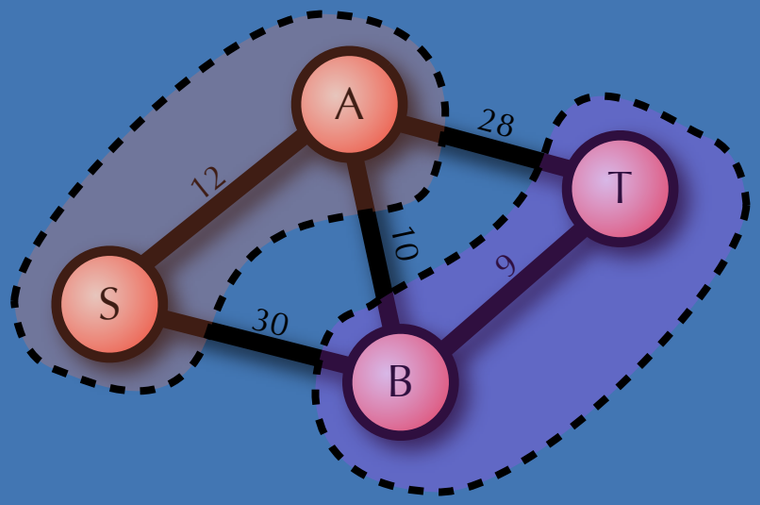


Prefix Sums

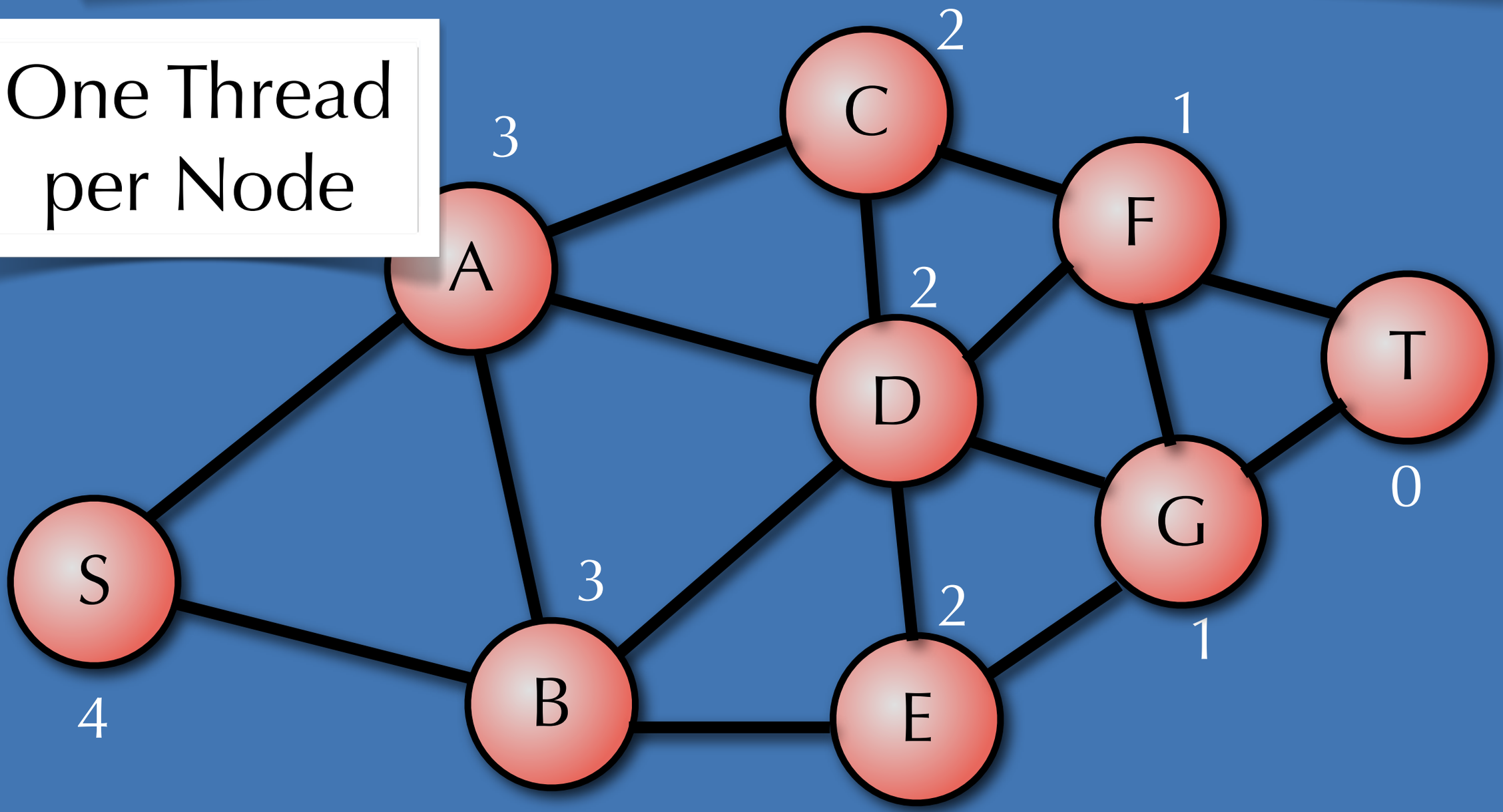
and their Applications

Adrien Treuille
Carnegie Mellon University

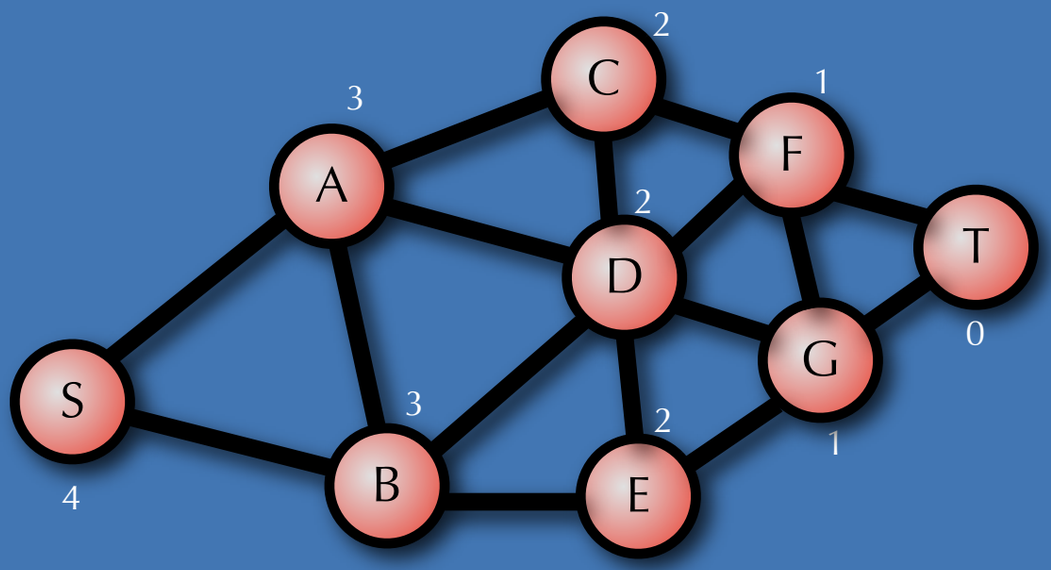
- motivating problem

BFS on the GPU

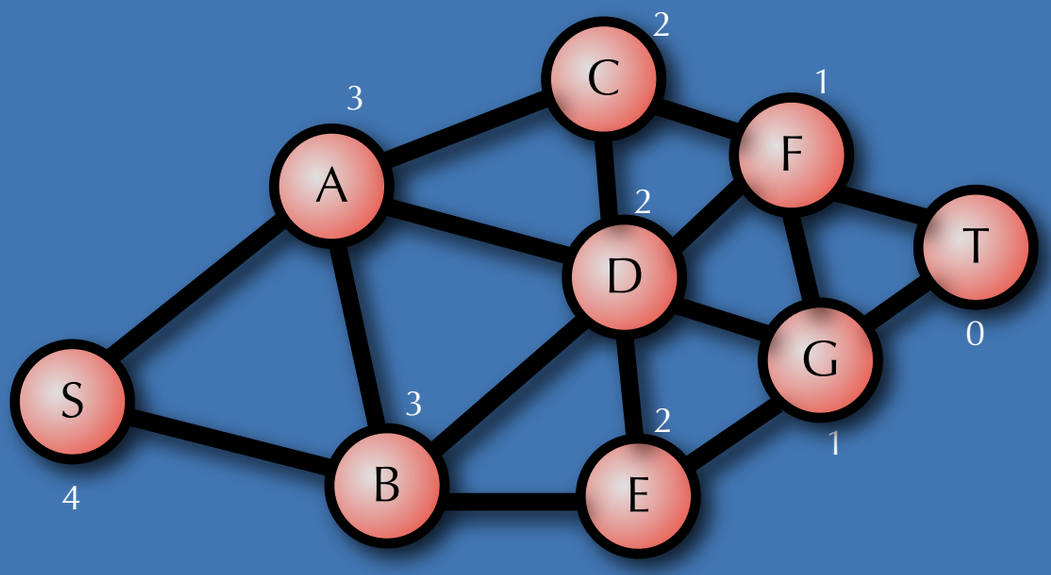
