

Algoritmer og Datastrukturer 2

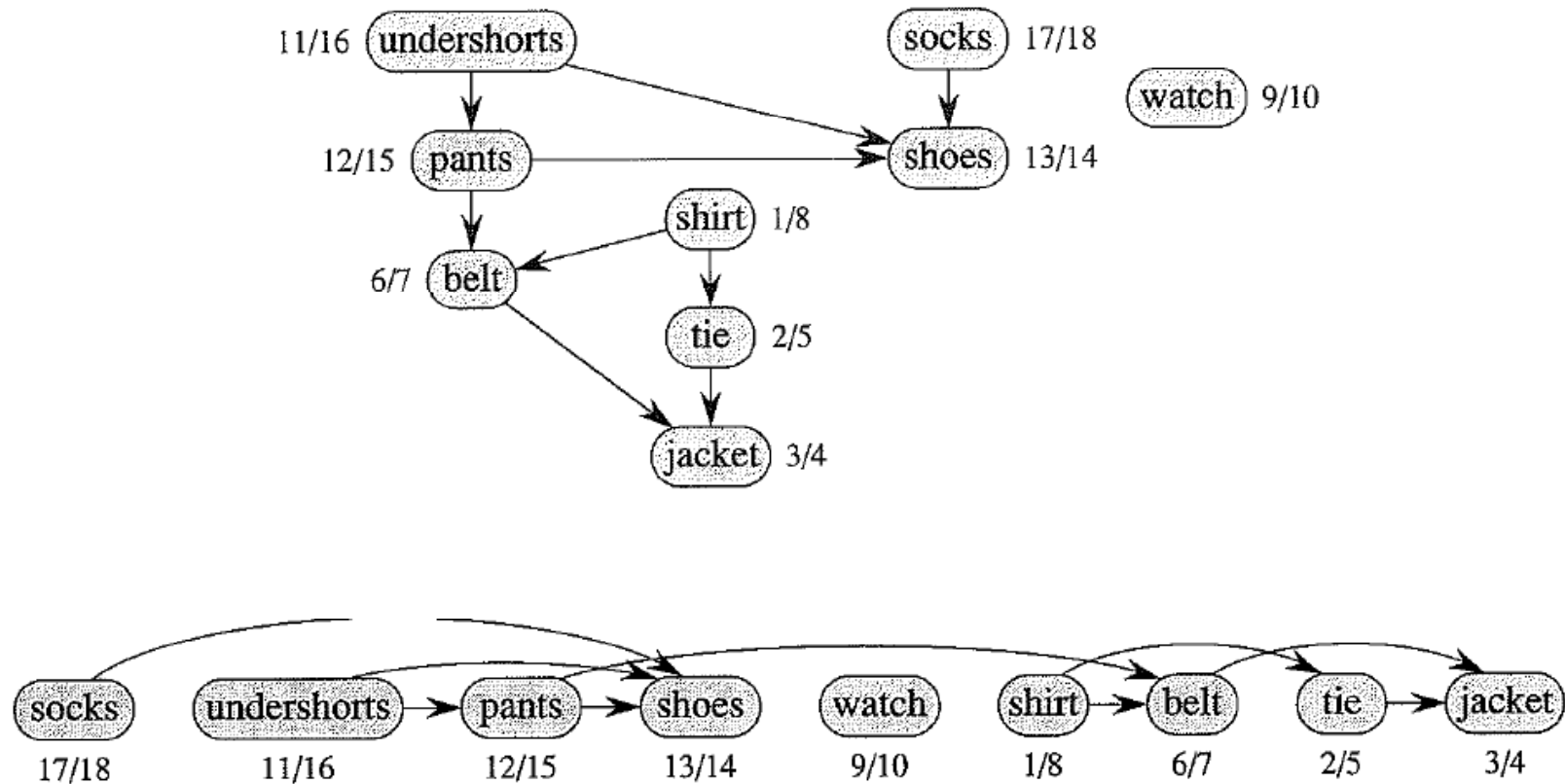
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Topologisk Sortering, Stærke Sammenhængskomponenter
[CLRS, kapitel 22.4-22.5]



AARHUS UNIVERSITET

Acykliske Grafer: Topologisk Sortering



Alle kanter går fra venstre-mod-højre

Microsoft Excel - Copy of SheepFlock

File Edit View Insert Format Tools Data Window Help Adobe PDF Type a question for help

