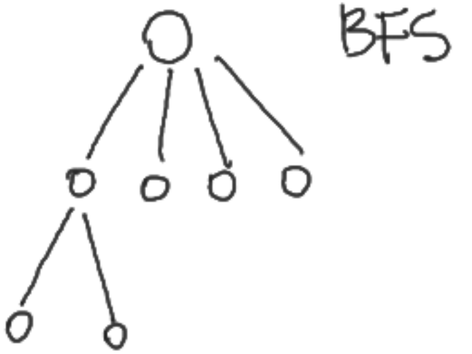
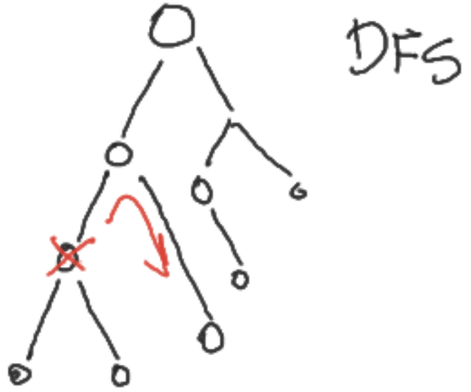


Greedy



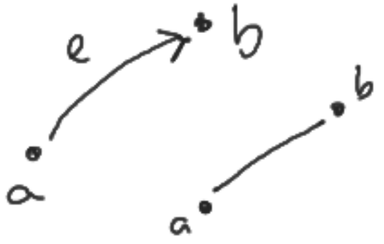
Backtracking

1) Shortest path

2) Minimum Spanning Tree

$G = (V, E)$ V = conjunto de vértices (o nodos)

E = conjunto de aristas $\subseteq V \times V$



$e = (a,b)$

$(a,b), (b,a)$

$n = |V|$ $m = |E|$

Formas de Representar Grafos

1) Matriz de adyacencia

$$A_G = \begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ \cdots & & & & & \\ & & & & & 0 \end{bmatrix}_{n \times n} \quad O(n^2)$$

