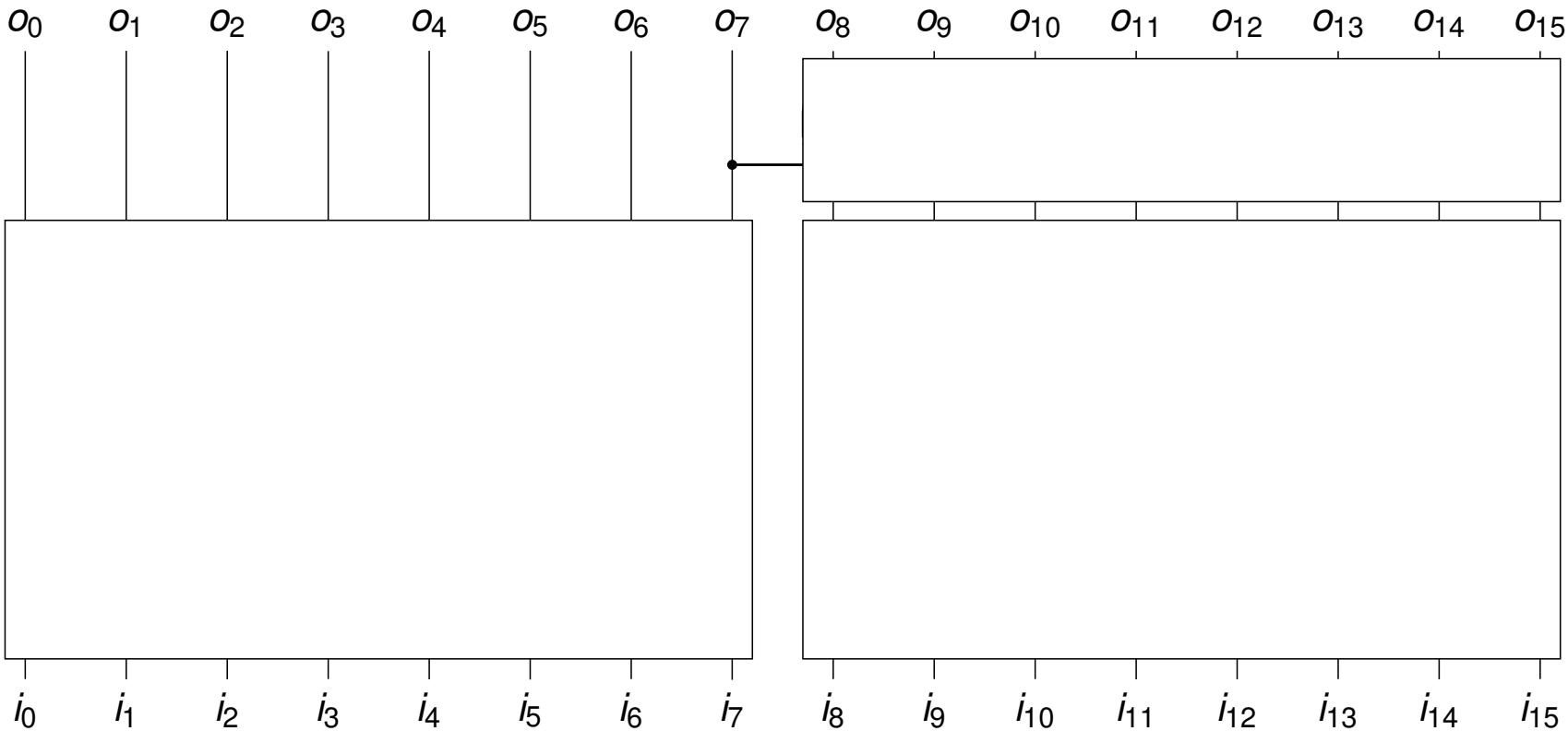


Gates=$n-1$, Time=$(n-1)t_{xor}$

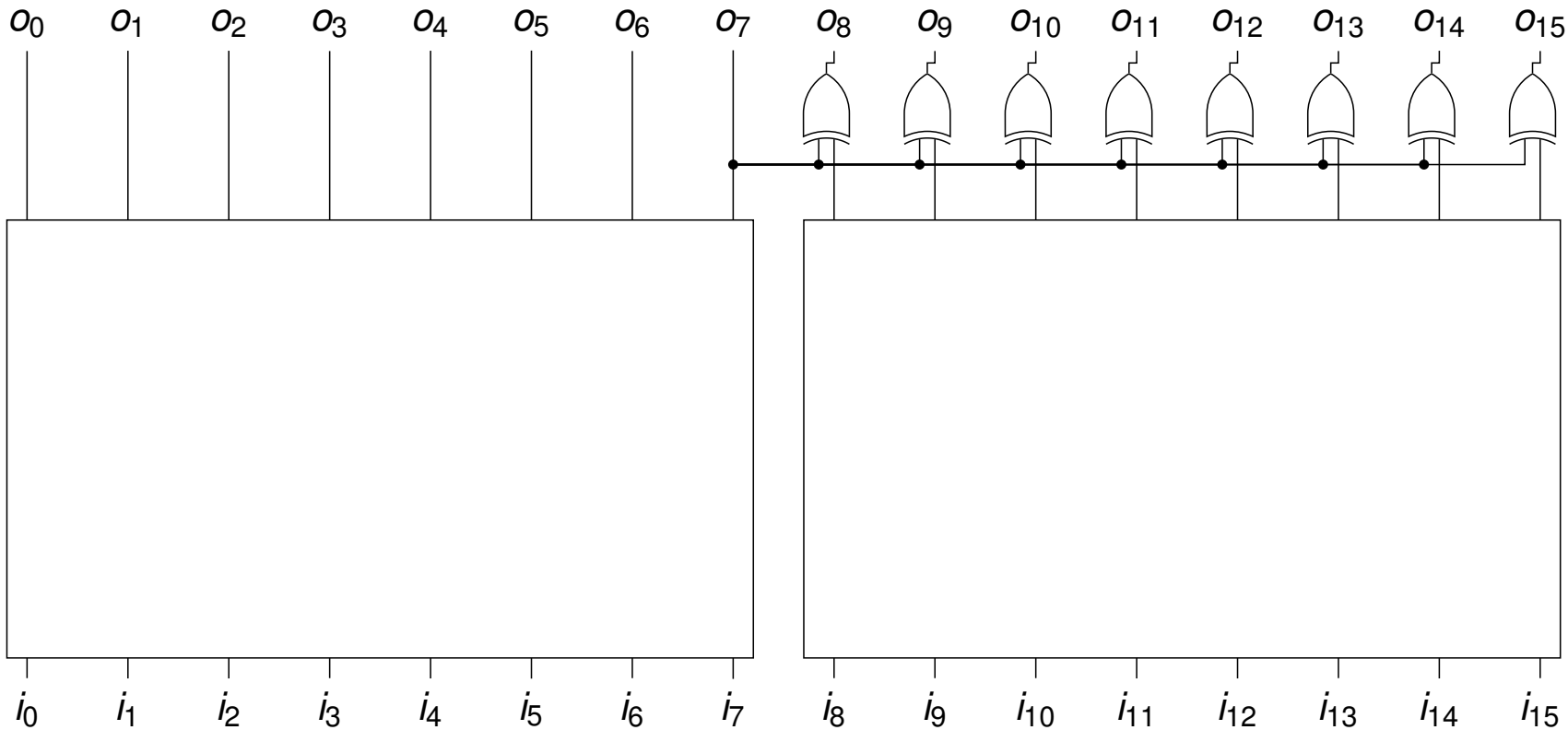
