

15-150

1 Quiz more

last week to approve extra credit

$\Rightarrow$ work

$\Rightarrow$ span

$(e_1, e_2) \Rightarrow (e'_1, e'_2)$

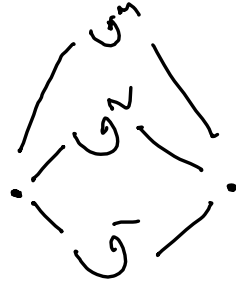
if $e_i \Rightarrow e'_i$ all:

all graphs have source & sink

• no computation

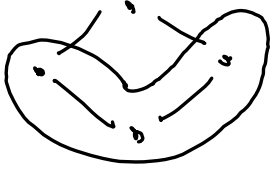
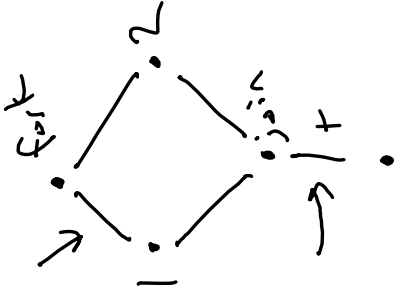
G_1 | G_2
sequential composition
| "step"

parallel composition



fork-join

$$1 + 2 \quad \text{op} + (1, 2)$$



$$O(\text{work}) = O(\text{nodes})$$

$$O(\text{span}) = O(\text{depth})$$

critical path

$$(1+2) * (3+4)$$

2 BFS

2 processors	X	Y
1	a	
2	b	c
3	d	e
4	f	g
5	h	i
6	j	
7		



P-DFS

P-BFS

Brent's Theorem

for work w
span s

processors p

$$\frac{w}{p} \leq s$$

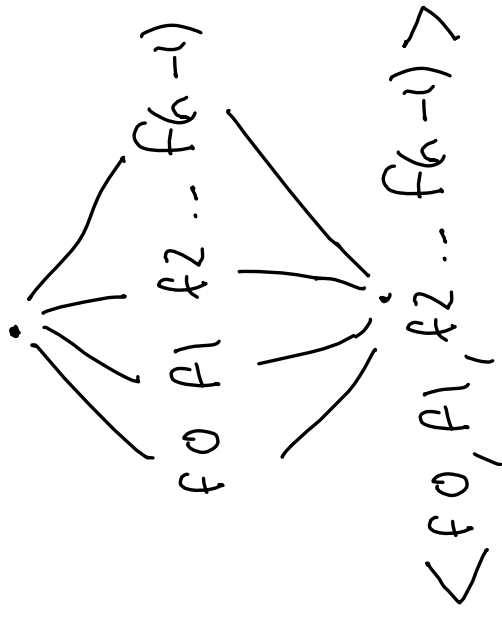
$$\text{time} \in \Omega \left(\max \left(\frac{w}{p}, s \right) \right)$$

$$\max \left(\frac{w}{p}, s \right) \in O(\text{time})$$

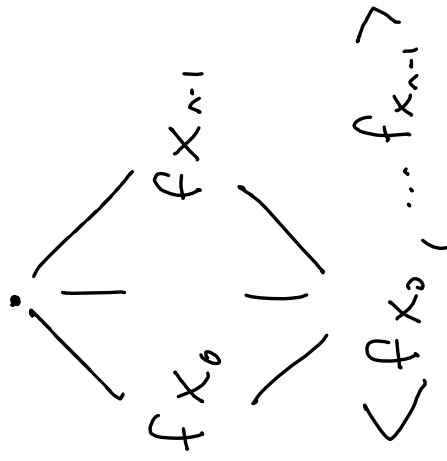
lists (linked) (immutable)

arrays (arbitrary access in constant time)
fixed length
mutable

tabulate $f \sim$



map $f \langle x_0, \dots, x_{n-1} \rangle$



① - associative

$$1 \oplus (2 \oplus 3) = (1 \oplus 2) \oplus 3$$

$$1 \oplus 2 \oplus 3$$

$$\begin{array}{ccccc} x_1 & & x_2 & & x_3 & & x_4 \\ & \diagdown & & \diagdown & & \diagdown & \\ & x_1 \oplus x_2 & & x_3 \oplus x_4 & & & \end{array}$$

$$2 \oplus x_1 \oplus x_2 \oplus x_3 \oplus x_4$$

$$\text{work } O(m \times n)$$

$$\langle \begin{matrix} 1 \\ 2 \end{matrix}, \begin{matrix} 3 \\ 4 \end{matrix} \rangle$$

span

$$O(\log(n) + \log(m))$$

$$\langle 3, 7 \rangle$$

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