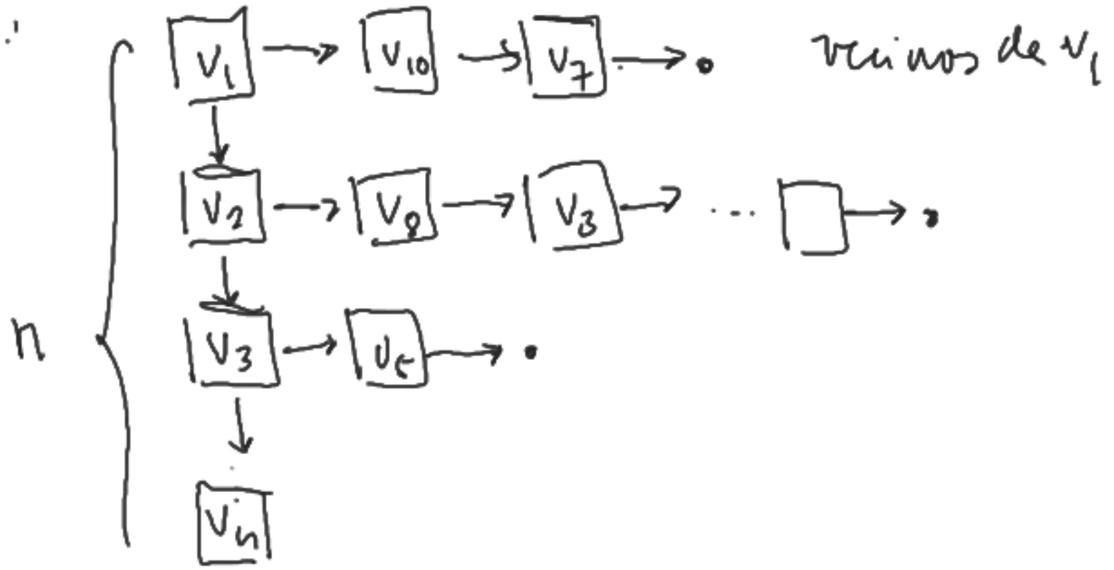
G no dirigido A es simétrica

G es dirigido A no es simétrica

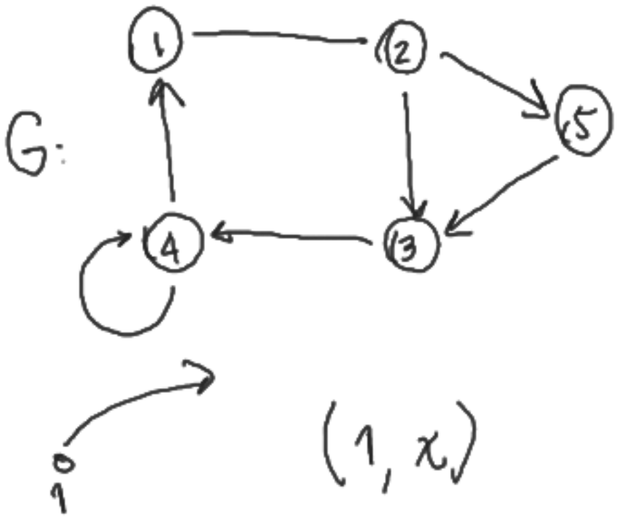
2) Matriz de Incidencia

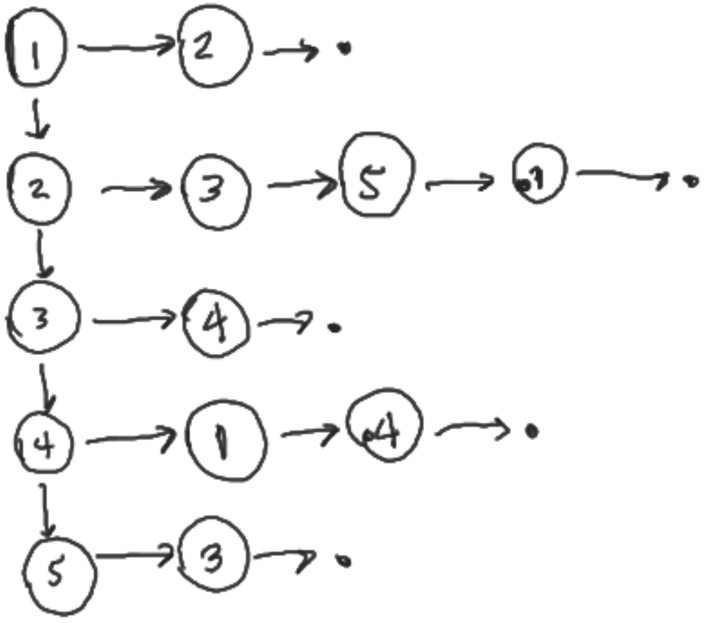
$$I_G = \begin{bmatrix} & & & e_j & \\ v_k & \pm & \pm & 1 & 0 \end{bmatrix}_{m \times n} \quad O(mn)$$

3) Listas de listas:



Ejemplo:



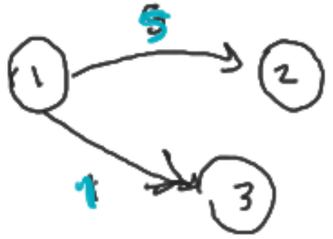


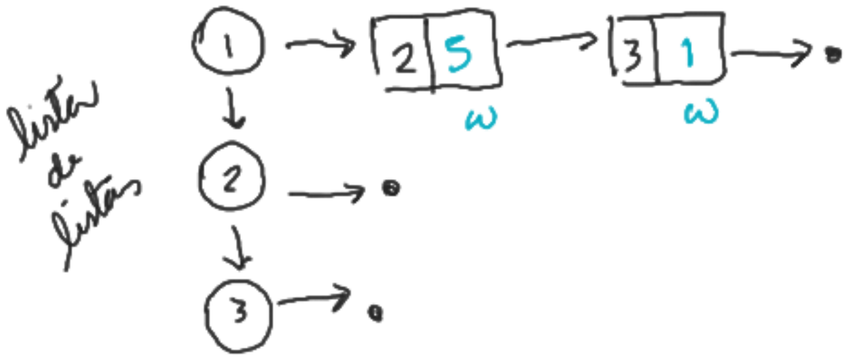
Grafo ponderado o grafo con pesos
(Weighted graphs)

$$G = (V, E, w)$$

$$w : E \longrightarrow \mathbb{R}$$

distancia, tiempo, flujo, costo, ...

