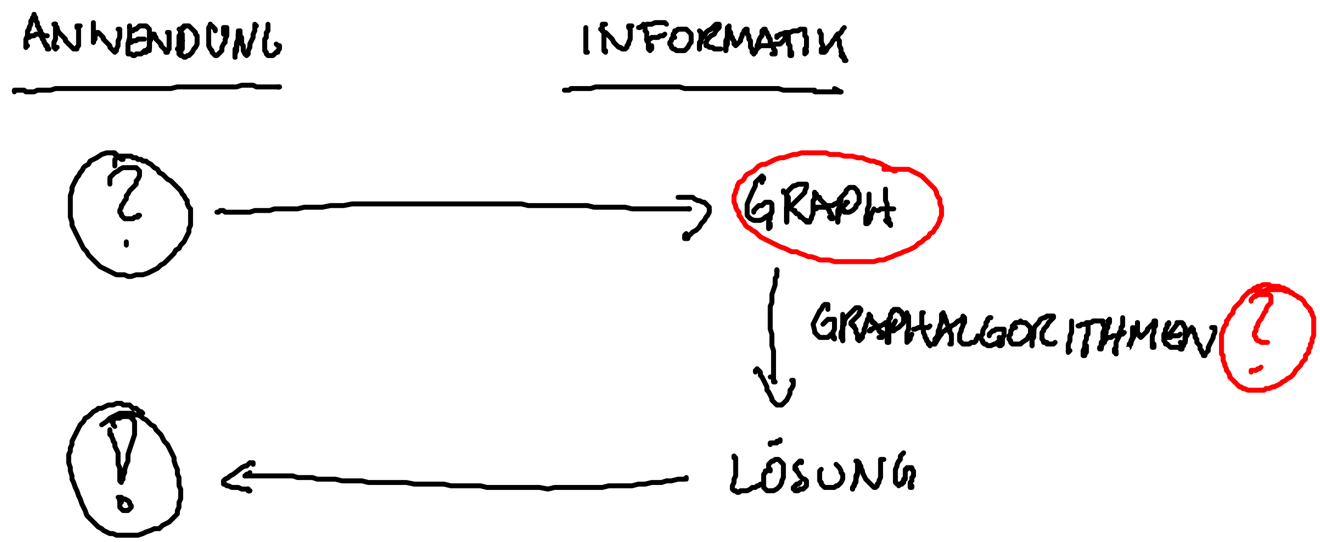
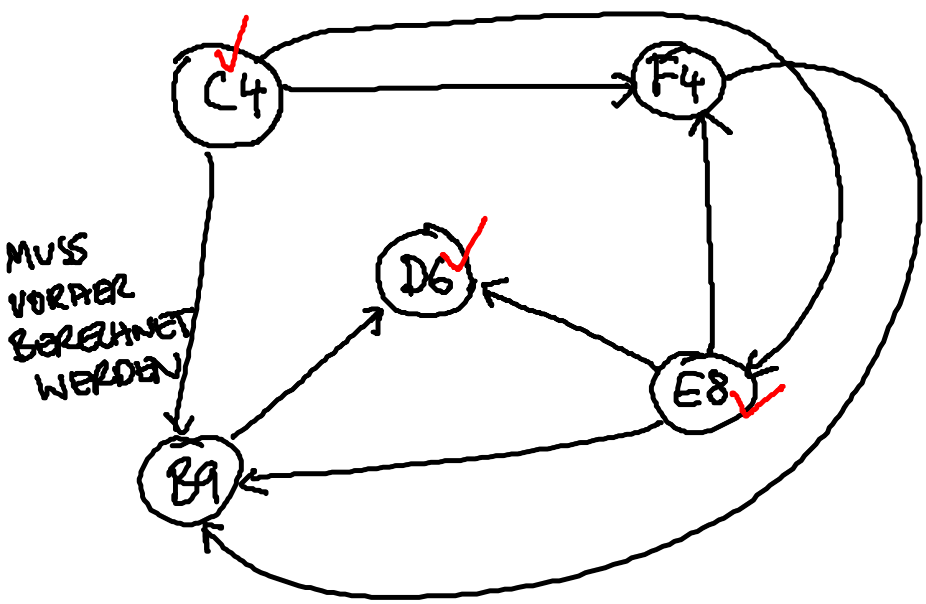
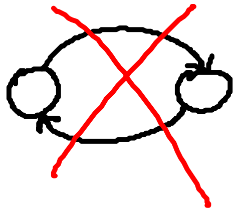
ALGODAT 2.6.2016





