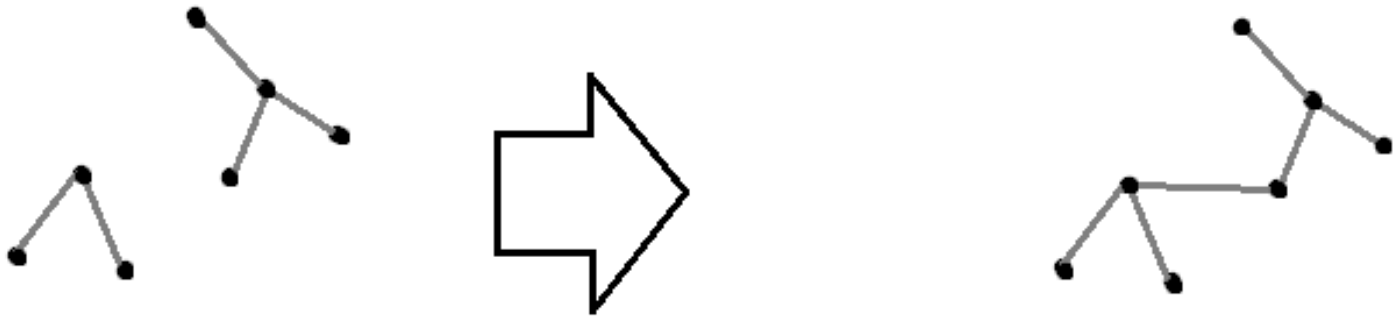
Graph implementations

Comp Sci 1575 Data Structures

Implementations

Implementation

Asymptotic comparison



Deforestation:
When adding a branch gives you fewer trees.

Outline

Implementation

Asymptotic comparison

1 Implementation

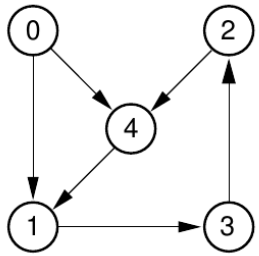
2 Asymptotic comparison

Implementations

Implementation

Asymptotic comparison

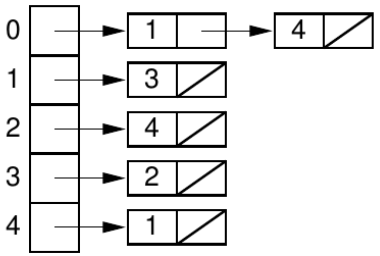
Directed



(a)

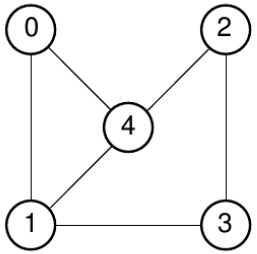
	0	1	2	3	4
0		1			1
1				1	
2					1
3			1		
4		1			

(b)



(c)

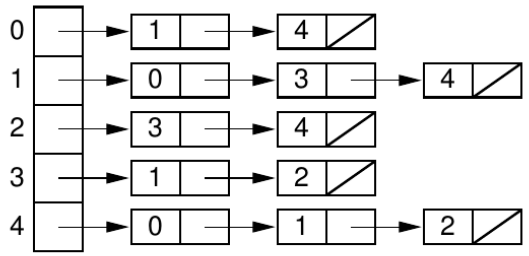
Un-directed



(a)

	0	1	2	3	4
0		1			1
1	1			1	1
2				1	1
3		1	1		
4	1	1	1		

(b)



(c)

Outline

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1 Implementation

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Asymptotic comparison

	Adjacency list	Adjacency matrix	Incidence matrix
Store graph	$O(\|V\| + \|E\|)$	$O(\|V\|^2)$	$O(\|V\| * \|E\|)$
Add vertex	$O(1)$	$O(\|V\|^2)$	$O(\|V\| * \|E\|)$
Add edge	$O(1)$	$O(1)$	$O(\|V\| * \|E\|)$
Remove vertex	$O(\|E\|)$	$O(\|V\|^2)$	$O(\|V\| * \|E\|)$
Remove edge	$O(\|V\|)$	$O(1)$	$O(\|V\| * \|E\|)$
Query adjacency	$O(\|V\|)$	$O(1)$	$O(\|E\|)$

- **Adjacency list:** Slow to remove vertices and edges, because it needs to find all vertices or edges
- **Adjacency matrix:** Slow to add or remove vertices, because matrix must be resized/copied
- **Incidence matrix:** Slow to add or remove vertices and edges, because matrix must be resized/copied

Draw