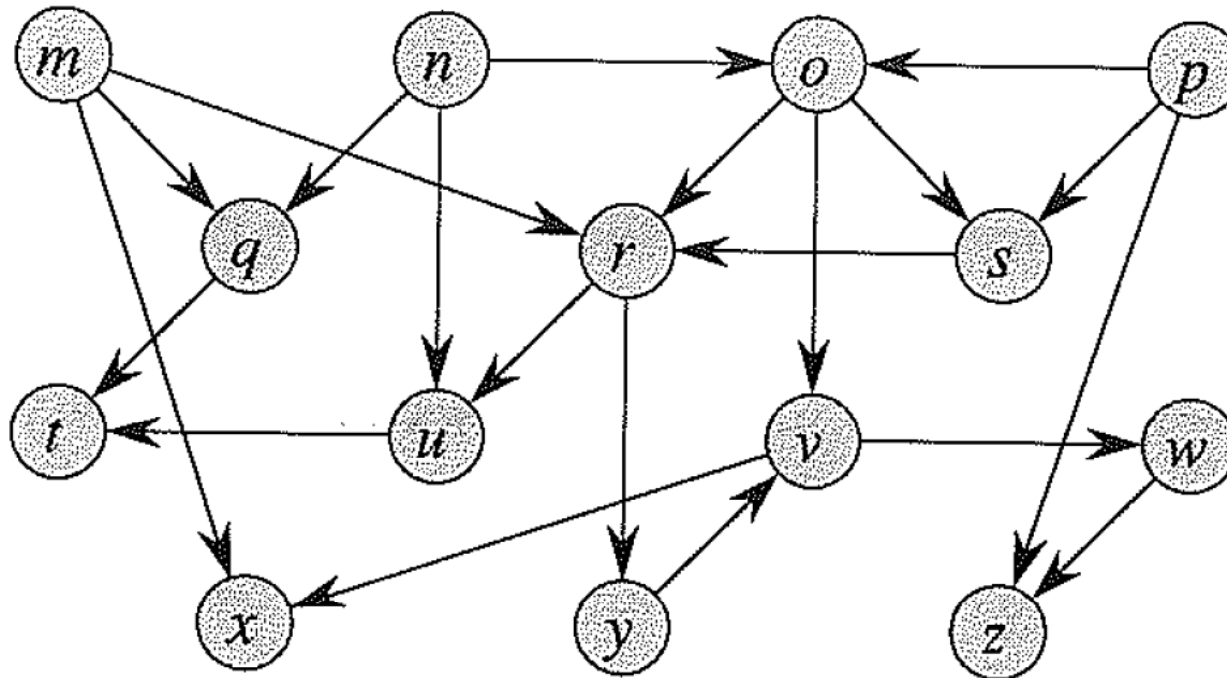
H18 =B18*G18

	A	B	C	D	E	F	G	H	I	
3	I. Description of animals in flock during the year.									
4	Ewes in flock:	700				[Green cells are those you can change.]				
5	Lambing rate:	4	times per	3	years =	1.33	times/year.			
6	Lambs weaned/lambing:	1.5	Days of lactation/lambing:		60					
7	Adult death loss per year:	3%	Days in lactation/year:		80					
8	Postweaning lamb loss:	2%	Lambs weaned per ewe per year:		2.0					
9	Ewe culling rate:	15%	Ram culling rate:		50%					
10	Rams/100 ewes:	1	(Only 1/3 of ewes bred per season under STAR system.)						Inventory	
11			Weaning	Market	Final	Price	Value	or sale		
12		Number	wt, lb	wt, lb	wt, lb	\$/lb	per head	value		
13	Ewes	700			150	\$1.00	\$150	\$105,000		
14	Rams	8			200	\$2.00	\$400	\$3,200		
15	Ewe lamb rplcmnts	126	30		100	\$1.25	\$125	\$15,750		
16	Ram lamb rplcmnts	5	40		130	\$2.00	\$260	\$1,300		
17	Ewe lambs sold	560	30	70		\$1.10	\$77	\$43,120		
18	Ram lambs sold	681	40	70		\$1.10	\$77	\$52,437		
19	Cull ewes sold	105		150		\$0.30	\$45	\$4,725		
20	Cull rams sold	5		200		\$0.30	\$60	\$300		
21	Fleece weight per adult	708			6	\$0.30	\$1.80	\$1,274		
22							Inventory:	\$125,250		
23							Sales:	\$101,856		