One Thread per Node

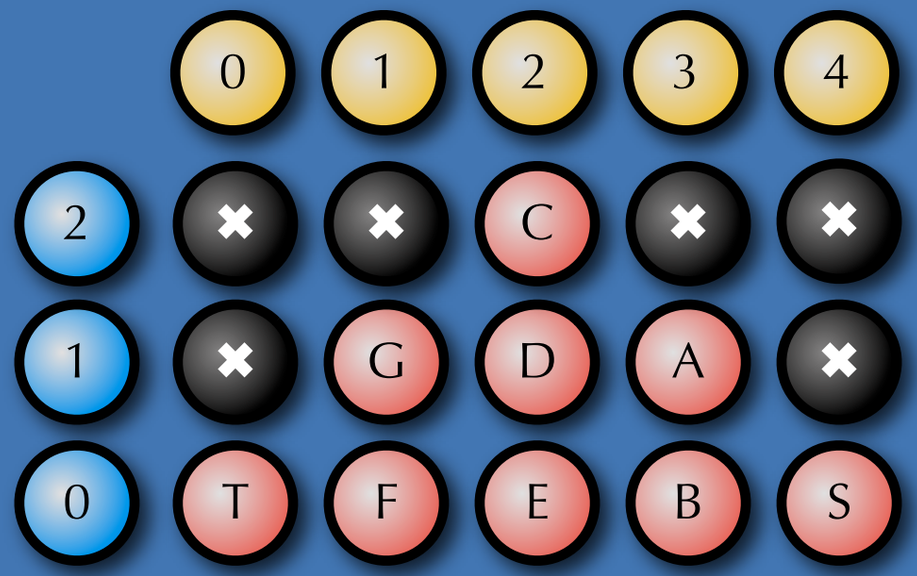


One Thread Per Node



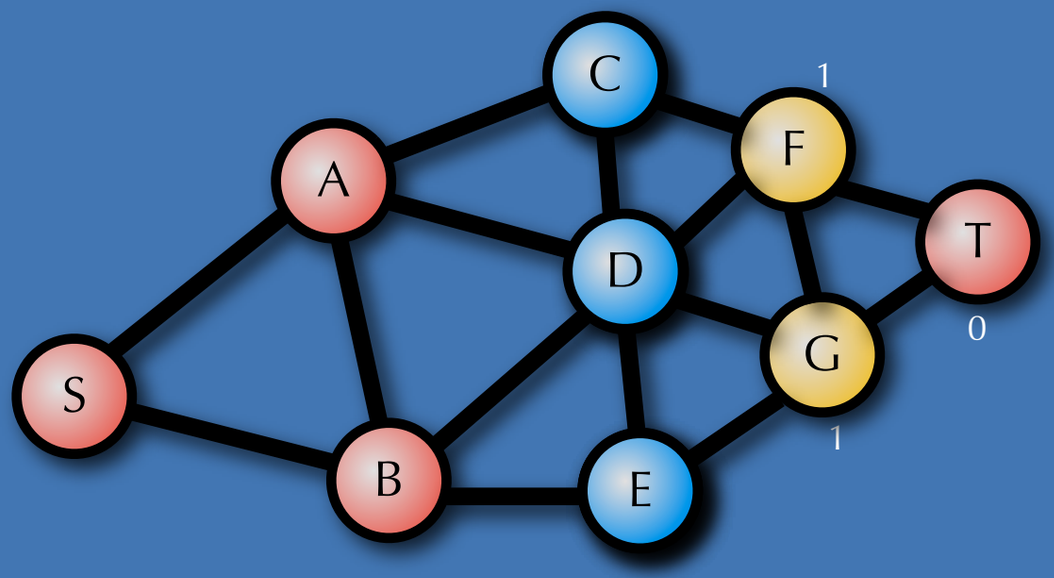
Separate Levels

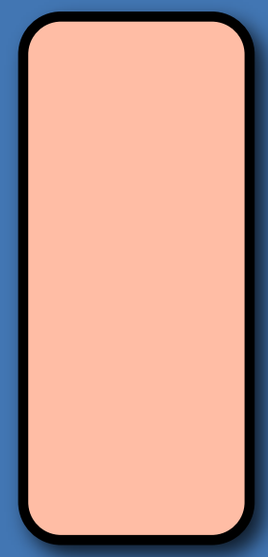




Separate Levels

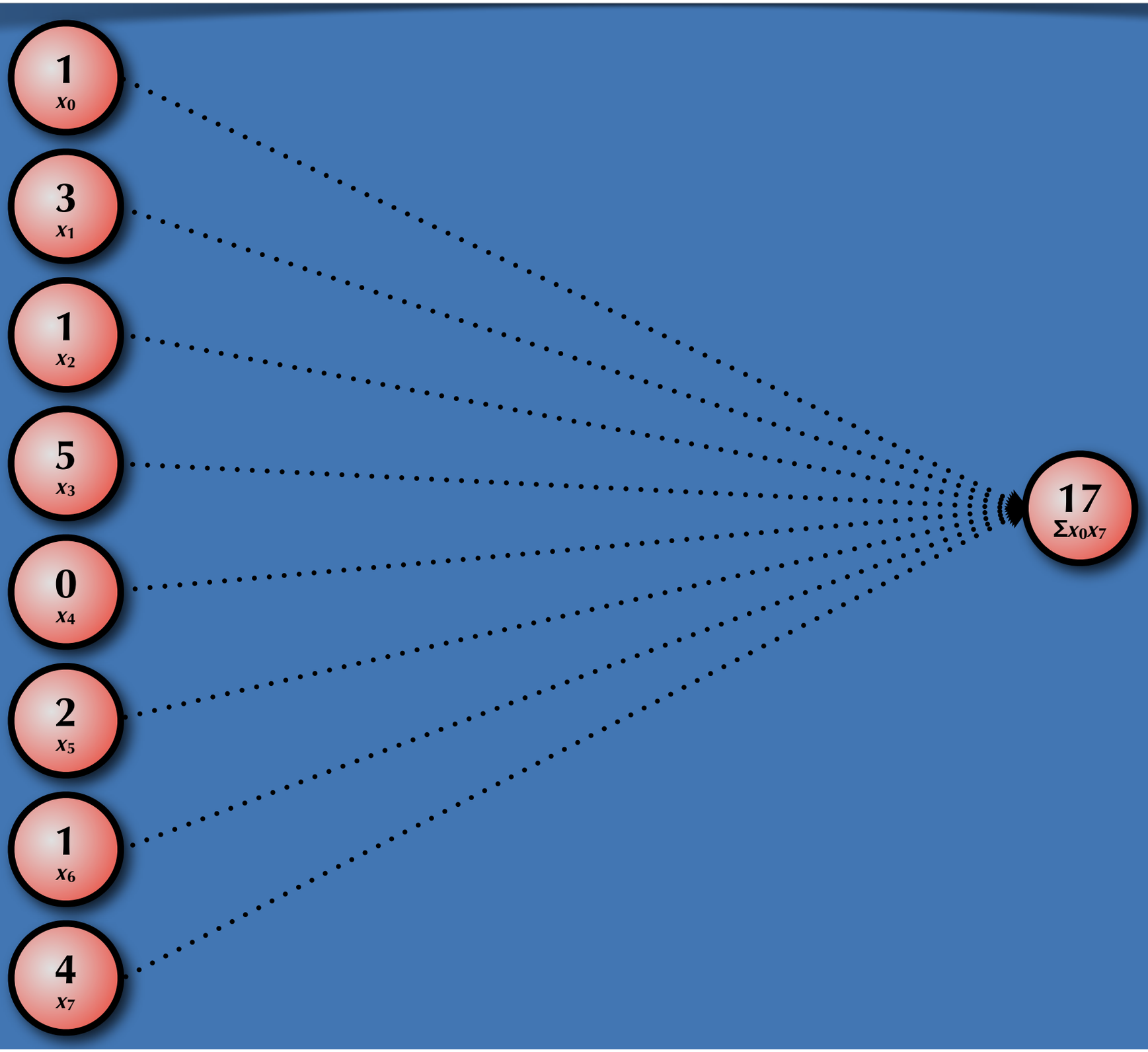
This Requires "Parallel Insert"