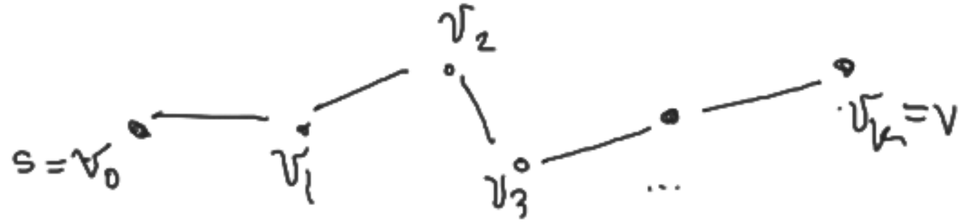




1) Shortest Path:

Dado $G=(V,E,d)$ y dado $s \in V$ (source).

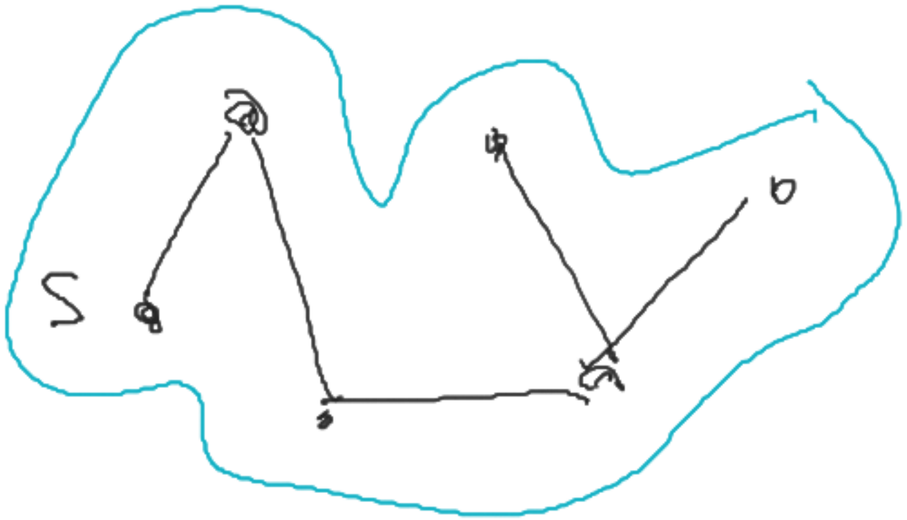
queremos hallar la ruta de menor distancia de s a $v \in V$.

