Computational Foundations for ML

10-607

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Notes and reminders

- Lab 3 on Monday

$$\text{fib}(n) = \text{fib}(n-1) + \text{fib}(n-2) \qquad n \geq 2$$

$$= 0 \qquad n = 0, \; n = 1$$

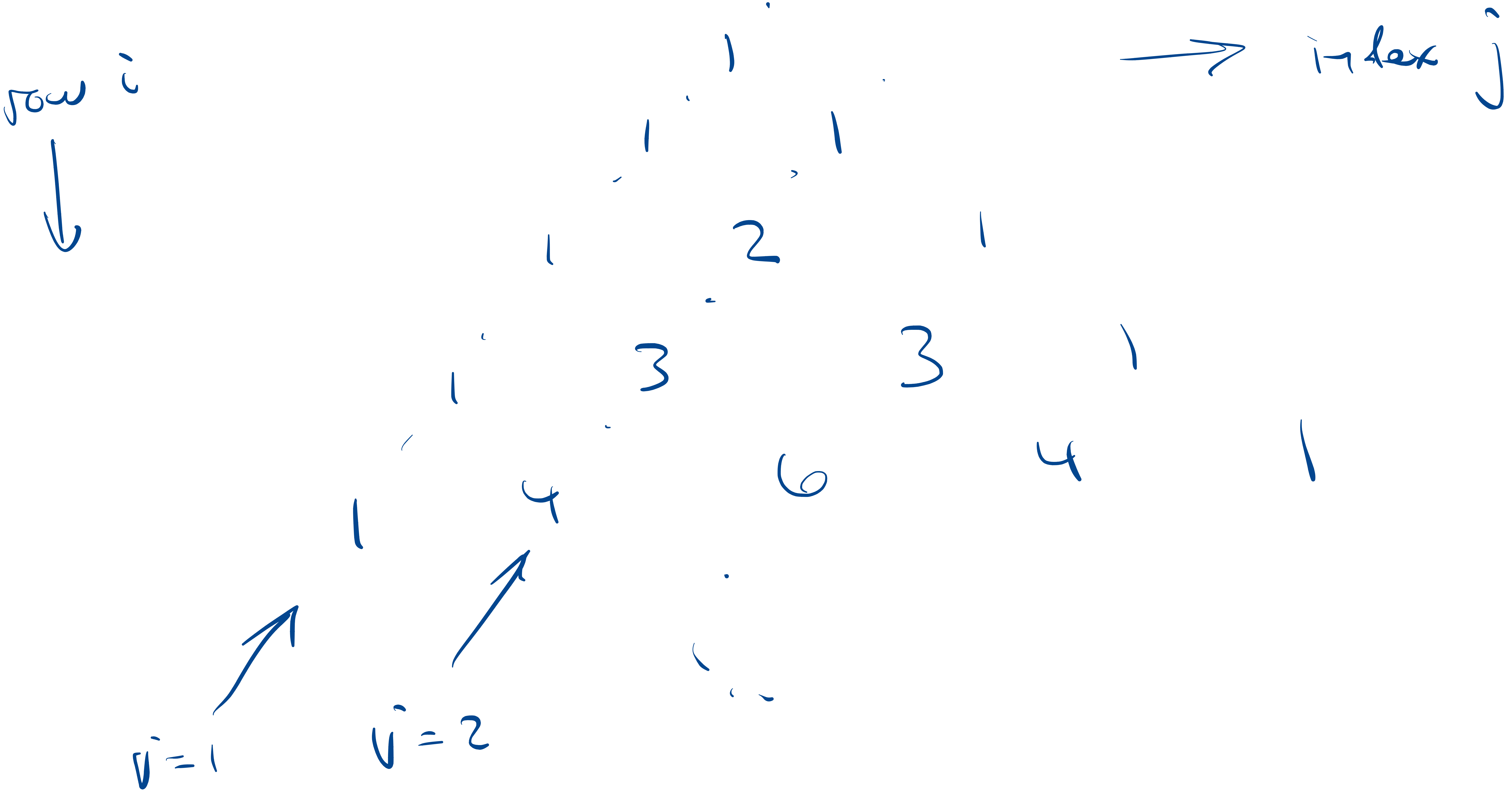
exp time $\hookrightarrow 2^{O(n^d)}$

$A \in \mathbb{R}^n$

for $k = 2, 3, \ldots n$

$A[k] \leftarrow A[k-1] + A[k-2]$

$R(n)$ in terms of $R(\lfloor \frac{n}{2} \rfloor)$ $R(\lceil \frac{n}{2} \rceil)$



The quick brown fox . . . .