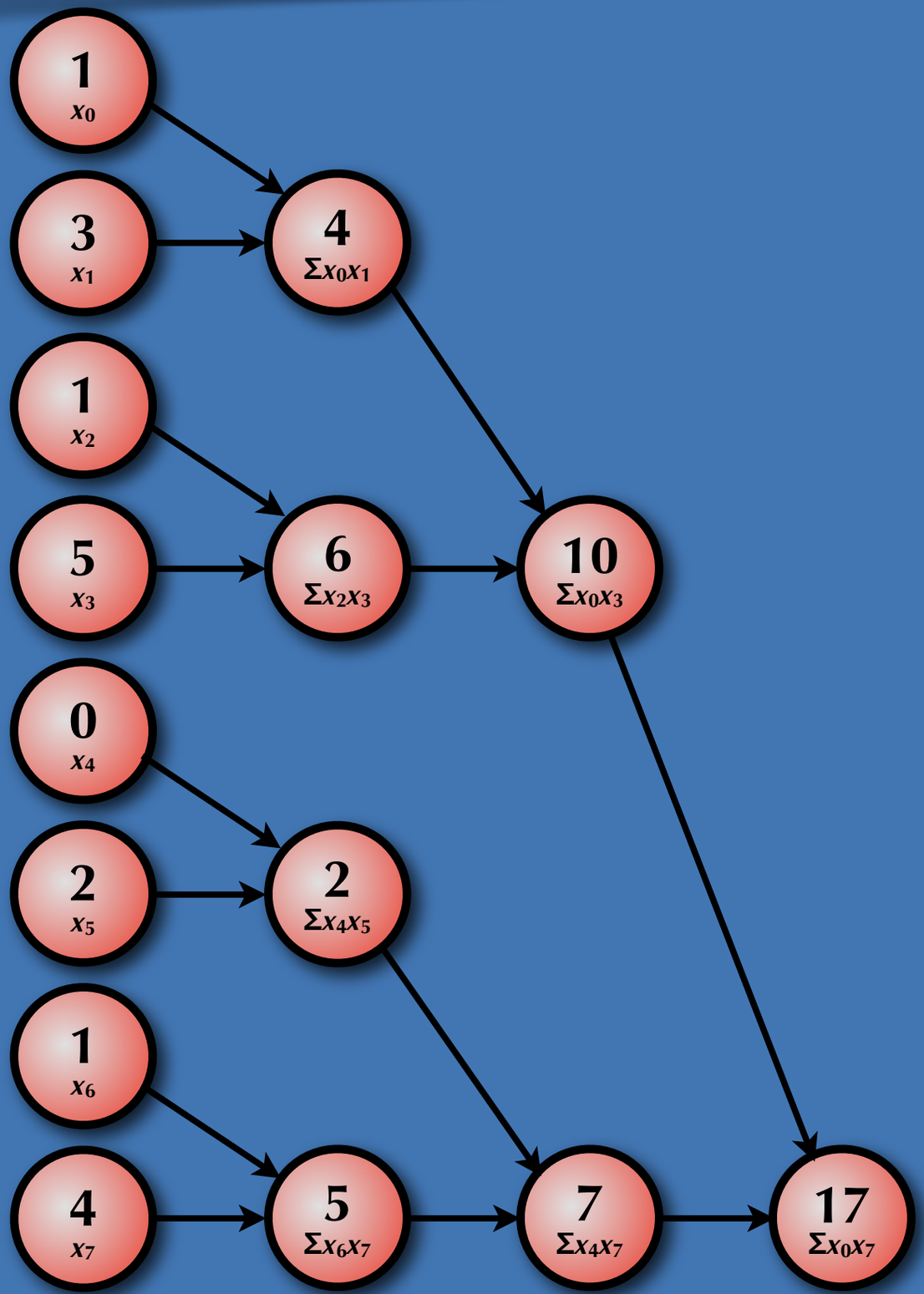
- the sum problem

The "Sum" Problem



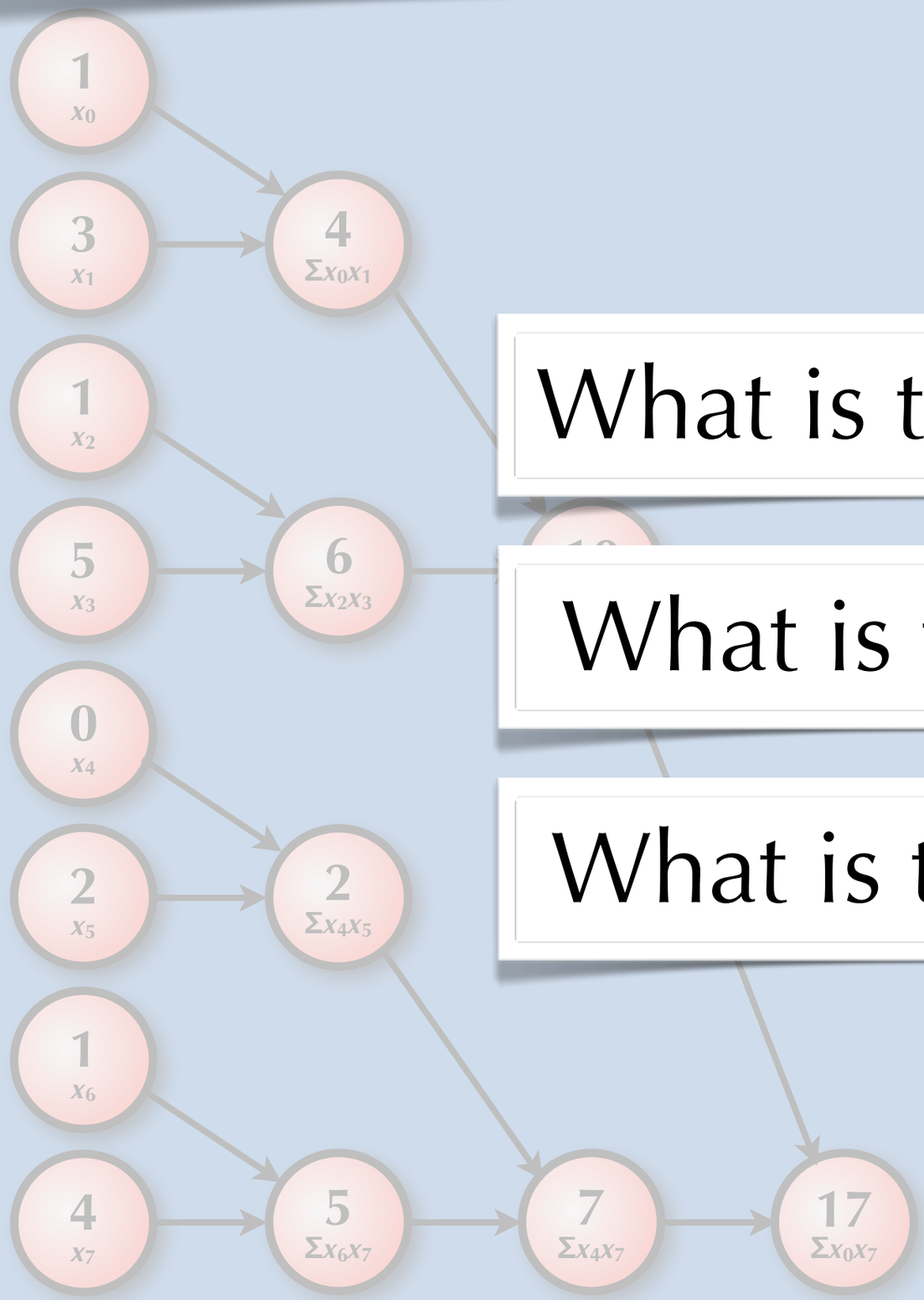
The "Sum" Problem

In Parallel!



The "Sum" Problem

In Parallel!



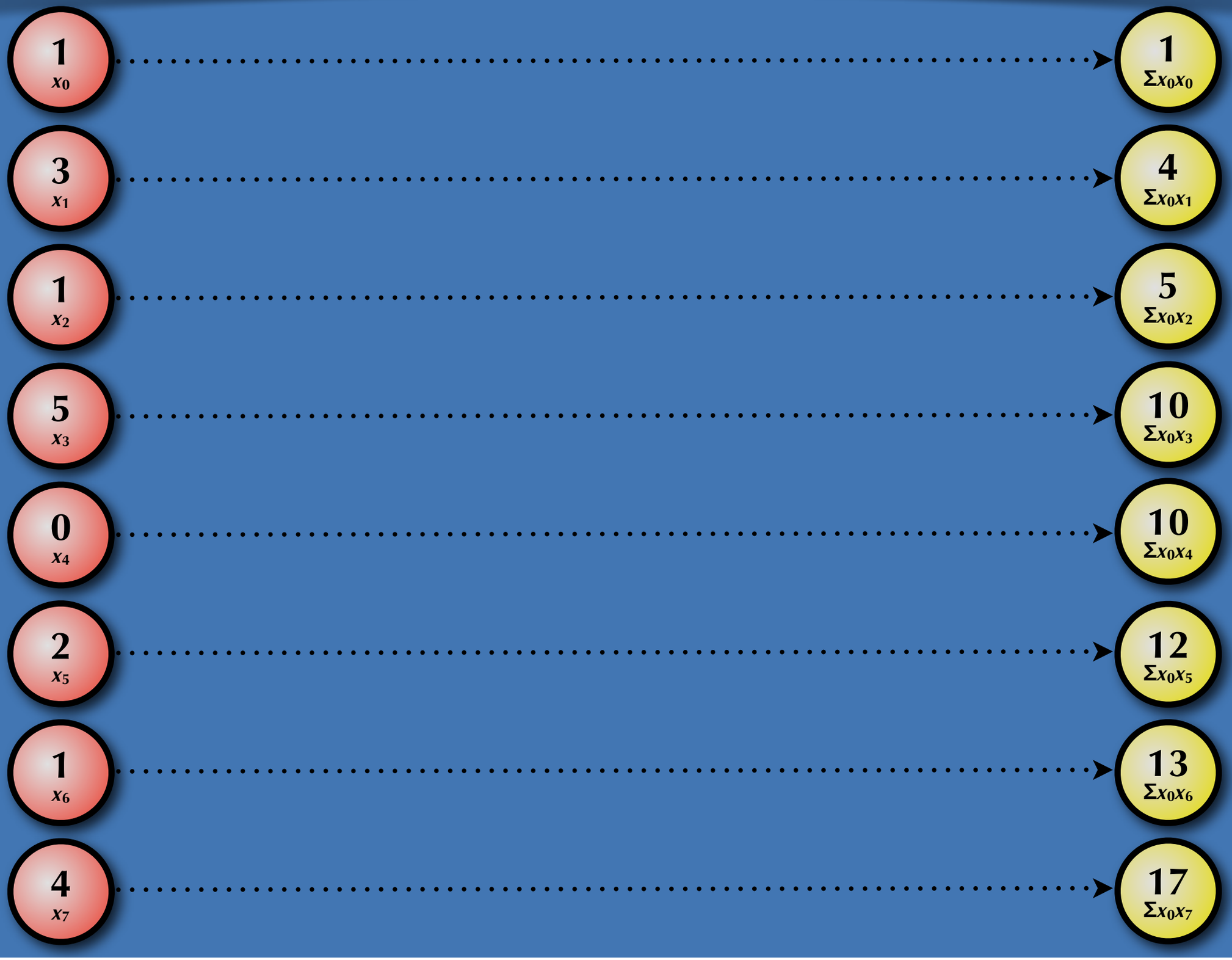
What is the **depth**?

What is the **span**?

What is the **work**?