REIHENFOLGE

C_4 E_8 F_4 B_9 D_6



1) WATCH 2) SHIRT 3) TIE

4) SOCKS 5) PANTS 6) SHOES 7) BELT 8) JACKET

4b) UNDERSHORTS

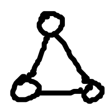
AUFWAND
- WORST
- BEST
- AVERAGE

- PLATZ
- ZEIT

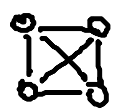
GRÖSSE EINGABE : n

$n \rightarrow \infty$ ZEITAUFWAND ?

$G = (V, E)$

 K_3

 K_2

 K_4

 K_1

"n" : $|V|$, $|E|$

$$\boxed{\frac{|V| \cdot (|V|-1)}{2}}$$

\# KNOTEN

\# KANTEN PRO KNOTEN

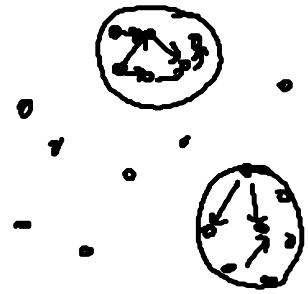
FÜR VOLLSTÄNDIGE GRAPHEN "WORST CASE"

AUFWAND VON TOPOLOGICAL SORT (DFS) $\in O(n!)$?

$\sim (|V| + |E|) \in O(|V|^2)$ $\quad \boxed{\in O(|V| + |E|)}$ OFFIZIELL

"PROPORTIONAL"

$n \to \infty$?



$|E| \leq |V|^2$

$T_{BFS} \cong \underline{\underline{|V|}} + |V|^2$

$f(n) = n + n^2$

$g(n) = n^2$

$\boxed{f(n) \in O(g(n))}$?

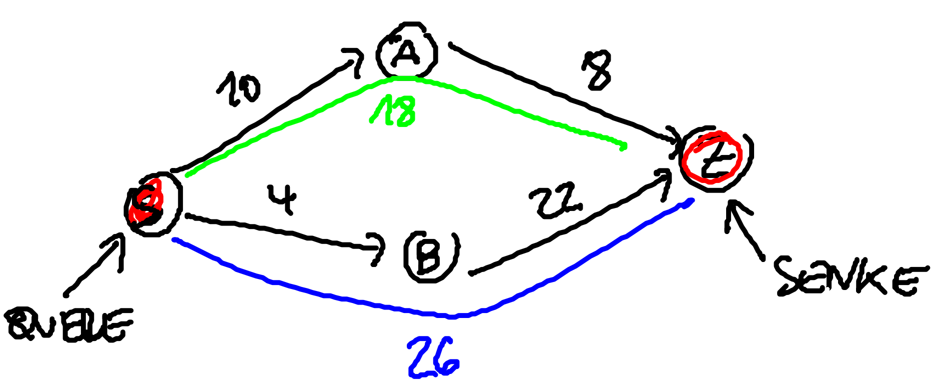
n_0? c?