Parallel Prefix Solution



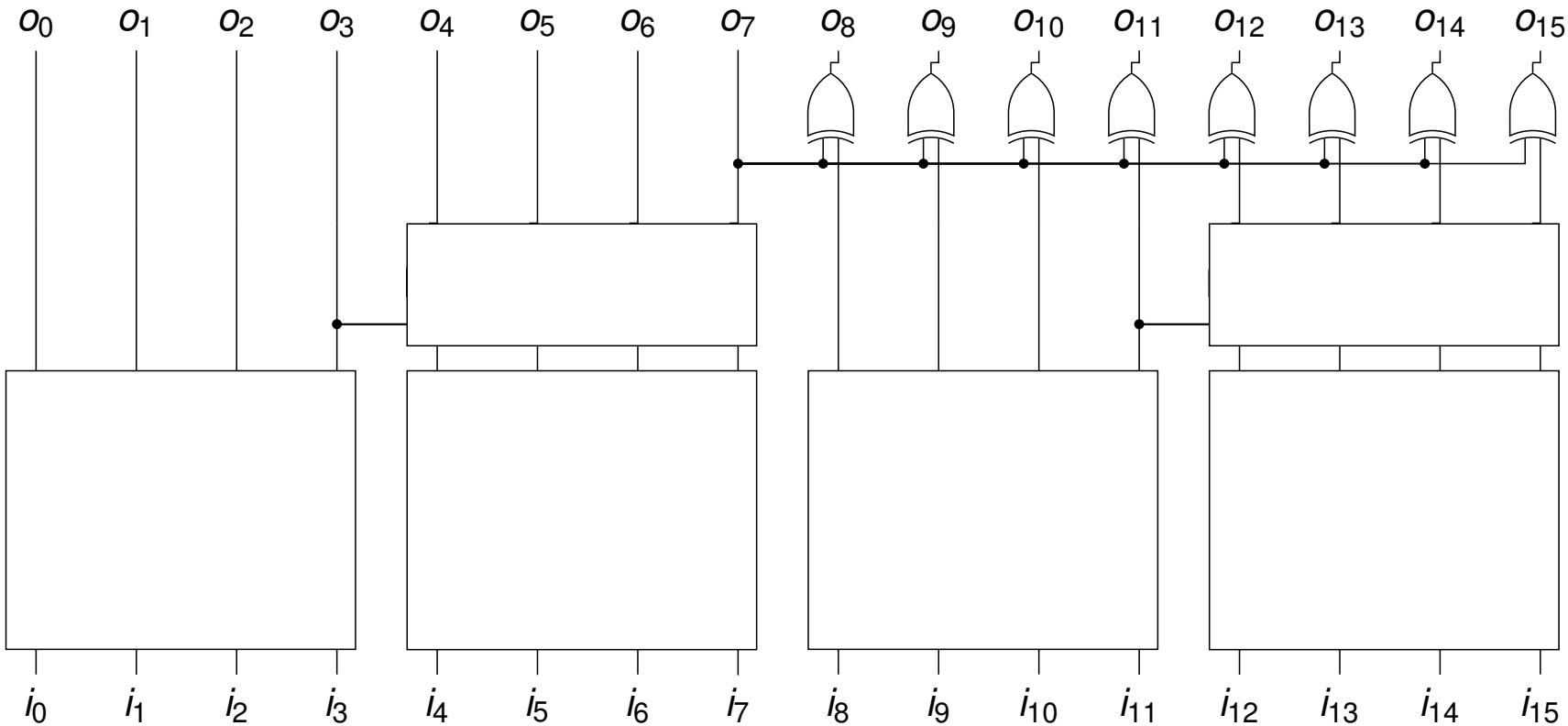
Parallel Prefix Solution



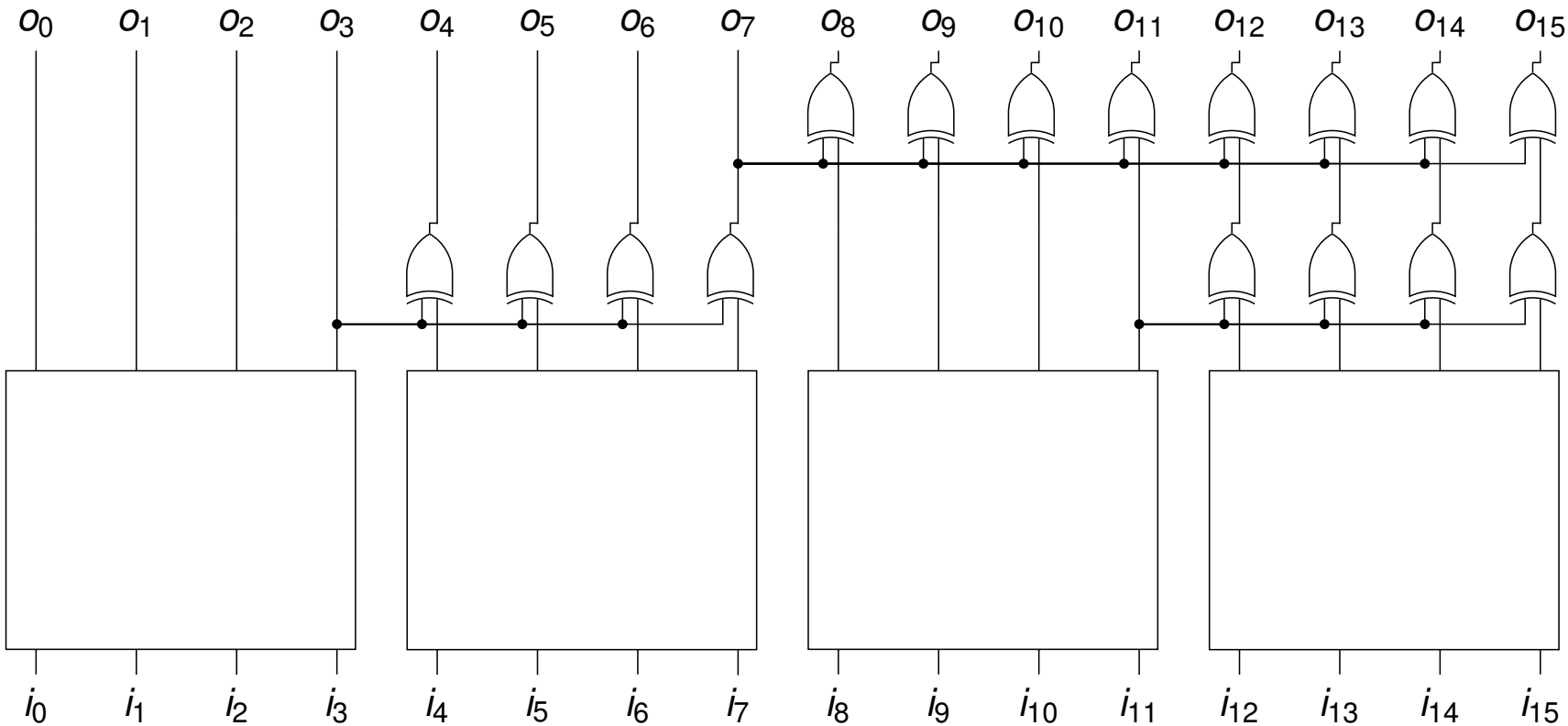