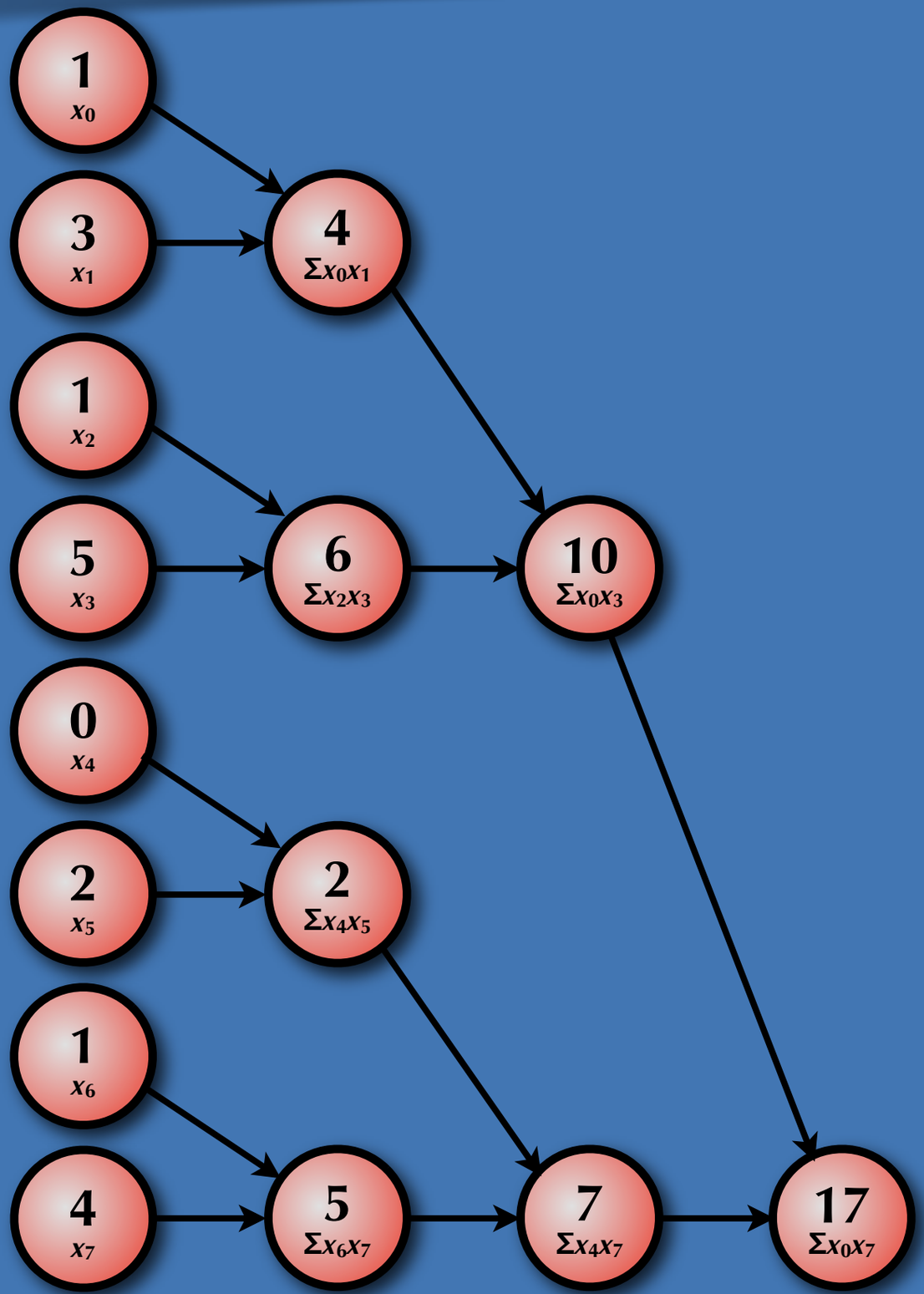
- the prefix sum problem

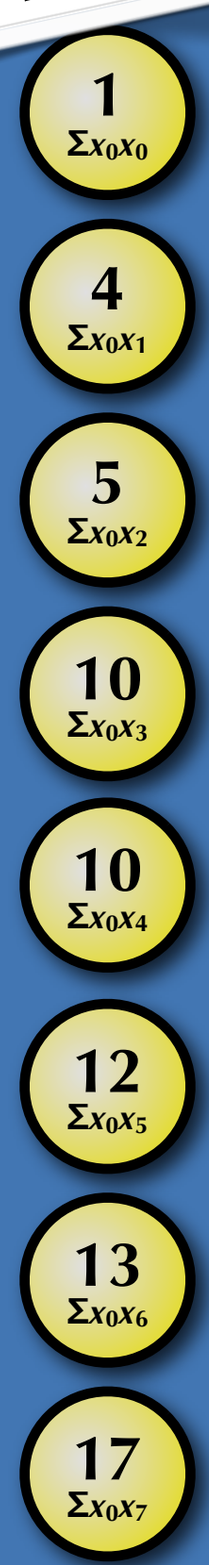
The "Prefix Sum" Problem



The "Prefix Sum" Problem

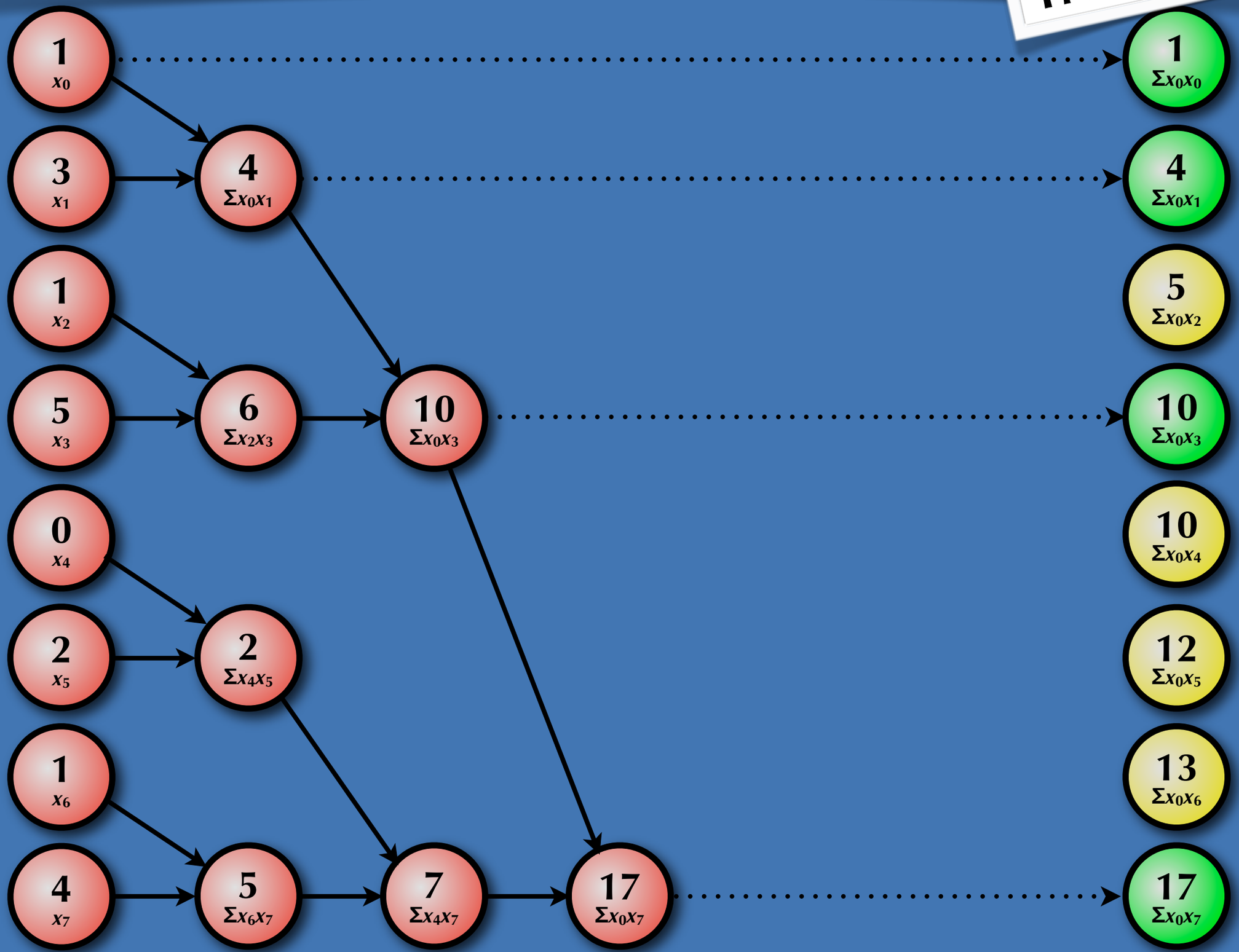
In Parallel!





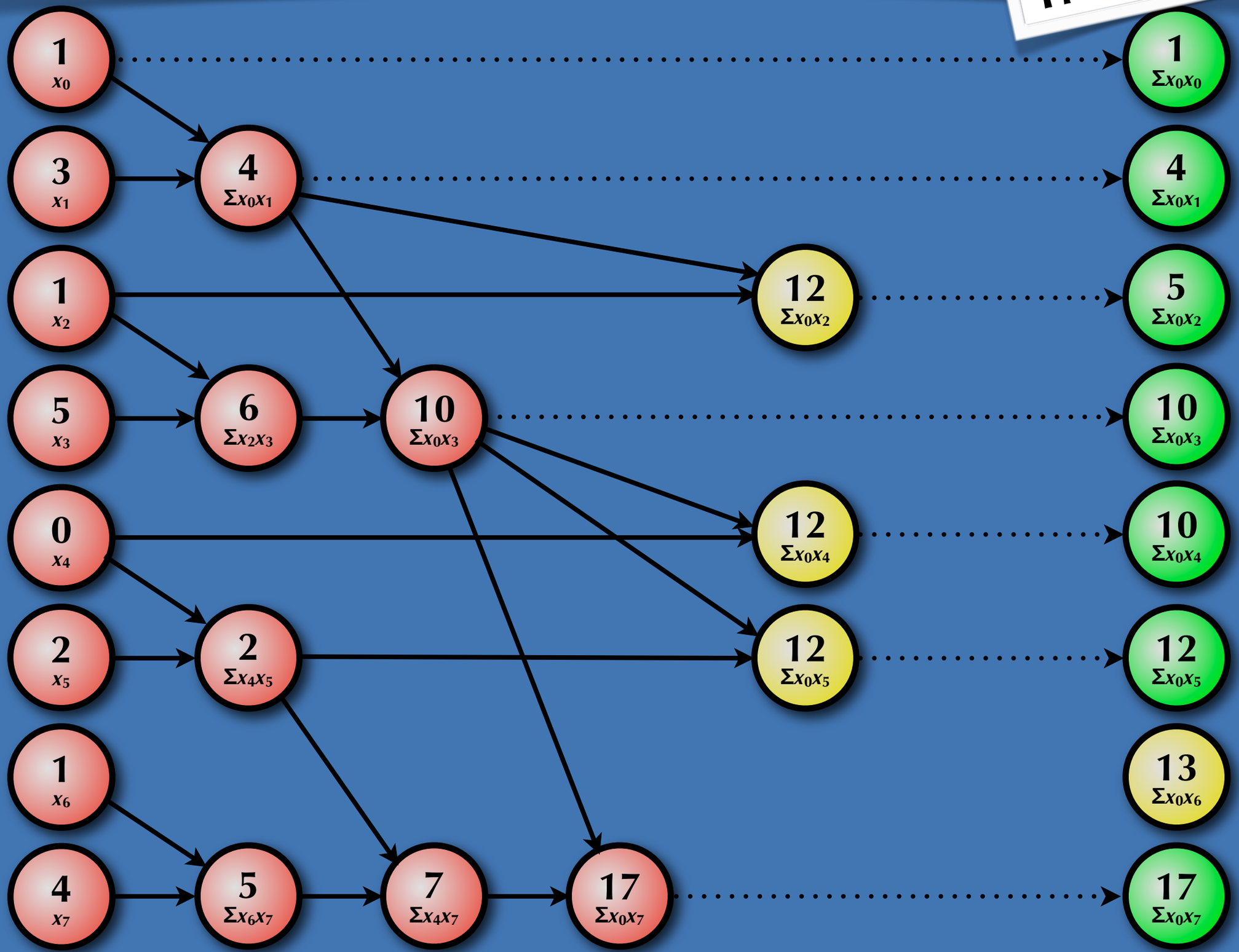
The "Prefix Sum" Problem

In Parallel!