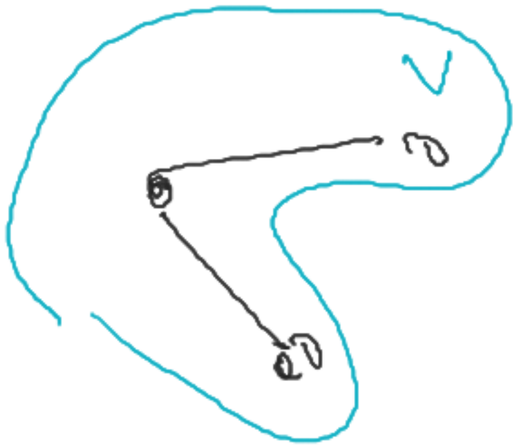


$$d(r) = \sum_{i=1}^{k} d(v_{i-1}, v_i)$$

camino $r = \{(v_0,v_1),(v_1,v_2),\dots,(v_{k-1},v_k)\} \subseteq E$ con

$v_0 = s$ y $v_k = v$





G es conexo

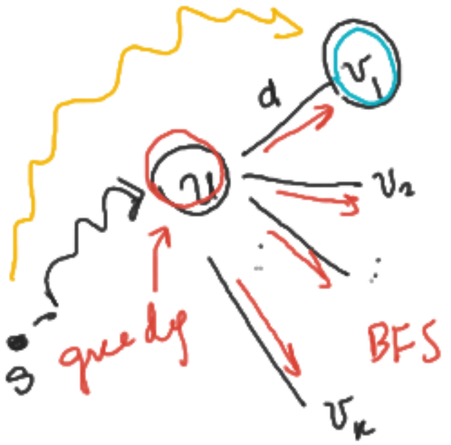
Dijkstra: (1959). $O(n^2) = O(V^2)$

dist = | ∞ | ∞ | ∞ | .. | ∞ |
v_1 v_2 v_3 ... v_n

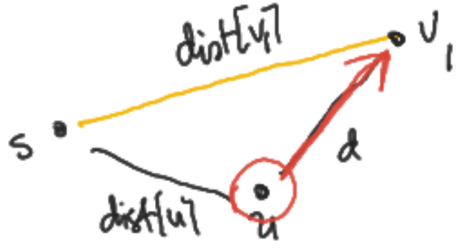
prev = | - | - | - | ... | - |
v_1 v_2 v_3 v_n

$d(s, v_i)$

heap
Fibonacci heap
Bucket heap

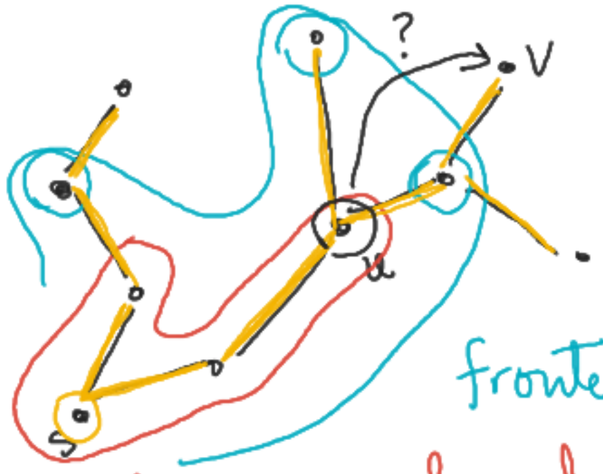


alt = dist[u] + d(u, v_i)



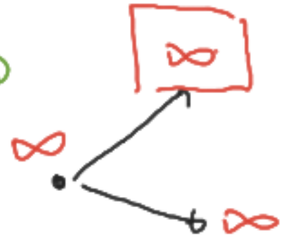
dist[v] ← alt

prev[v_i] ← u



Q

no explorados

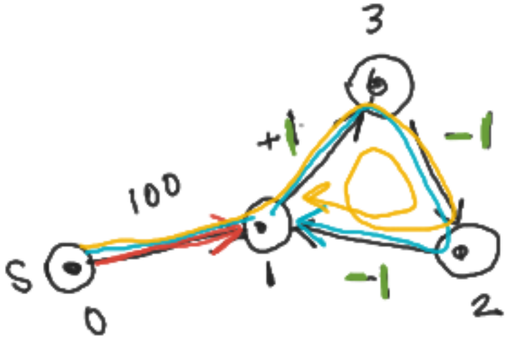


frontera

nodos ya explorados

no informados

si informados



$\sum d = +1-1-1 = -1$

ciclo con peso negativo.

$d = 100$

$d = 100 + (1-1-1) = 99$

$d = 98$

$d = 97$ ...

0
-1
-2
⋮
$-\infty$

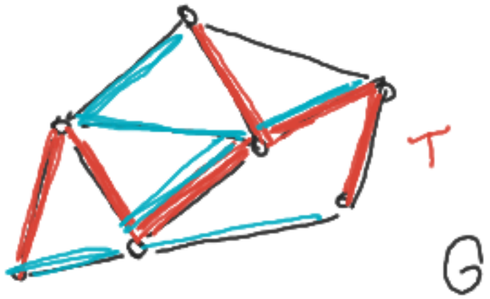
2) Minimum Spanning Tree:

$G = (V, E, d)$ no-dirigido y conexo.

Queremos hallar el árbol $T \subseteq G$ con $\sum_{e \in T} d(e)$ es mínima.

T árbol

- conexo
- no cicla



T

G

$T = (V, E_T)$

$E_T \subseteq E$.

Prim: (Jarník '58, Prim '57, Dijkstra 59)

Kruskal ('56)

Borůvka ('26)