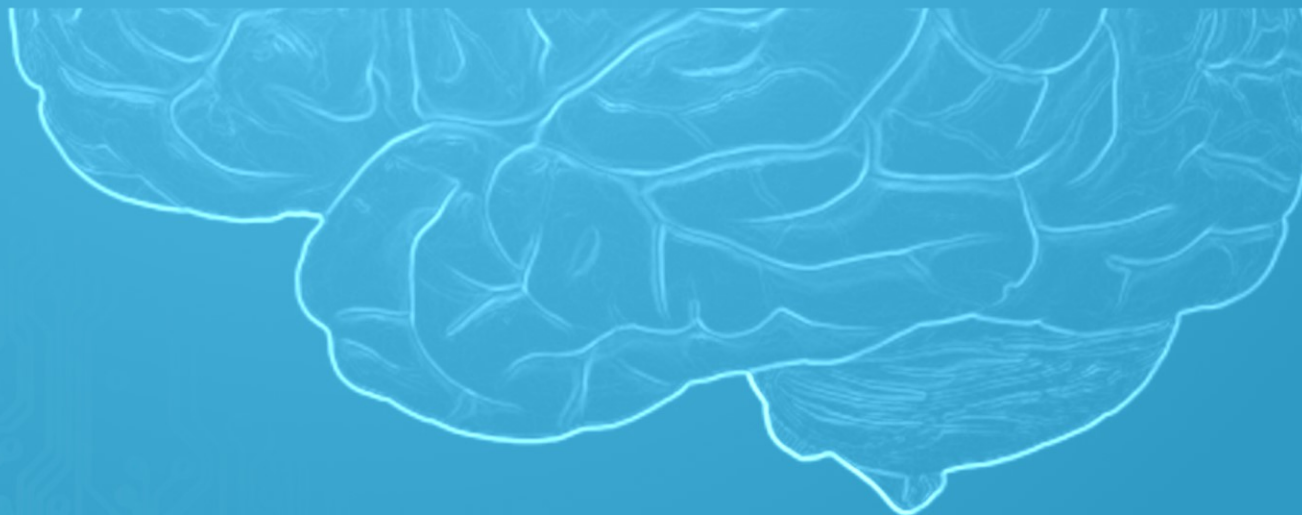




Structuri de date și algoritmi

Grafuri – Acoperire și Capacitate

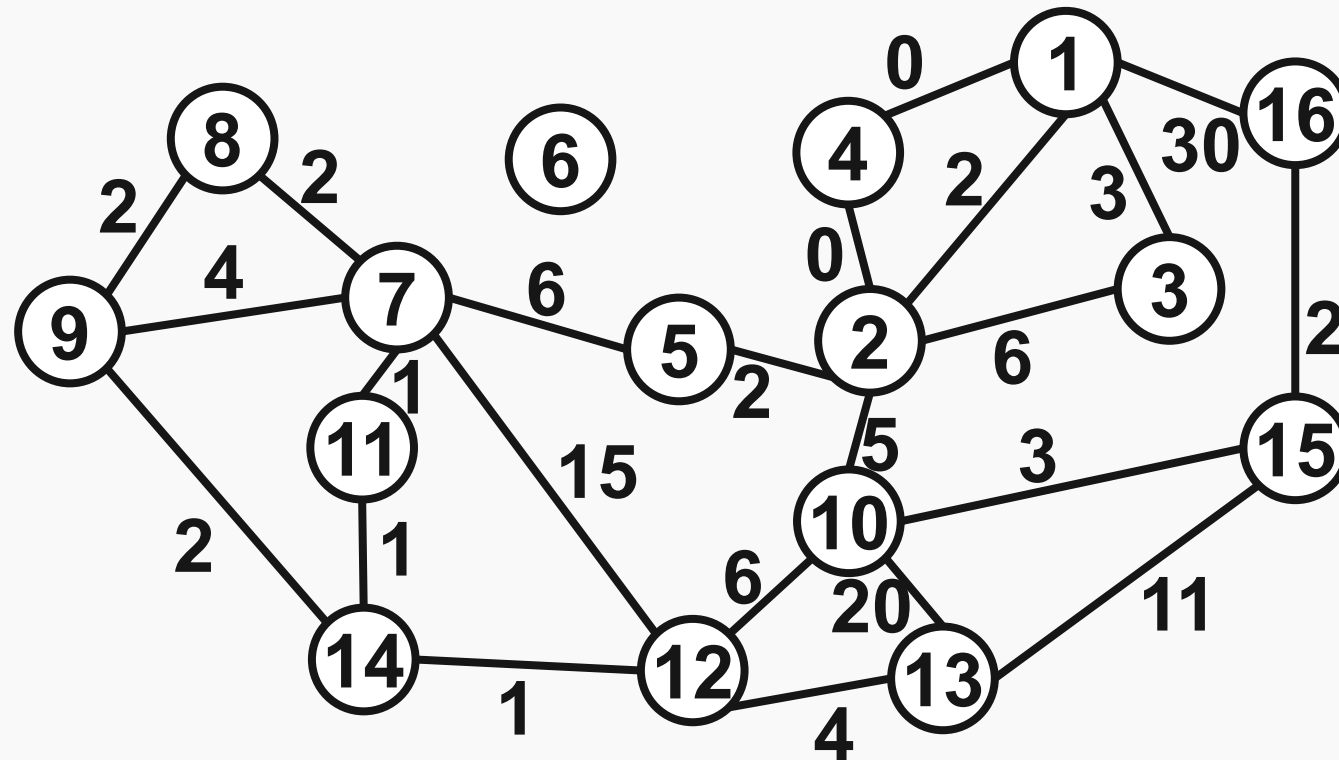
Lect. Dr. Ing. Cristian Chilipirea – cristian.chilipirea@mta.ro