Parallel Prefix Solution



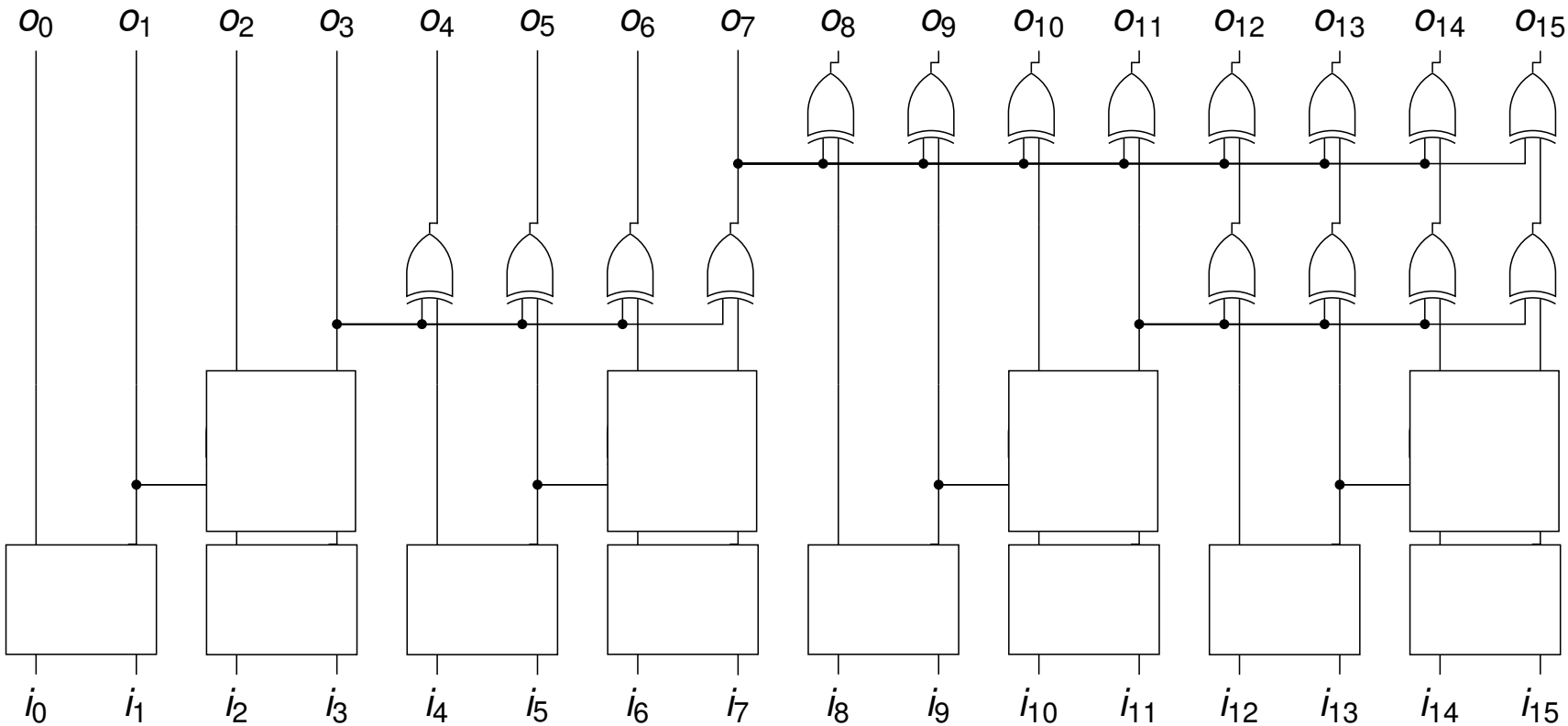
Parallel Prefix Solution



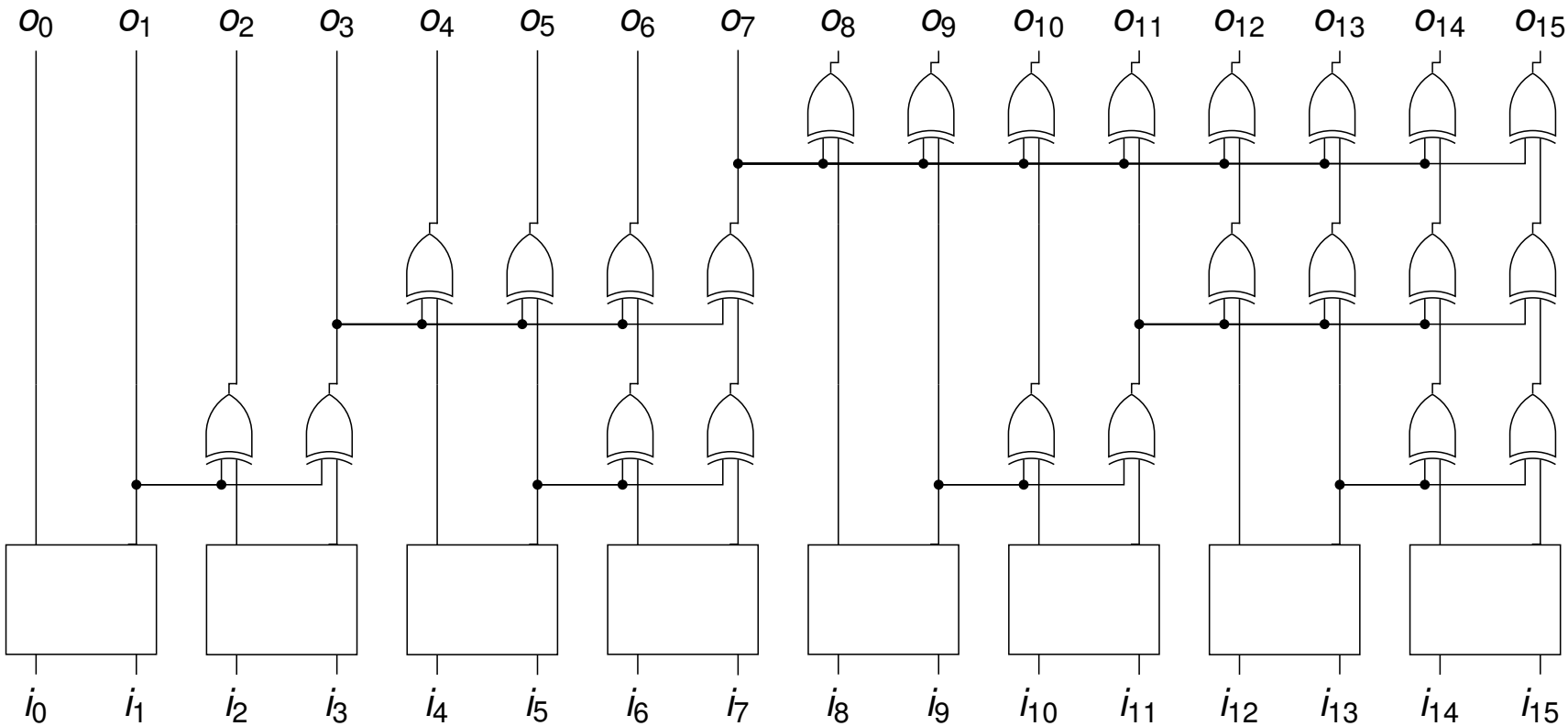