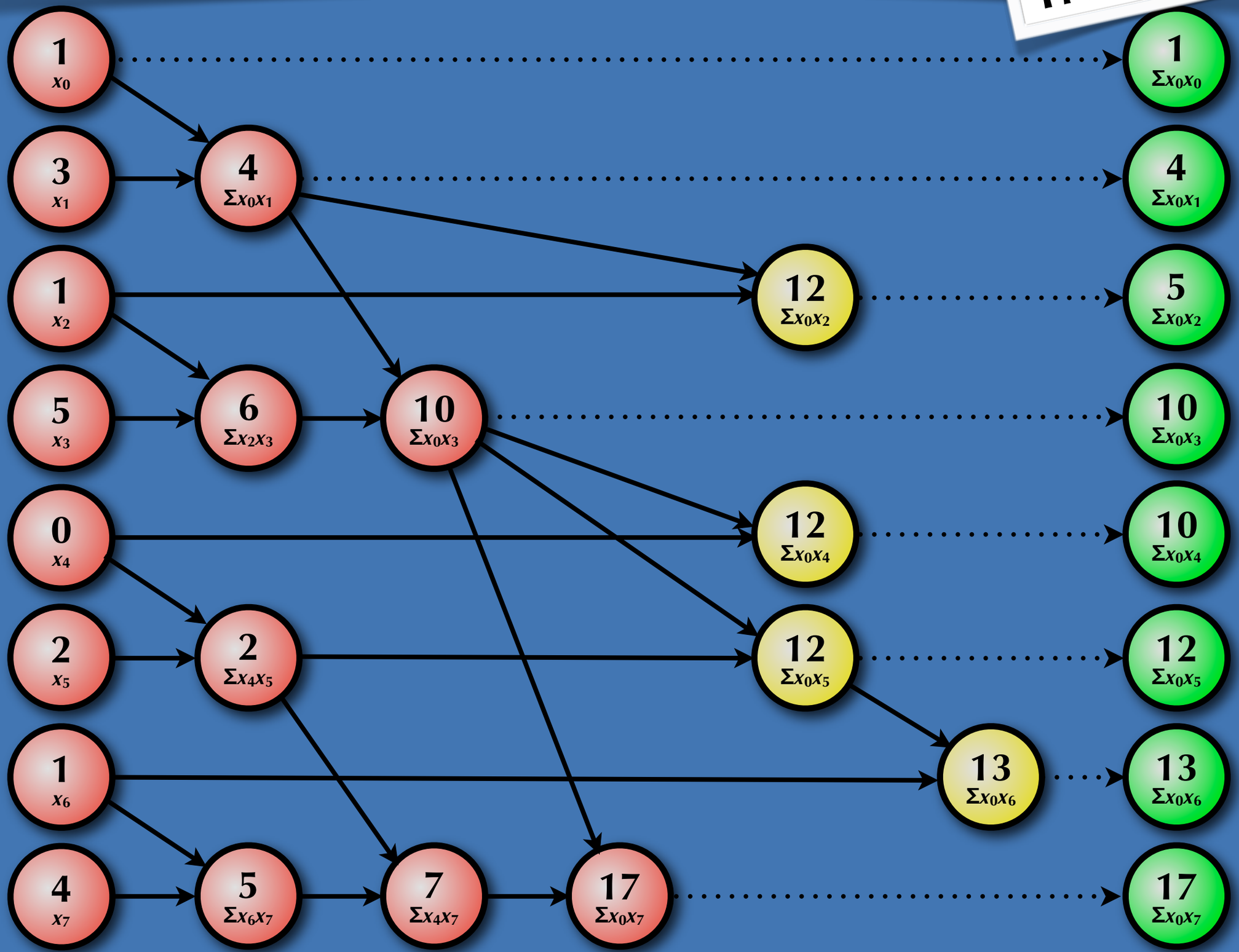
The "Prefix Sum" Problem

In Parallel!



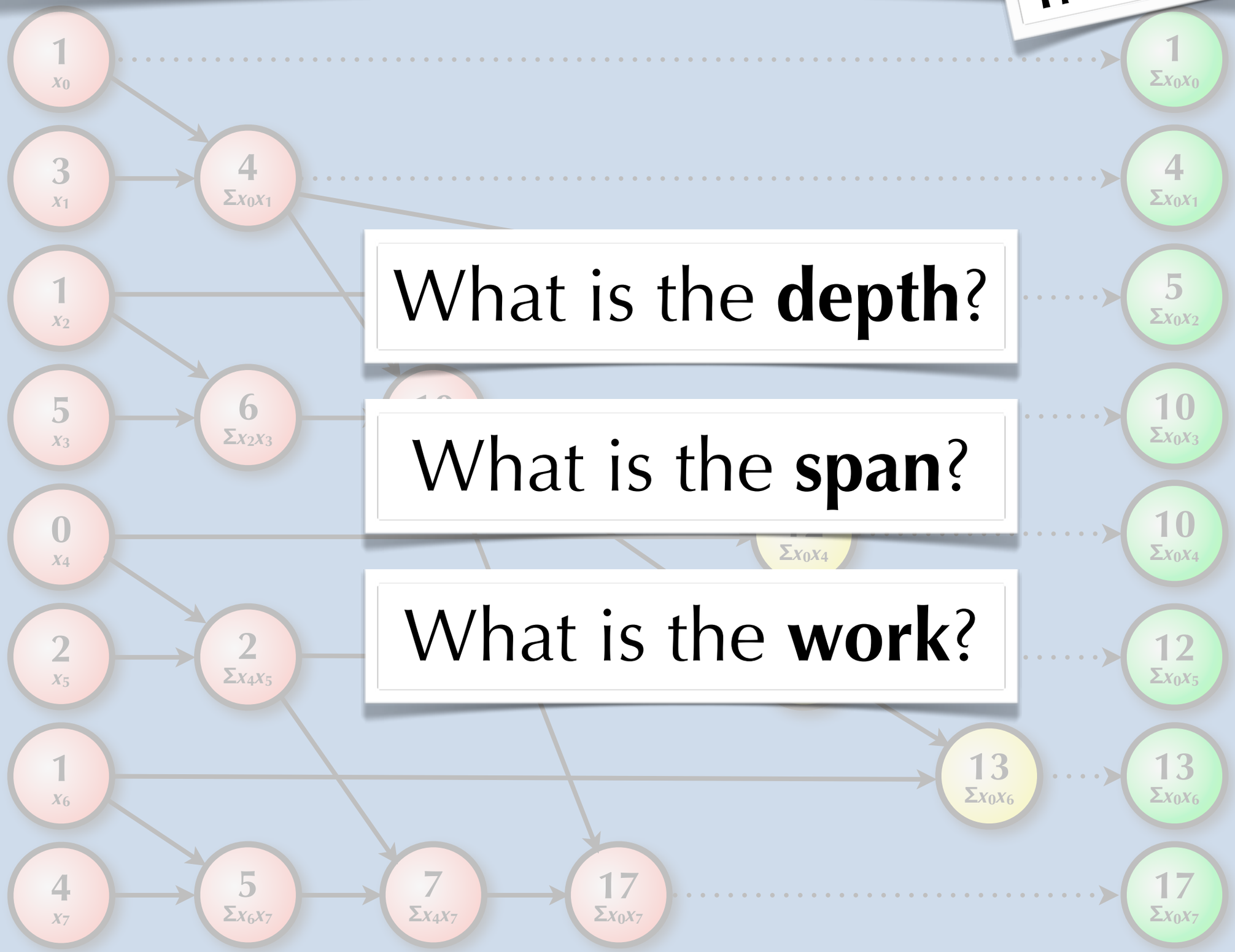
The "Prefix Sum" Problem

In Parallel!



The "Prefix Sum" Problem

In Parallel!



What is the **depth**?

What is the **span**?

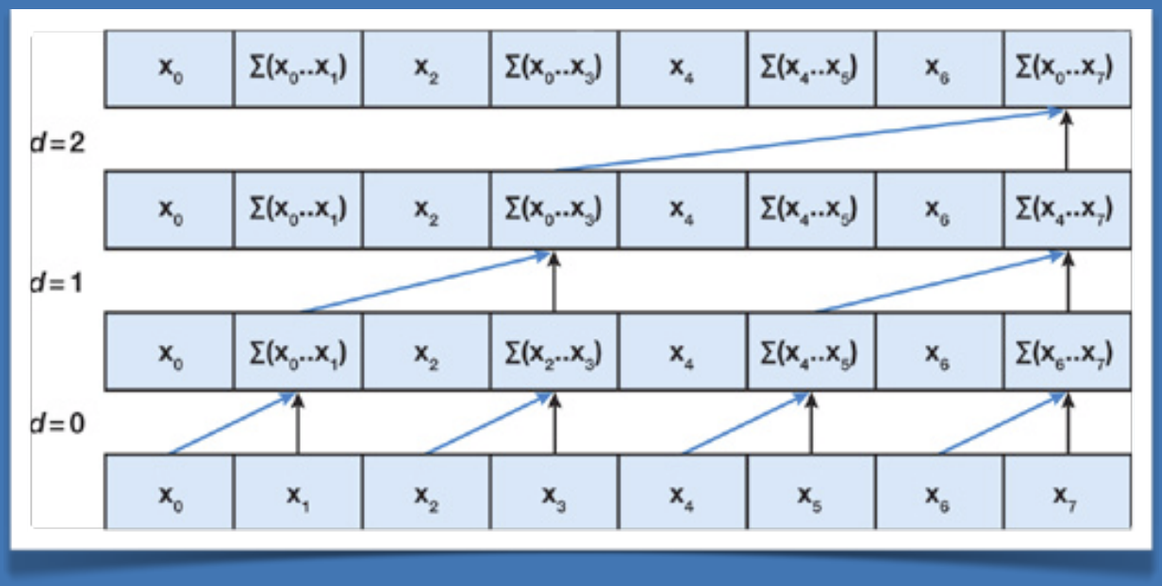
What is the **work**?