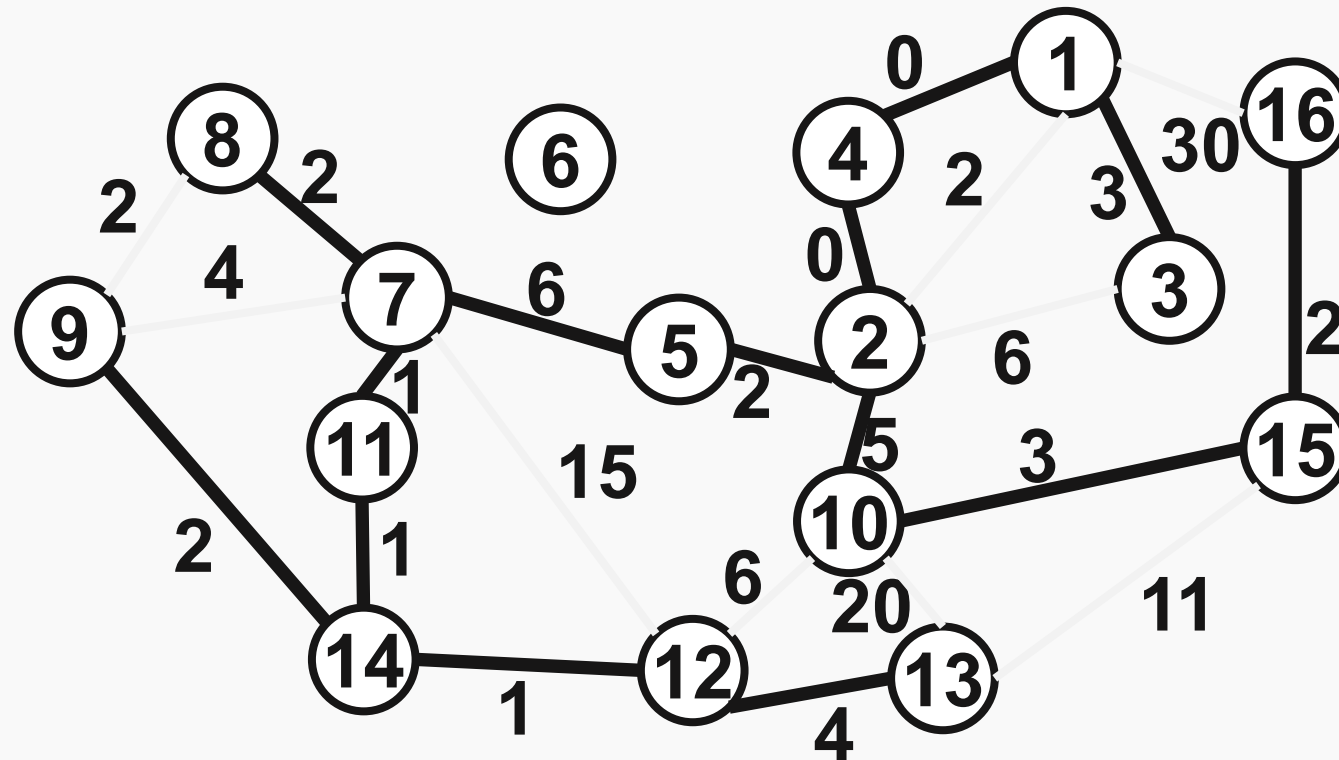


Arbori minimi de acoperire





Arbori minimi de acoperire



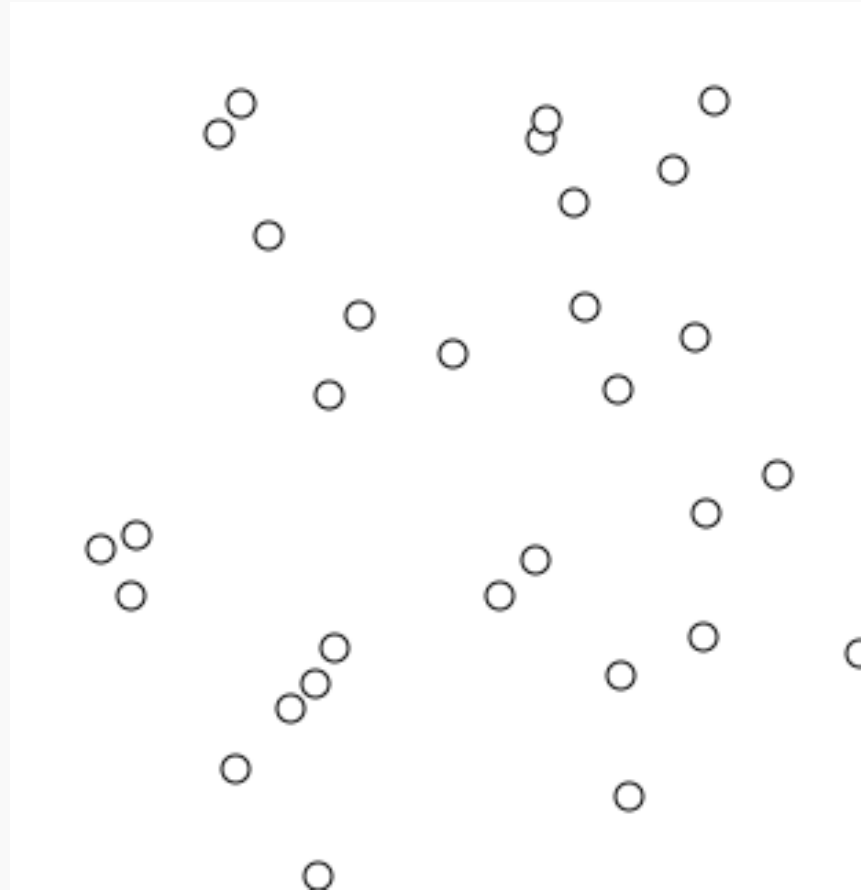


Algoritmul lui Kruskal

```
tree Kruskal(G) {
    sort(G.E); // sort by weight
    A = {};
    for each (node in G.V)
        Make_set(node);
    for each ((u, v) in G.E) {
        if (Find_set(u) != Find_set(v)) {
            A = A U {(u, v)};
            Union(Find_set(u), Find_set(v));
        }
    }
    return A;
}
```