Parallel Prefix Solution



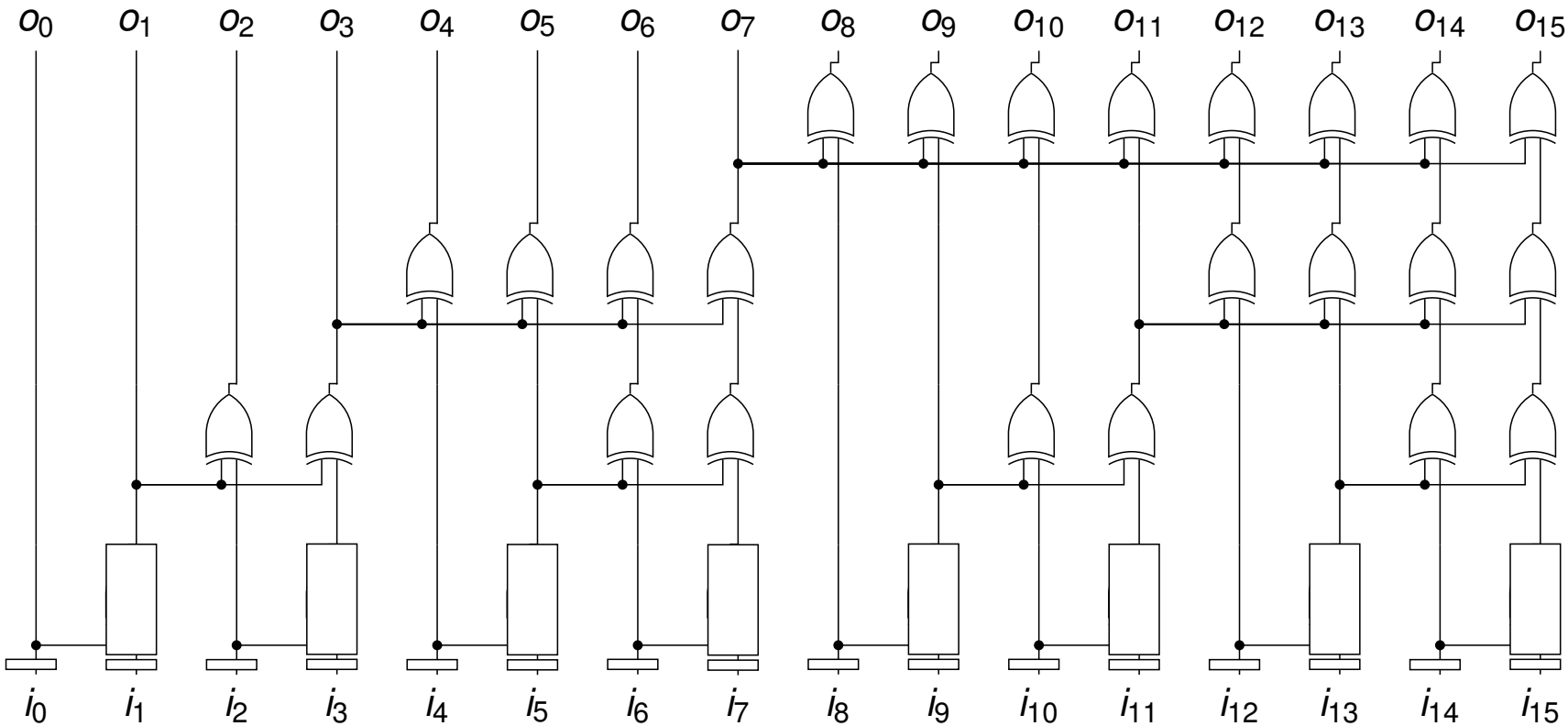
Parallel Prefix Solution



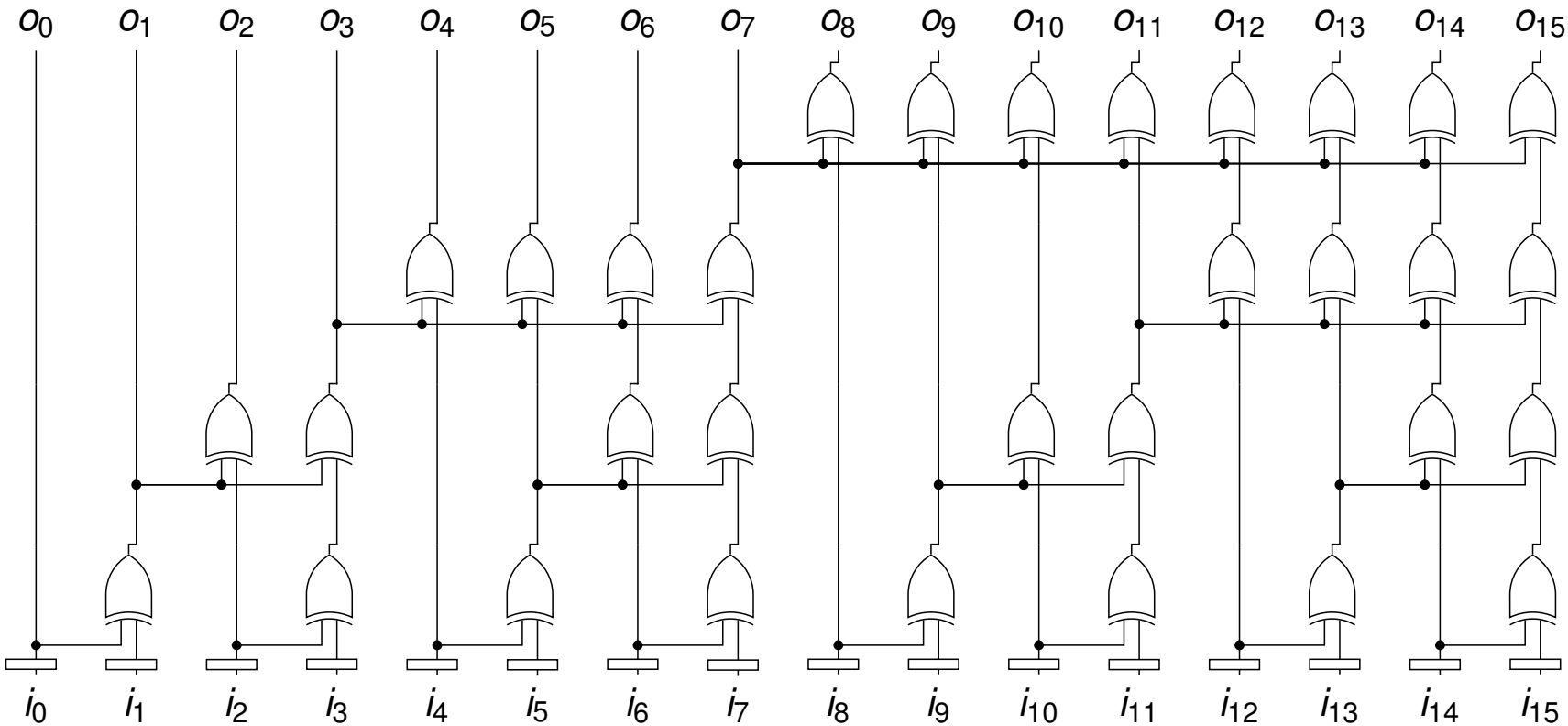