$= 100$ ✓ $\quad 2$ ✓

for $O(n)$

$O(n^2)$

$$O(n) \cdot O(n^2) = O(n^3)$$



9. JUNI 2016 ALGO DAT

a) SINGLE-SOURCE SHORTEST PATH

b) FLOW IN GRAPHS

SINGLE-SOURCE SHORTEST PATH — VOLL VERNÜPFTER GRAPH $O(|V|^2 + \dots)$

DIJKSTRA $O(|E| + |V| \log |V|) \rightarrow O(\cancel{|E|} + |V| \log |V|$

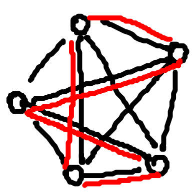
BELLMAN-FORD $O(|V| \cdot |E|) \rightarrow O(|V| \cdot |V|) = O(|V|^2)$

$\boxed{|V| = |E|}$ $\rightarrow O(|V|^2 \cdot |V|) = O(|V|^3)$

WIE GUT SIND DIE EIGENTLICH?

K_n = VOLL VERNÜPFTE GRAPH MIT n KNOTEN

K_5



$$\#\text{PFADE} = \sum_{k=1}^{n} \underbrace{\#\text{PFADE DURCH } k \text{ KNOTEN}}_{P_k}$$

$$\sum \begin{cases} P_1 = n \\ P_2 = n(n-1) \\ P_3 = n(n-1)(n-2) \\ \vdots \\ P_n = n! \end{cases}$$

ZIEMLICH GUT!

FLOYD-WARSHALL $O(|V|^3)$

$k=0$	1	2	3	4	$\dots$
1	0	∞	∞		
2		$\ddots$		$w(2,4)$	
3	$w(3,1)$		$\ddots$	∞	
4		∞		0	
$\vdots$					

$\leftarrow$ FÜR $Z_0 \triangleq$ KEINEN ZWISCHENKNOTEN

START

ZIEL

$SP(i, j, k)$

MENGE Z DER KNOTEN DIE WIR ALS „ZWISCHENKNOTEN" ZULASSEN

$$Z_k = \{v_1, \dots, v_k\}$$

$$SP(i,j,0) = w(i,j)$$

$$\boxed{SP(i,j,k+1) = \min \begin{cases} SP(i,j,k) \\ SP(i,k+1,k) + SP(k+1,j,k) \end{cases}}$$

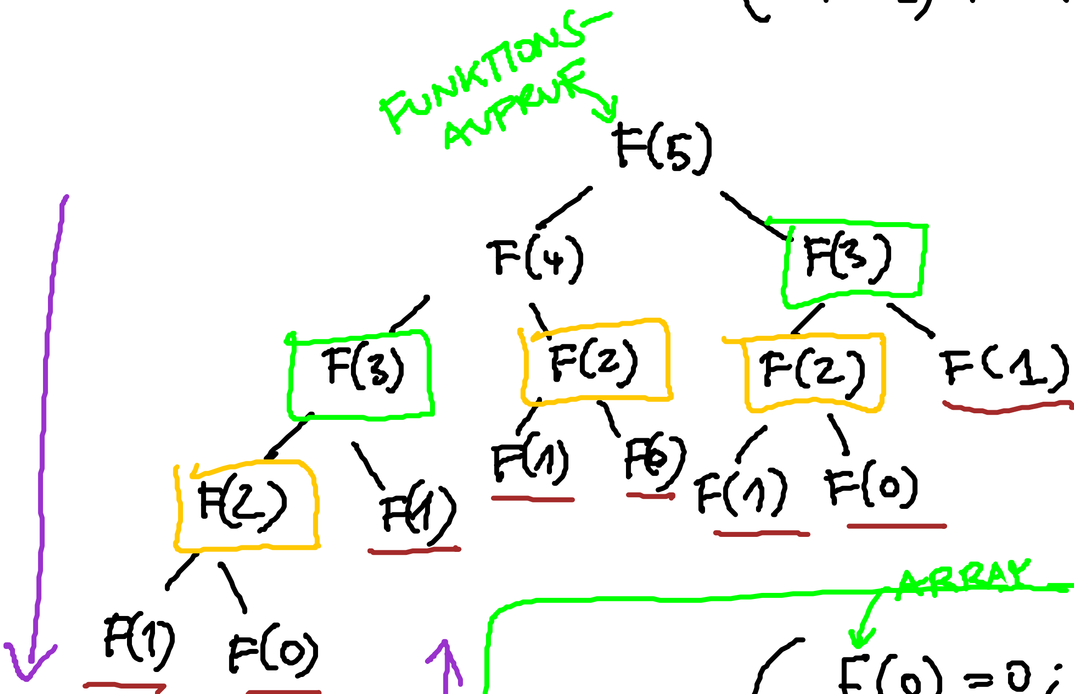
K	1	2	3	4	$\dots$
1					
2				$SP(2,4,K)$	
3					
4					
$\vdots$					