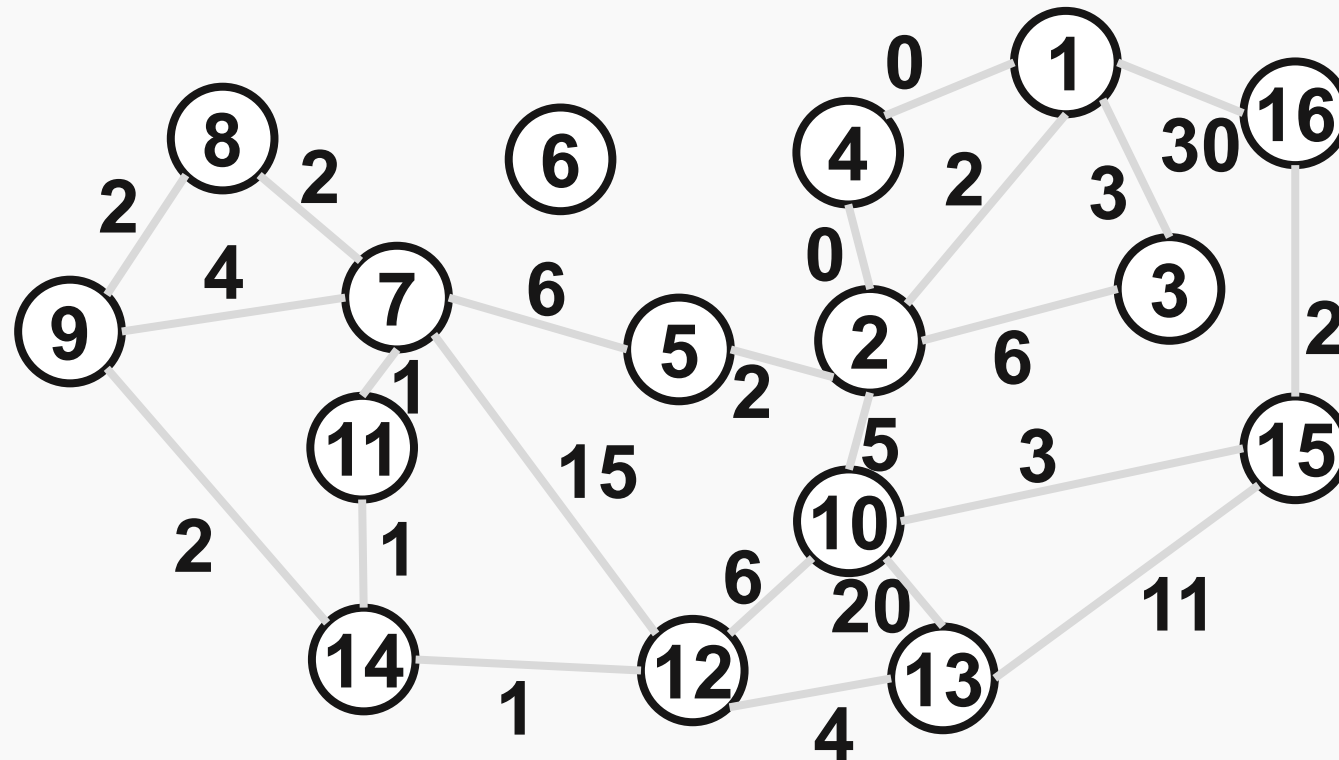


Algoritmul lui Kruskal



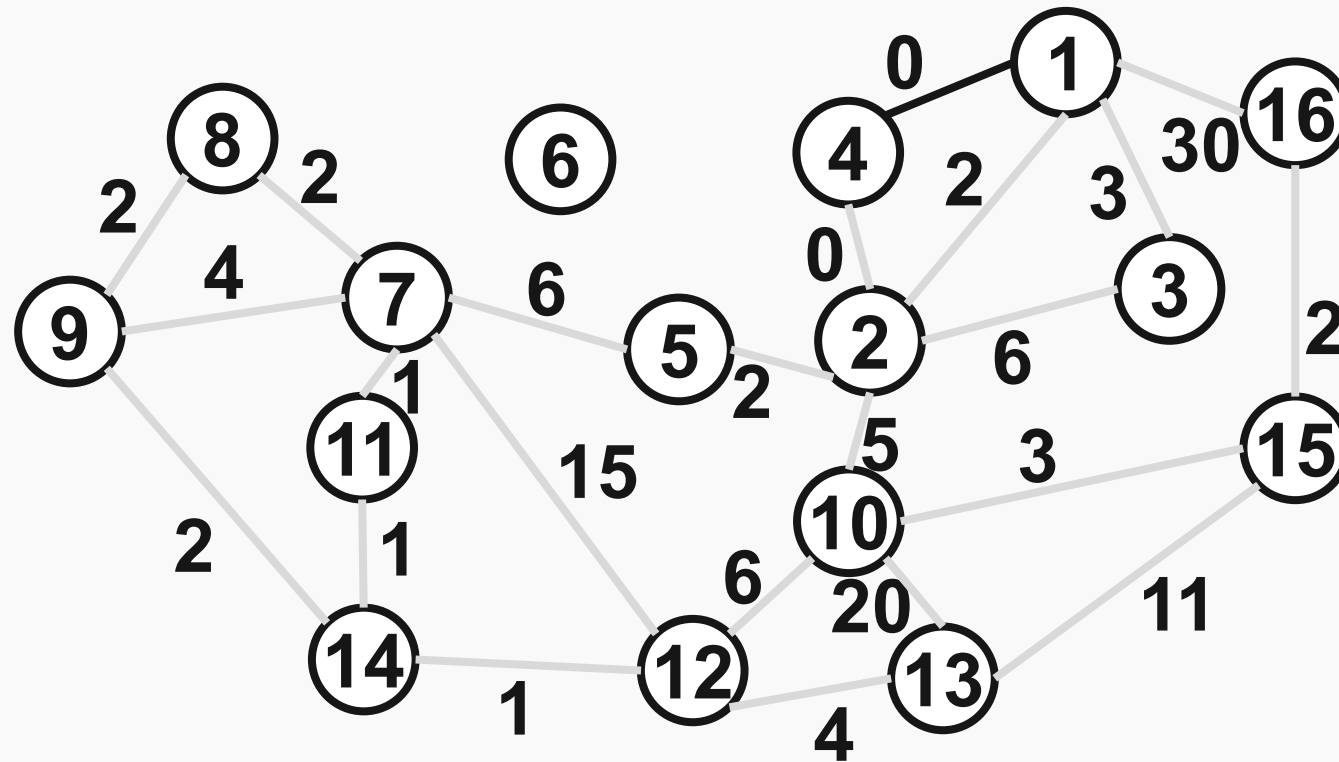