Parallel Prefix Solution



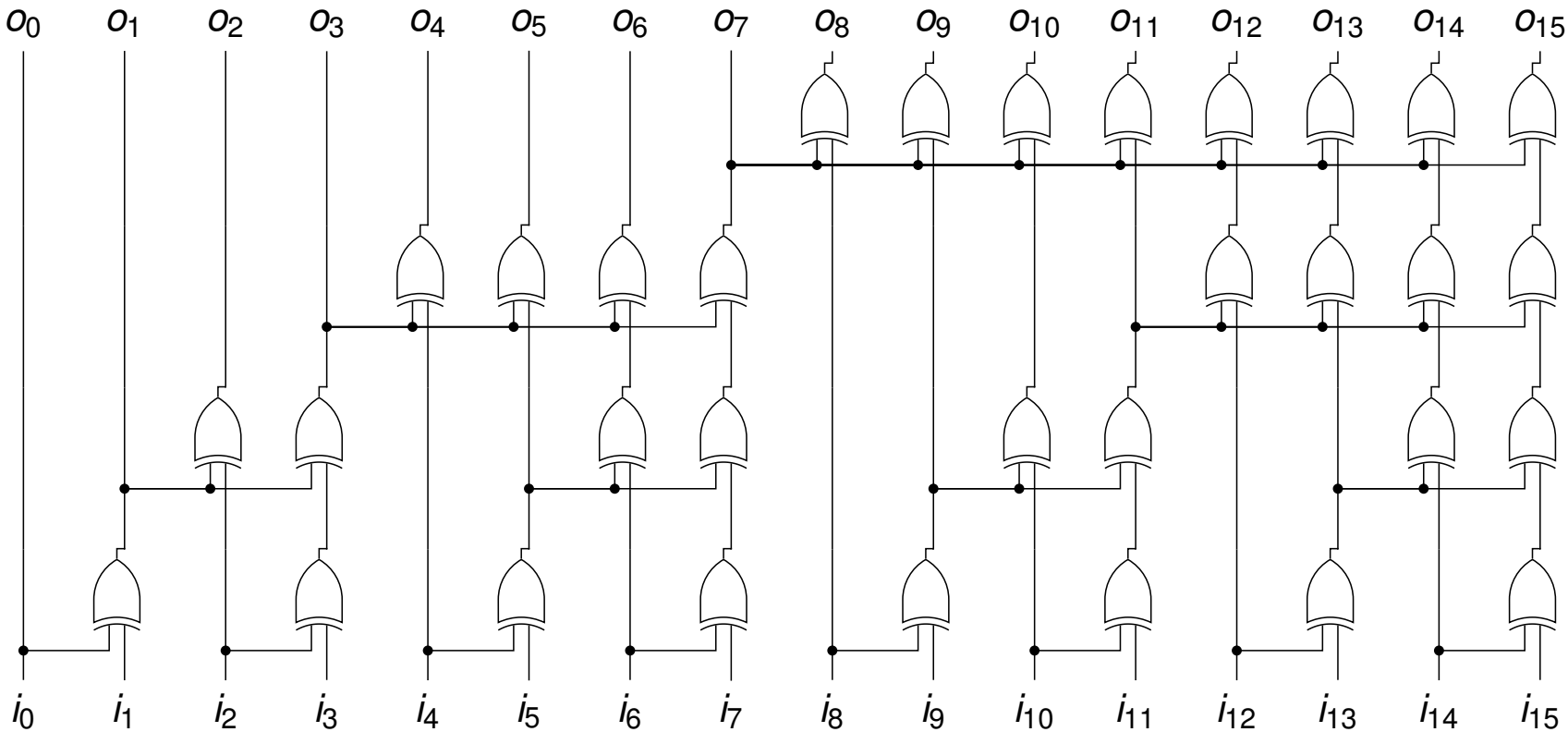
Parallel Prefix Solution



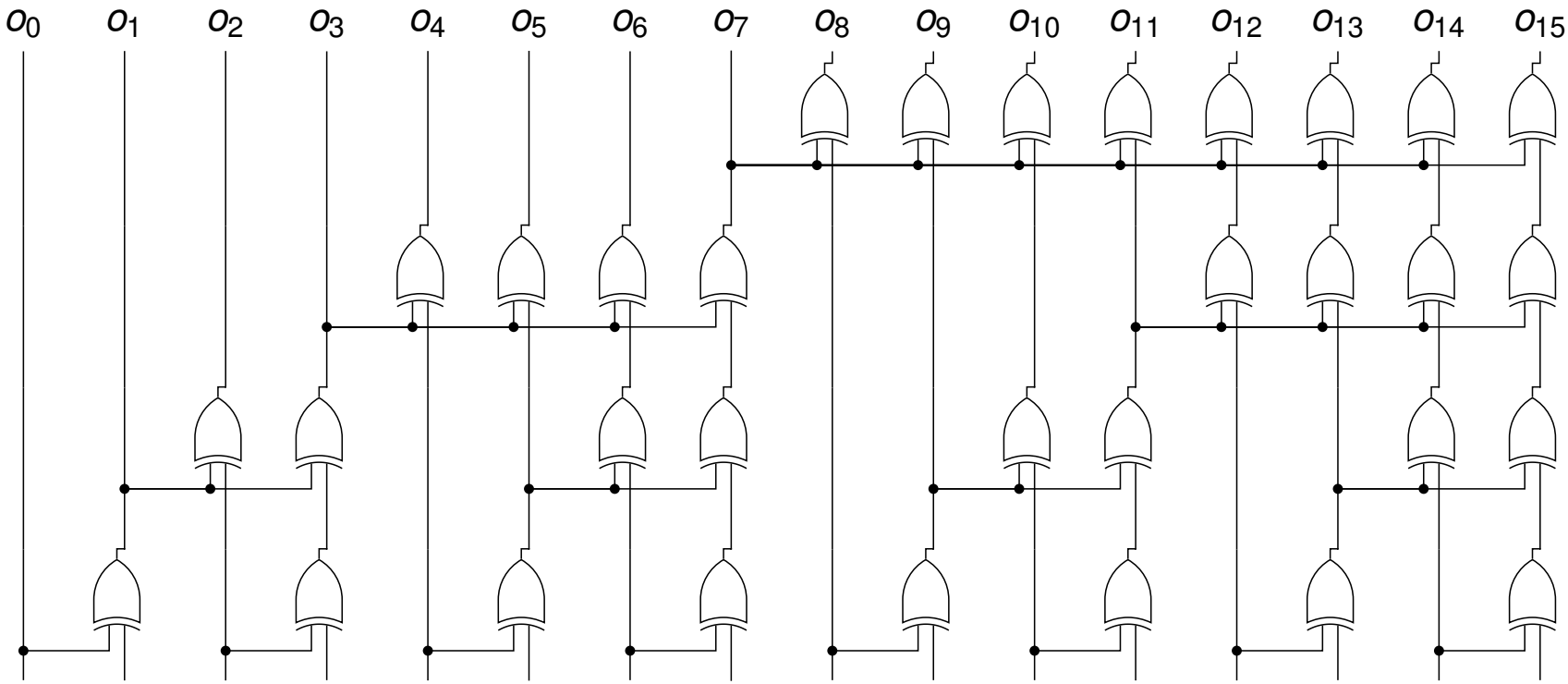