Ready

Topologisk sortering = en rækkefølge hvor vi kan beregne cellernes indhold

Topologisk Sortering



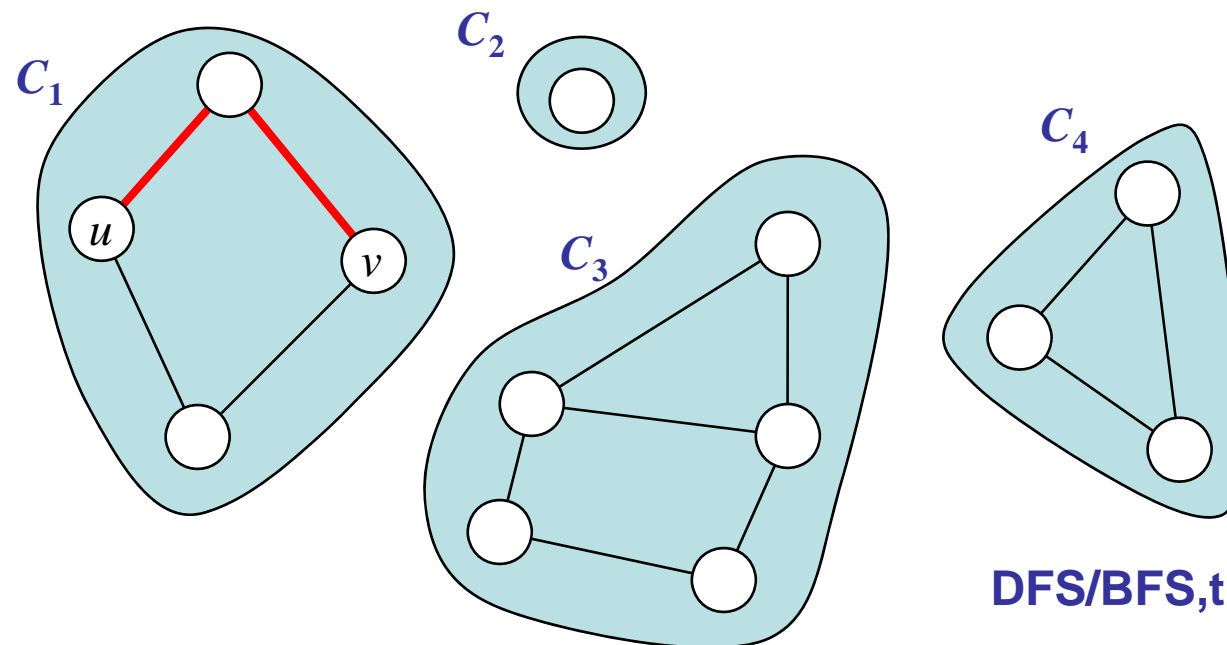
TOPOLOGICAL-SORT(G)

- 1 call $\text{DFS}(G)$ to compute finishing times $f[v]$ for each vertex v
- 2 as each vertex is finished, insert it onto the front of a linked list
- 3 **return** the linked list of vertices

Tid $O(m+n)$

Sammenhængskomponenter

Opdeling af knuderne i en **uorienteret** graf i **komponenter** C_1, \dots, C_k , således at u og v er i C_i hvis og kun hvis der er en **sti** mellem u og v