In Place Prefix Sum

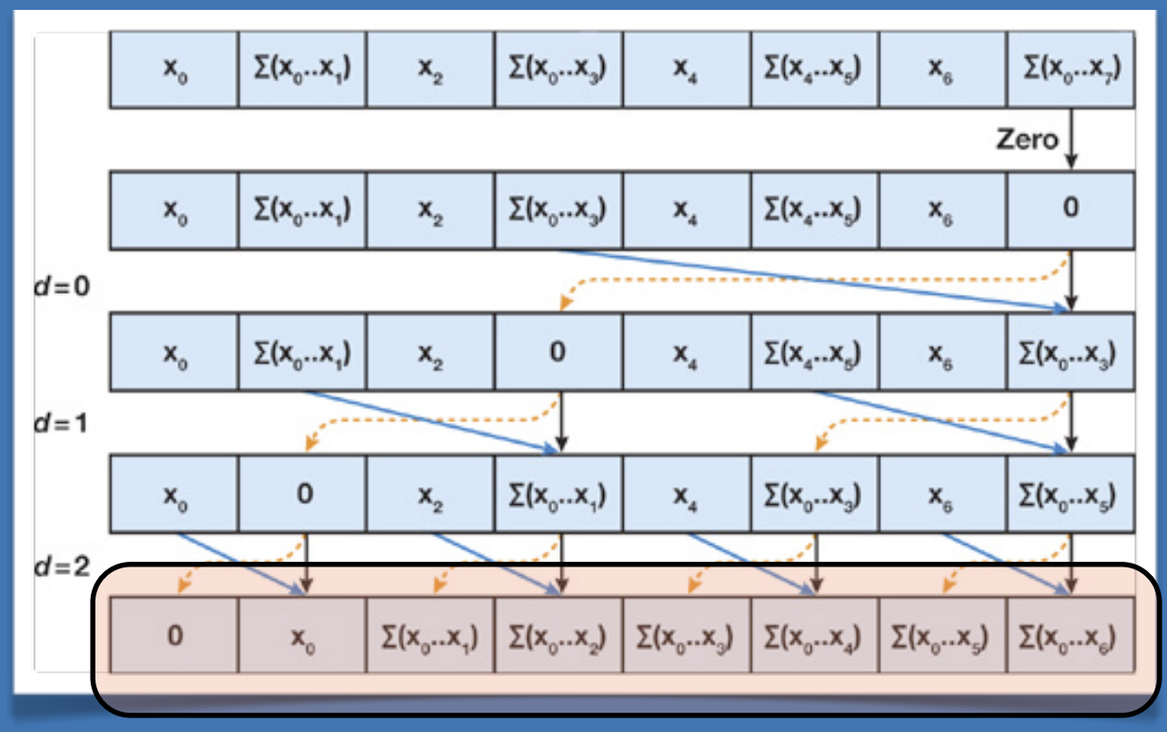
- in place prefix sums

"In Place" Prefix Sum

Forward Pass



Reverse Pass

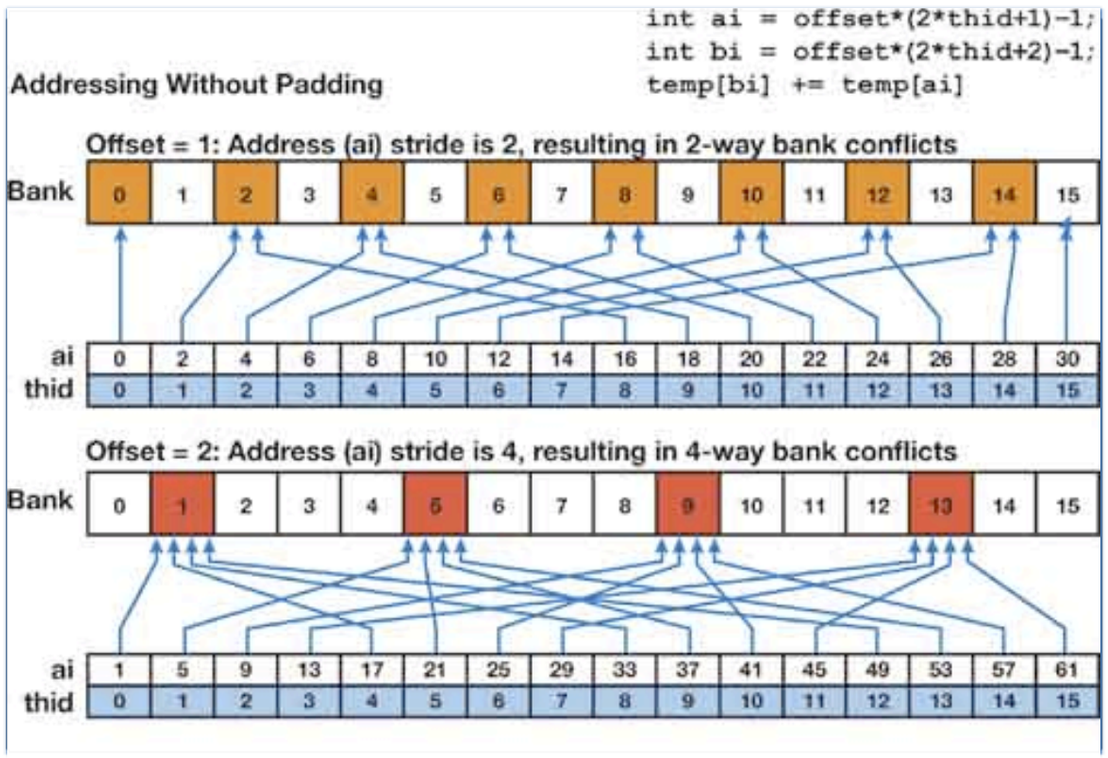


A "Pre-scan"

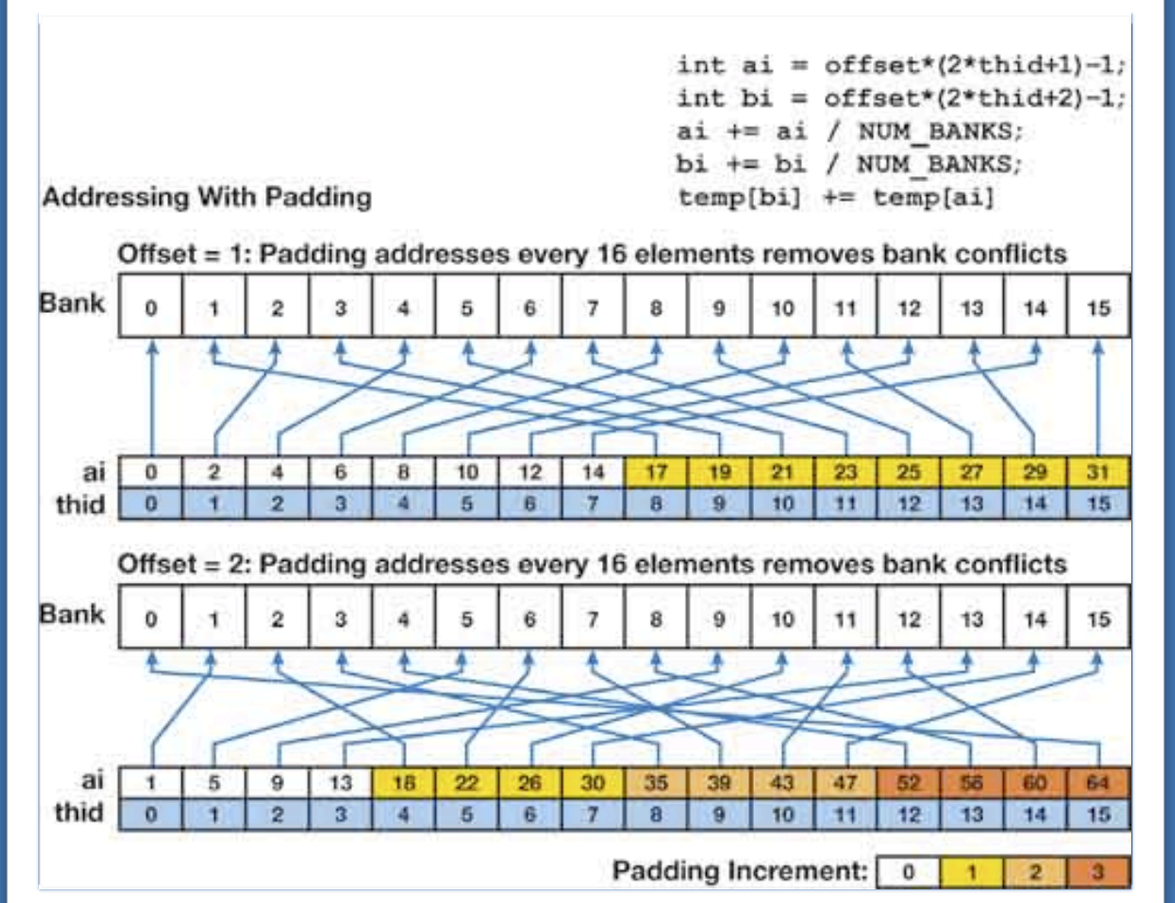
source: http://http.developer.nvidia.com/GPUGems3/gpugems3_ch39.html