$\Rightarrow$

$K+1$	1	2	3	4	$\dots$
1					
2					
3					
$\vdots$					

AUSFLUG

$$F(n) = \begin{cases} 0 & n=0 \\ 1 & n=1 \\ F(n-1) + F(n-2) & \text{SONST} \end{cases}$$



REKURSIVER BAUM

$O(c^n)$

$O(n)$

ARRAY

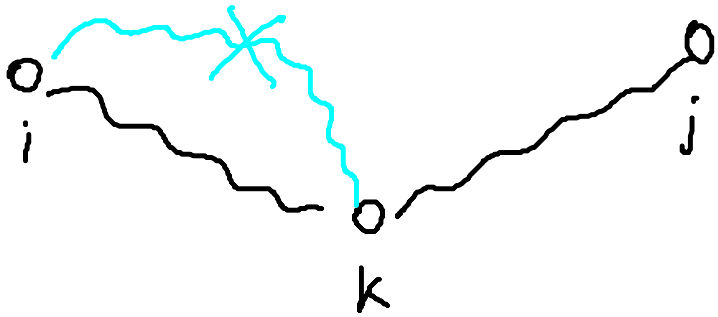
```
F(0) = 0;                        O(1)
F(1) = 1;                        O(1)
For (i = 2; i ≤ n; i++)          O(n)
    F(i) = F(i-1) + F(i-2)
return F(n)
```

DYNAMISCHE PROGRAMMIERUNG

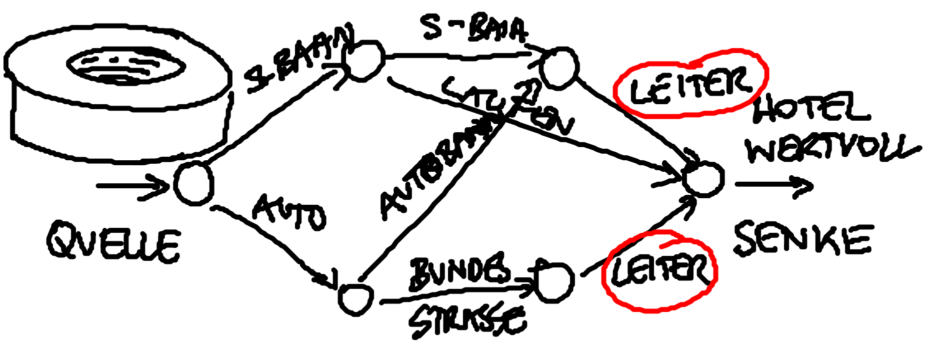
✓ • WIEDERKEHRENDE UNTERPROBLEME

✓ • LÖSUNG DES UNTERPROBLEMS MUSS TEIL DER LÖSUNG DES GESAMTPROBLEMS

~ KÜRZESTE PFAD $i \to j$

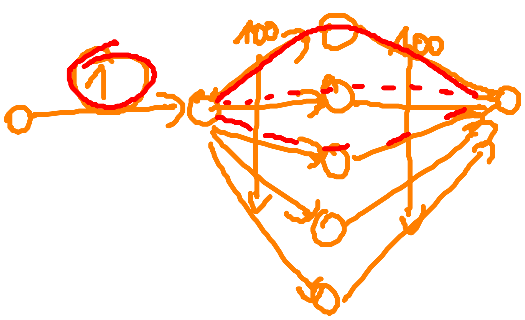


b) FLÜSSE IN GRAPHEN



WAS IST DER MAXIMALE FLUSS IN DEM GRAPHEN?