S → NP VP

NP → det A N

$O(n^3 J)$

$O(n^2)$

$$P(i, j) = P(i-1, j-1) + P(i-1, j)$$

$$A(i, j) = 0$$

$$P(i,j) \quad A(i,j) \neq 0 \rightarrow A(i,j)$$

$$j = 1 \quad \longrightarrow \quad 1$$

$$i = j \quad \longrightarrow \quad 1$$

$$T \quad \longrightarrow \quad P(i-1, j-1) + P(i-1, j)$$

↳ assign to $A(i,j)$ before returning

S = XYZZY → subsequence XYZ, XYY
not ZYX

T = XYZXYZ

LCS(i, j) → A[i, j]

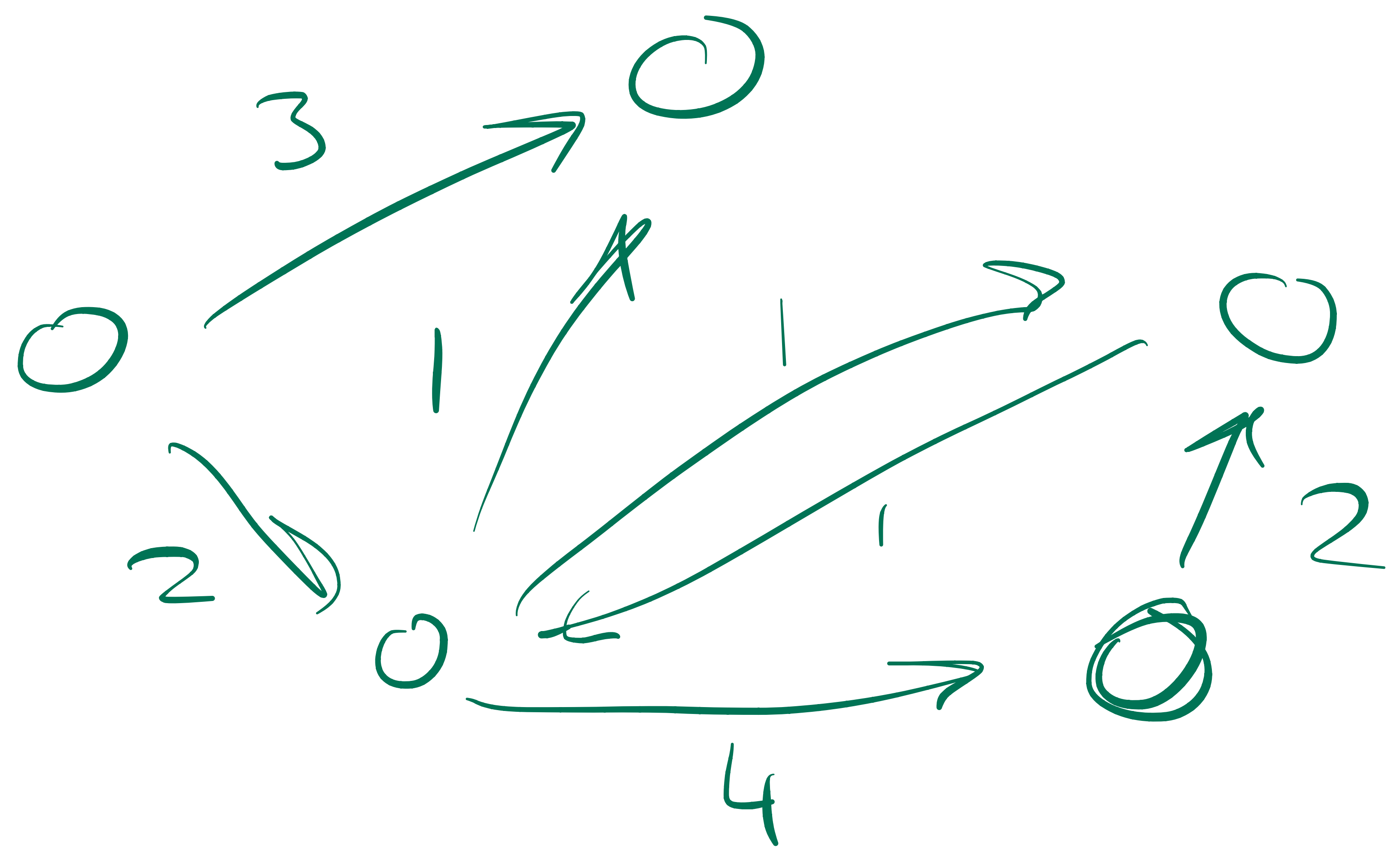
LCS(i, j) → longest common subsequence of S[1...i] and T[1...j]