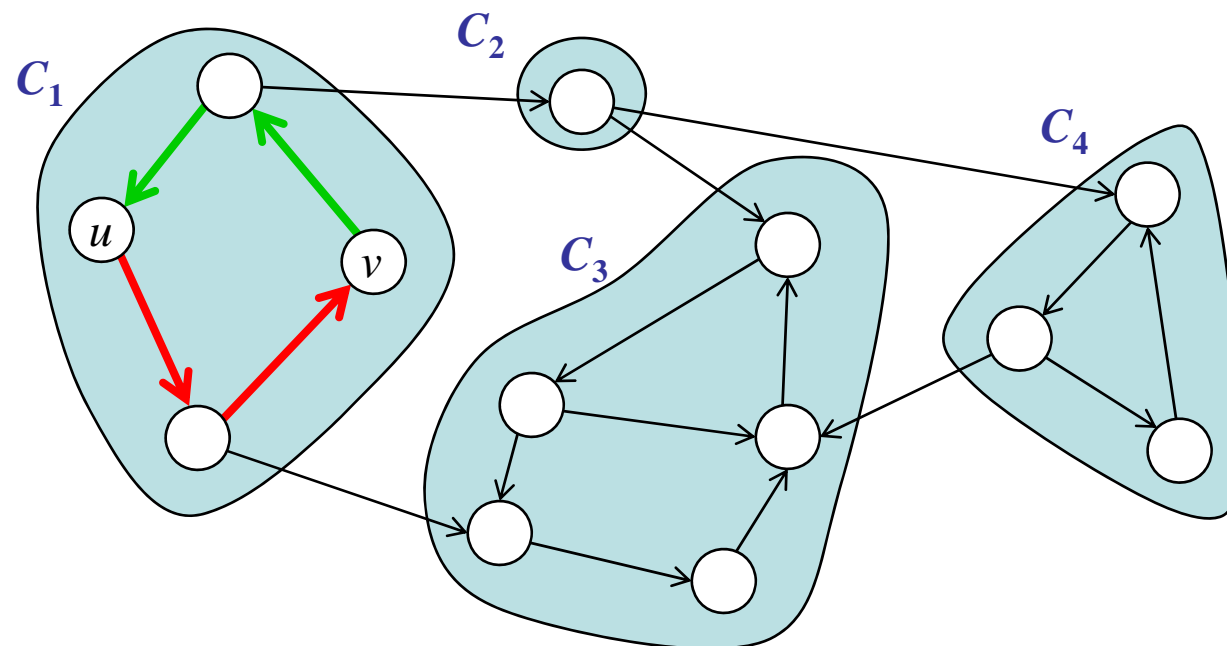


Stærke Sammenhængskomponenter

Opdeling af knuderne i en **orienteret** graf i **komponenter** C_1, \dots, C_k , således at

u og v er i C_i hvis og kun hvis der både er

- en **sti fra u til v** og
- en **sti fra v til u**



Stærke Sammenhængskomponenter

STRONGLY-CONNECTED-COMPONENTS (G)

- 1 call DFS(G) to compute finishing times $f[u]$ for each vertex u
- 2 compute G^T
- 3 call DFS(G^T), but in the main loop of DFS, consider the vertices in order of decreasing $f[u]$ (as computed in line 1)
- 4 output the vertices of each tree in the depth-first forest formed in line 3 as a separate strongly connected component

DFS(G)

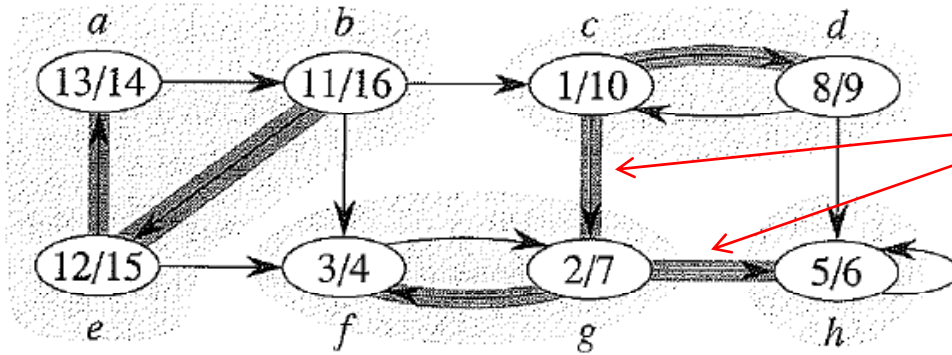
```
1 for each vertex  $u \in V[G]$ 
2   do  $color[u] \leftarrow WHITE$ 
3      $\pi[u] \leftarrow NIL$ 
4  $time \leftarrow 0$ 
5 for each vertex  $u \in V[G]$ 
6   do if  $color[u] = WHITE$ 
7     then DFS-VISIT( $u$ )
```

DFS-VISIT(u)

```
1  $color[u] \leftarrow GRAY$     ▷ White vertex  $u$  has just been discovered.
2  $time \leftarrow time + 1$ 
3  $d[u] \leftarrow time$ 
4 for each  $v \in Adj[u]$     ▷ Explore edge  $(u, v)$ .
5   do if  $color[v] = WHITE$ 
6     then  $\pi[v] \leftarrow u$ 
7         DFS-VISIT( $v$ )
8  $color[u] \leftarrow BLACK$     ▷ Blacken  $u$ ; it is finished.
9  $f[u] \leftarrow time \leftarrow time + 1$ 
```

Tid $O(m+n)$

Stærke Sammenhængskomponenter



DFS trækanter
mellem to stærke
sammenhængs-
komponenter