FRAGE: SIND PFADE EINDEUTIG?



$|F| = 1$

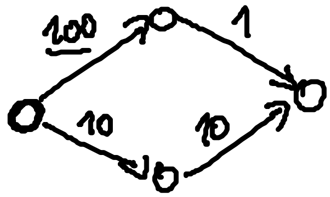
WIE IMPLEMENTIEREN WIR "FINDPATH" IM FORD-FULK.

- DFS $\quad O(|E|\, f)$

EDMONDS-KARP

- BFS $\quad O(|V|\, |E|^2)$

HAUSAUFGABE

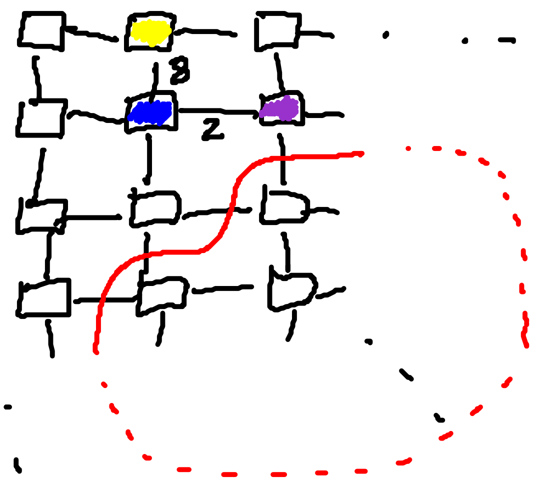


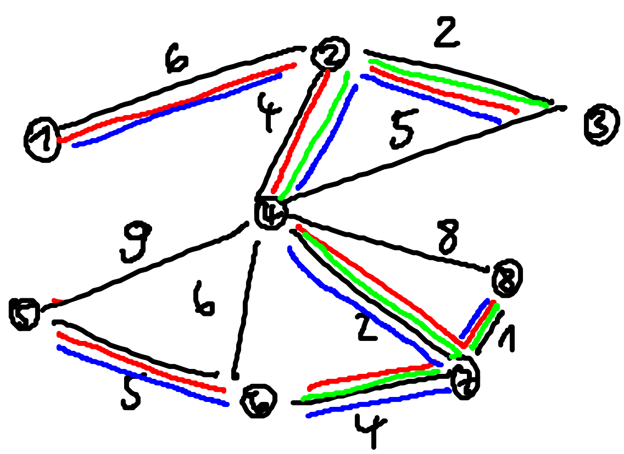
16. JUNI 2016 — ALGO DAT

(MINIMALE) SPANBÄUME

Das sollte natürlich "Spannbäume" mit zwei n sein!

BILD ALS GRAPH





MINIMALER SPANNBAUM

VERSUCH EINES ALGO.

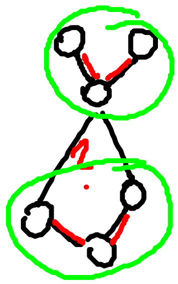
KRUSKAL
{7, 8, 4, 6,
2, 3, 5, 1}

DIJKSTRA MACHT DAS!

IDEEN:

- MIT KÜRZESTER KANTE ANFANGEN (SORTIEREN)
- SPEZIALFALL : KNOTEN MIT 1 KANTE

- BESUCHTE KNOTEN MARKIEREN (?)



$\boxed{\text{THEOREM : } w(\text{MIN-CUT}) = \text{MAX-FLOW}}$