Bank Conflicts

Forward Pass



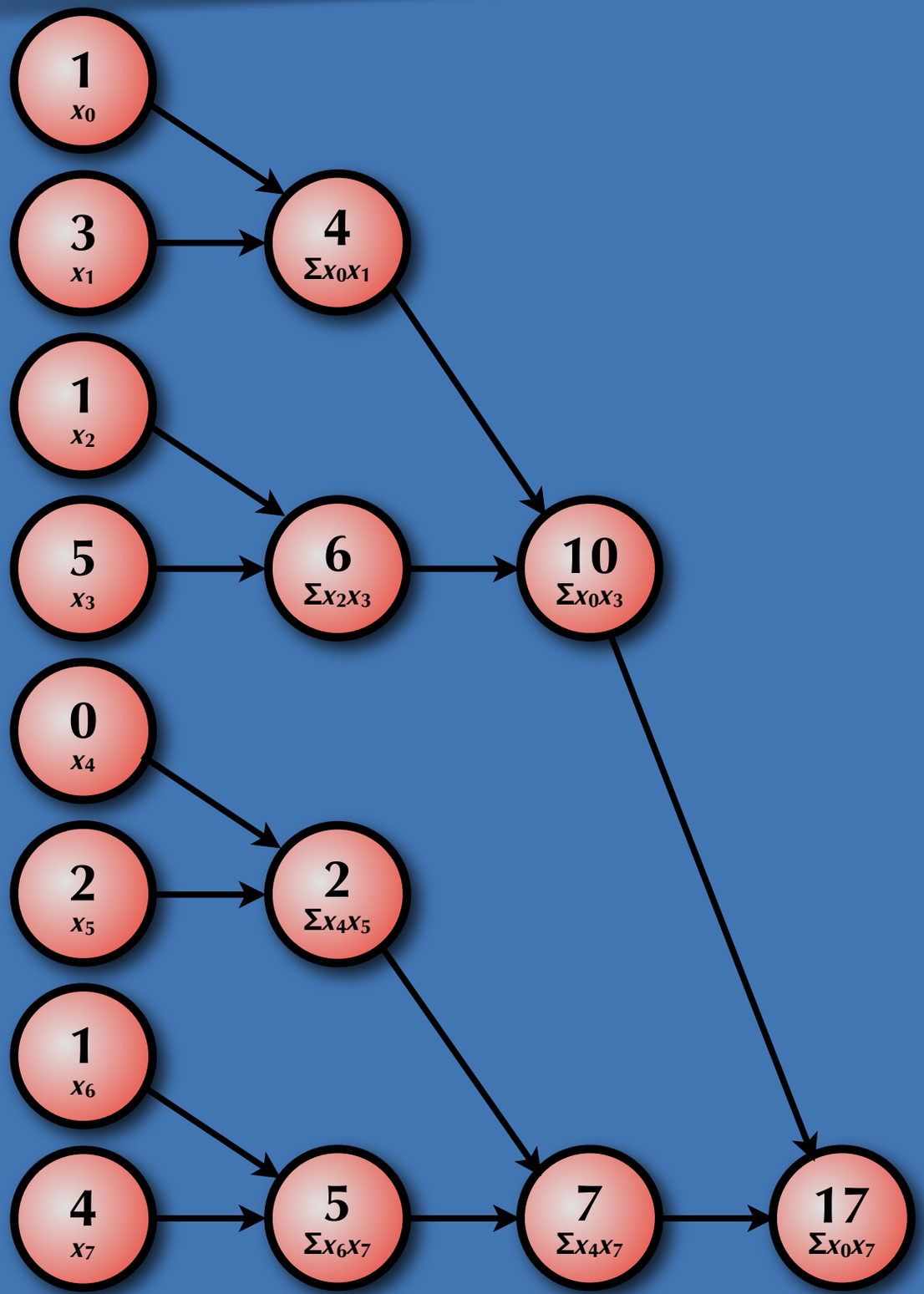
Reverse Pass



source: http://http.developer.nvidia.com/GPUGems3/gpugems3_ch39.html

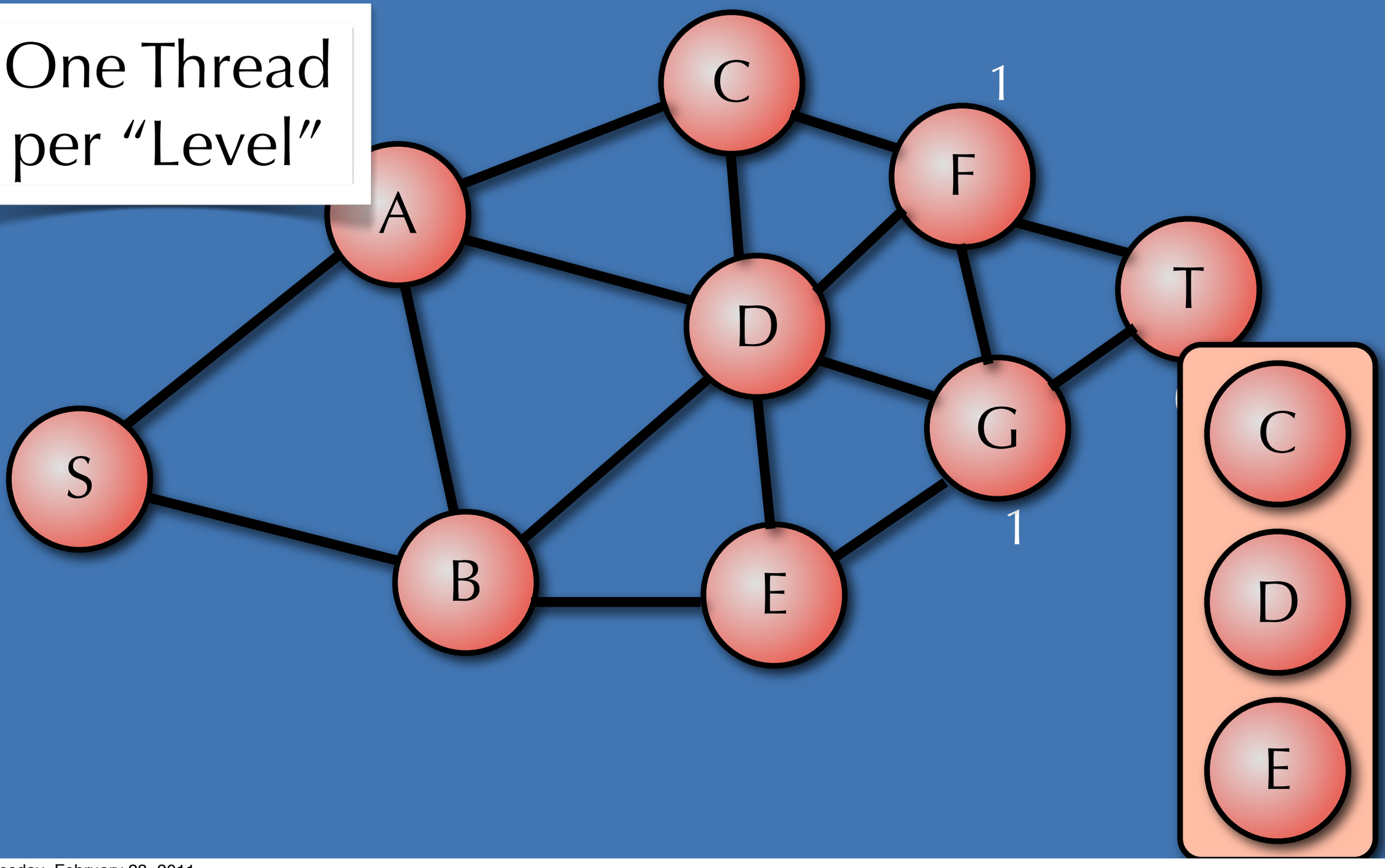
The "Sum" Problem

In Parallel!



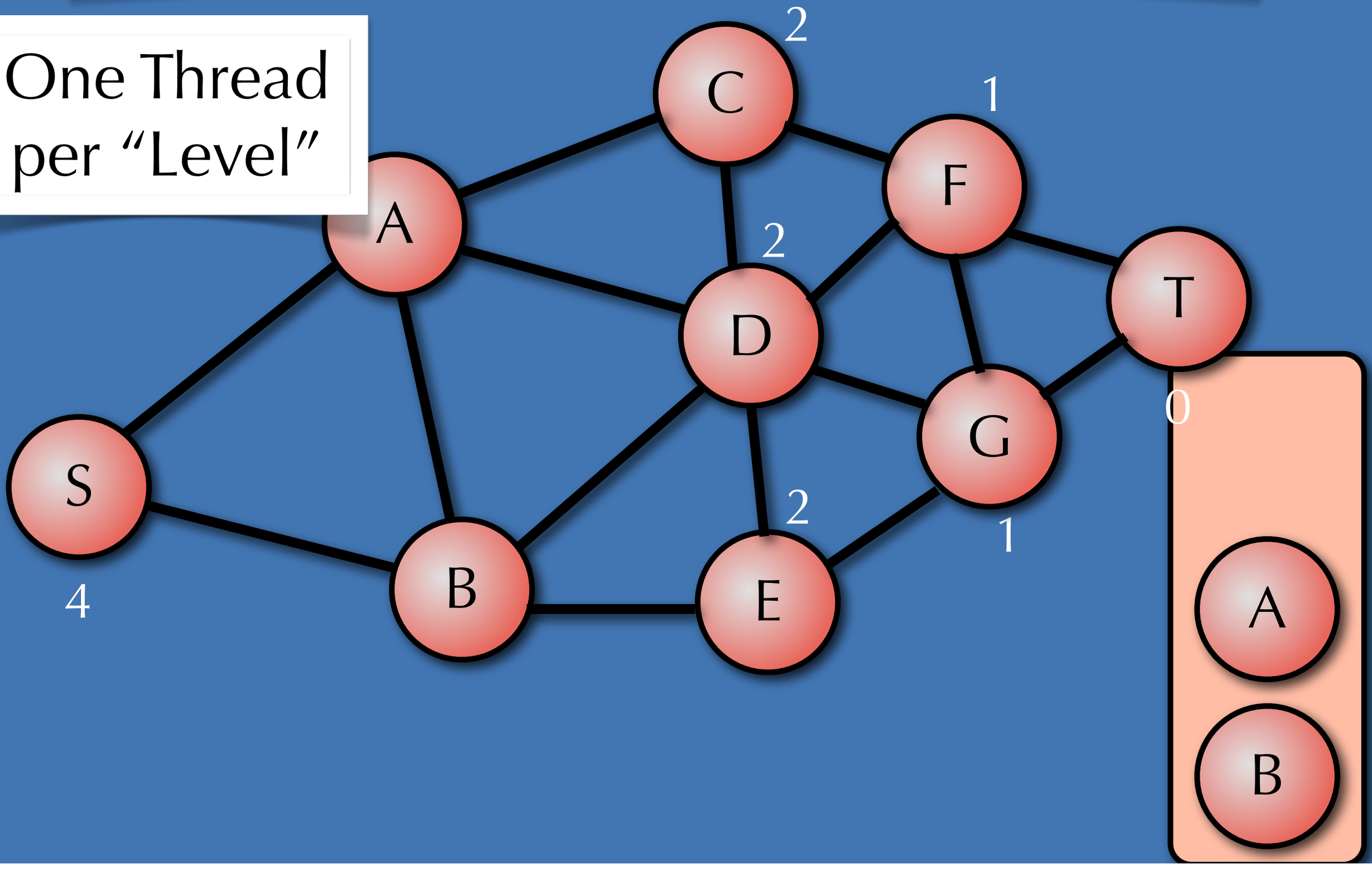
BFS on the GPU

One Thread per "Level"



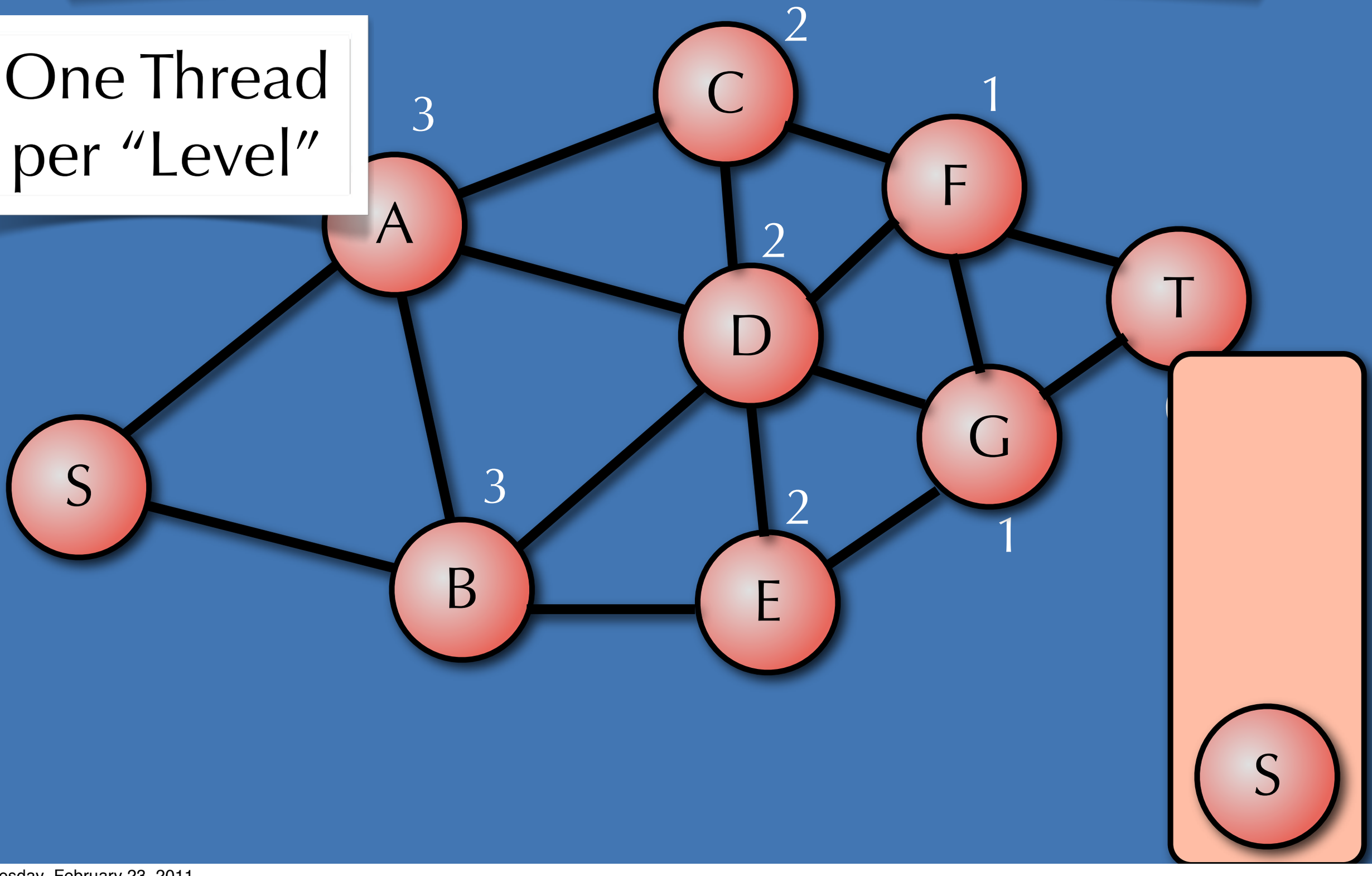
BFS on the GPU

One Thread per "Level"