S[i] = T[j] → call LCS(i-1, j-1), append S[i]

else → LCS(i-1, j)
LCS(i, j-1) → take longer

	x	y	z	z	y
z			z	z	z
z			z	zz	zz
y		y	y	zz	zzy
z					
x					

$J(v)$ = cost of cheapest path from v to goal



$|V| = 5$

$|E| = 7$

$J(\text{goal}) = 0$

$$J(v) = \min_{(v,w) \in E} \left[c_{vw} + J(w) \right]$$

$J(v, n)$ = cost of cheapest path $v \to$ goal using $\leq n$ edges

$$J(\text{goal}, 0) = 0$$

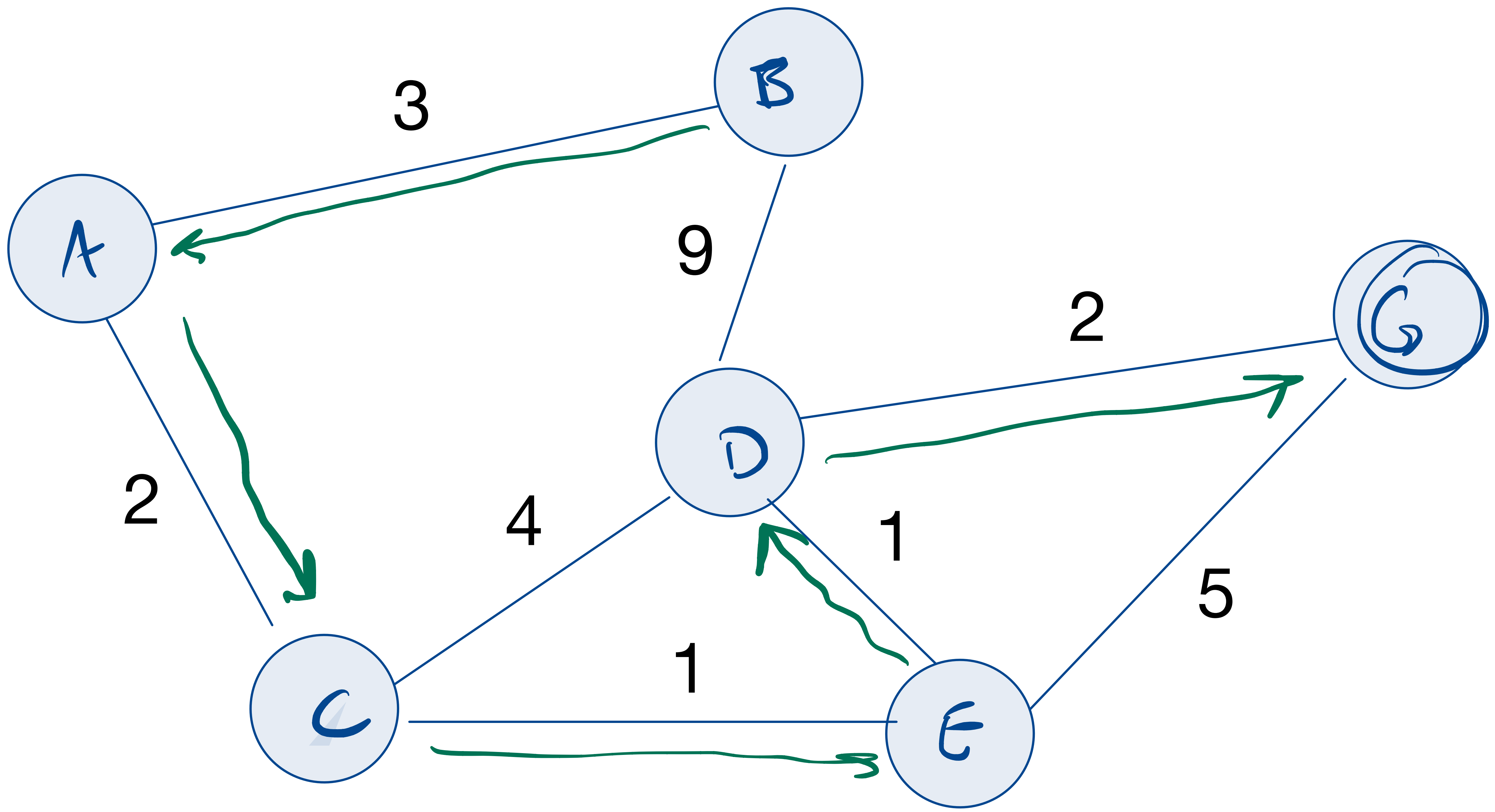
$$J(v, 0) = \infty \qquad v \neq \text{goal}$$

$$J(v, n) = \min \left[J(v, n-1), \min_{(v,w) \in E} \left[c_{vw} + J(w, n-1) \right] \right]$$

$$O(|V|\,|E|)$$

Bellman-Ford

n	A	B	C	D	E	G
0	∞	∞	∞	∞	∞	0
1	∞	∞	∞	2	5	0
2	∞	11	6	2	3	0
3	8	11	4	2	3	0
4	6	11	4	2	3	0
5	6	9	4	2	3	0



	#1	p	#2
pancakes	00	1/2	0
shredded wheat	10	1/4	10
bagels	01	1/8	110
caviar	11	1/8	111
E(length)	2		

$$\frac{1}{2}\cdot 1 + \frac{1}{4} 2 + \frac{1}{8}\cdot 3 + \frac{1}{8}\cdot 3 = 7/4$$

$$\frac{3+3+4+4}{8} = \frac{14}{8} = \frac{7}{4}$$