Parallel Prefix Solution



Parallel Prefix Solution

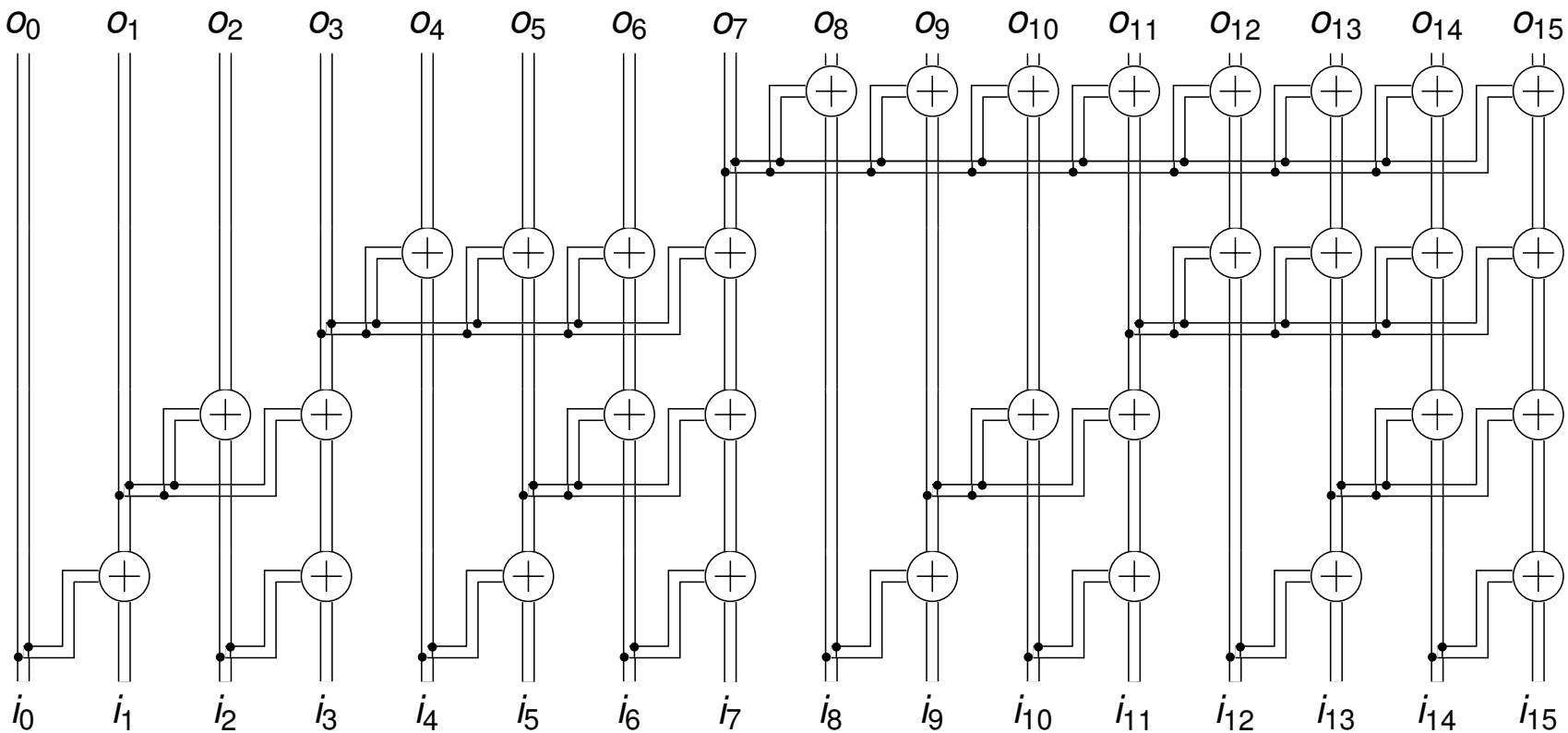


Parallel Prefix Solution