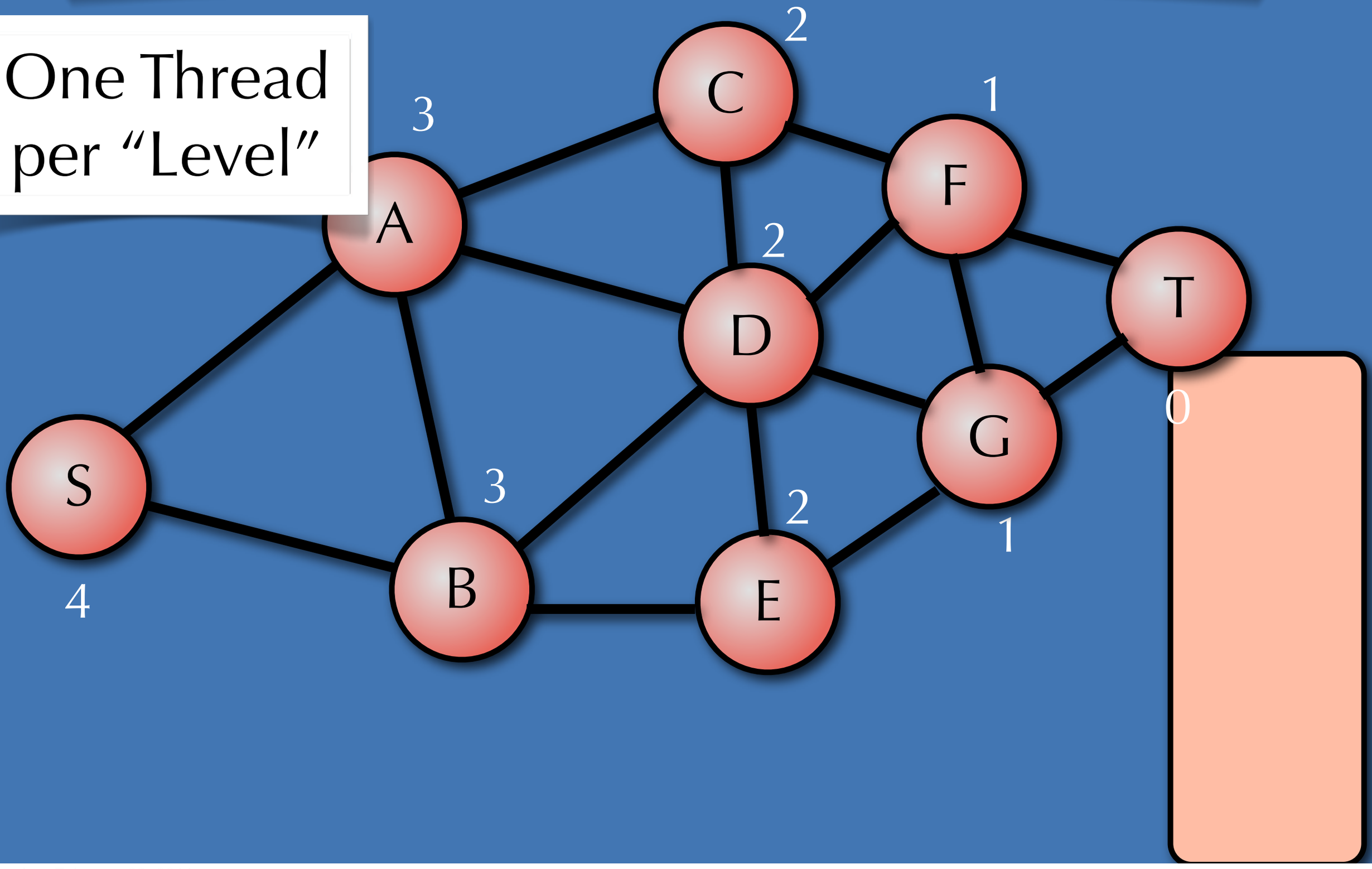
BFS on the GPU

One Thread per "Level"

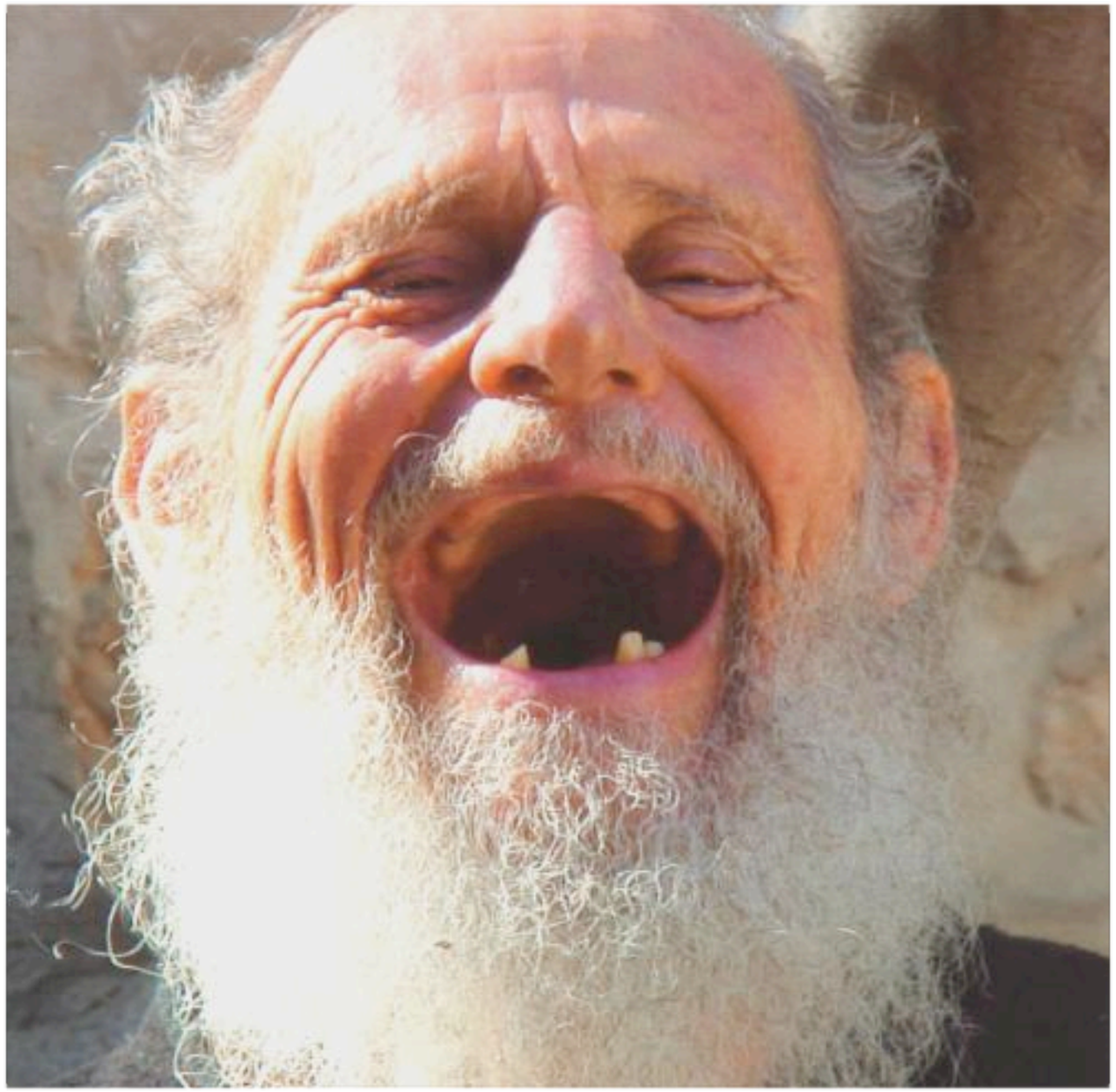


BFS on the GPU

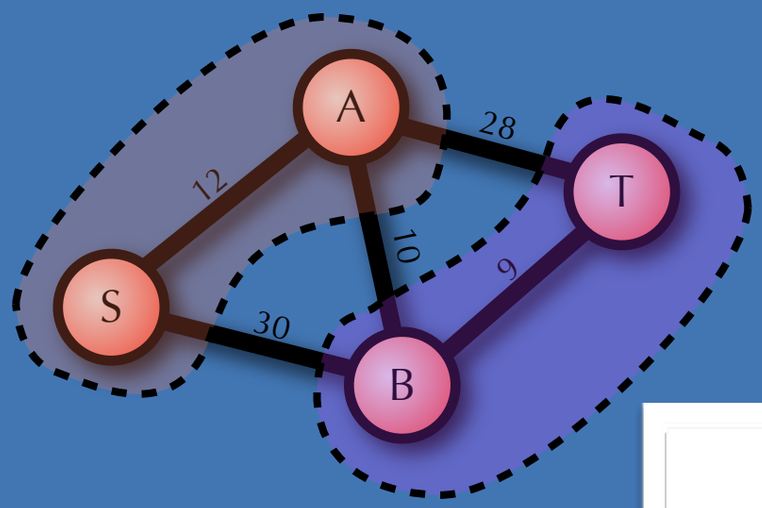
One Thread per "Level"



No Project 3



Overview



- Overview of P3
- Optimal Masks
- Optimal Masks as Graph Cuts
- Parallel Solution
- An announcement!