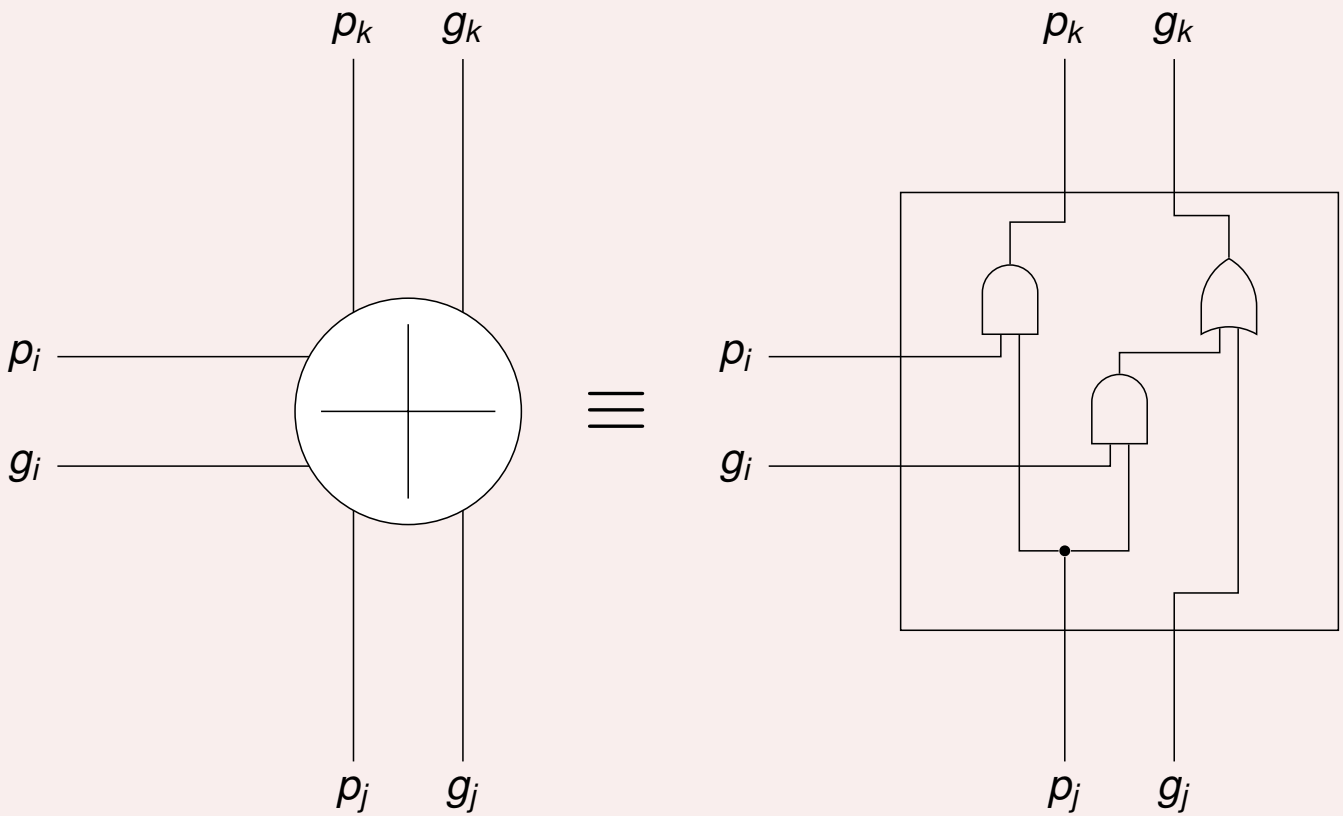
Gates=$\frac{n}{2}\log_2 n$, Time=$(\log_2 n)t_{xor}$

Adapting to Carry Computation



Carry Logic

Carry Logic (Associative)



- The generate outputs used as carry
- Computed in time $(\log_2 n) t_{carry\_logic}$