Algoritmul lui Kruskal



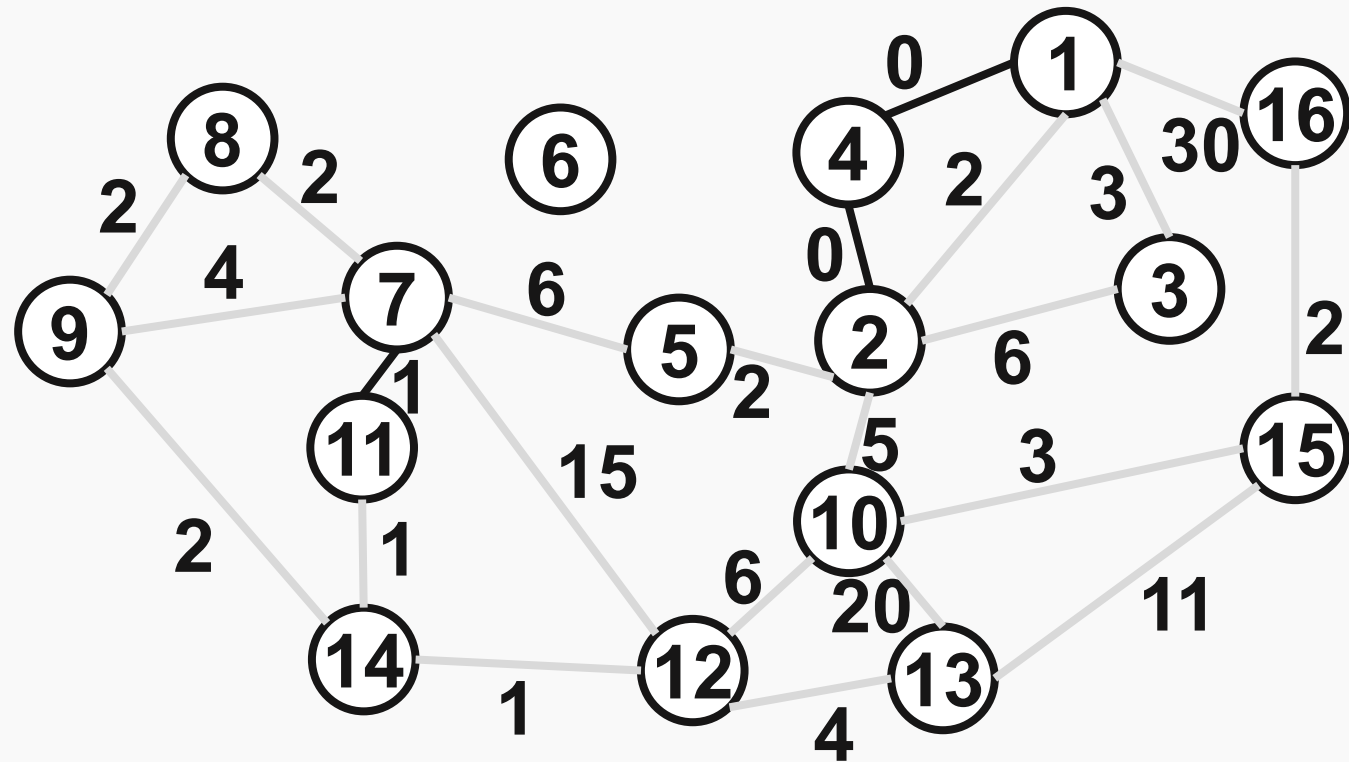


Algoritmul lui Kruskal



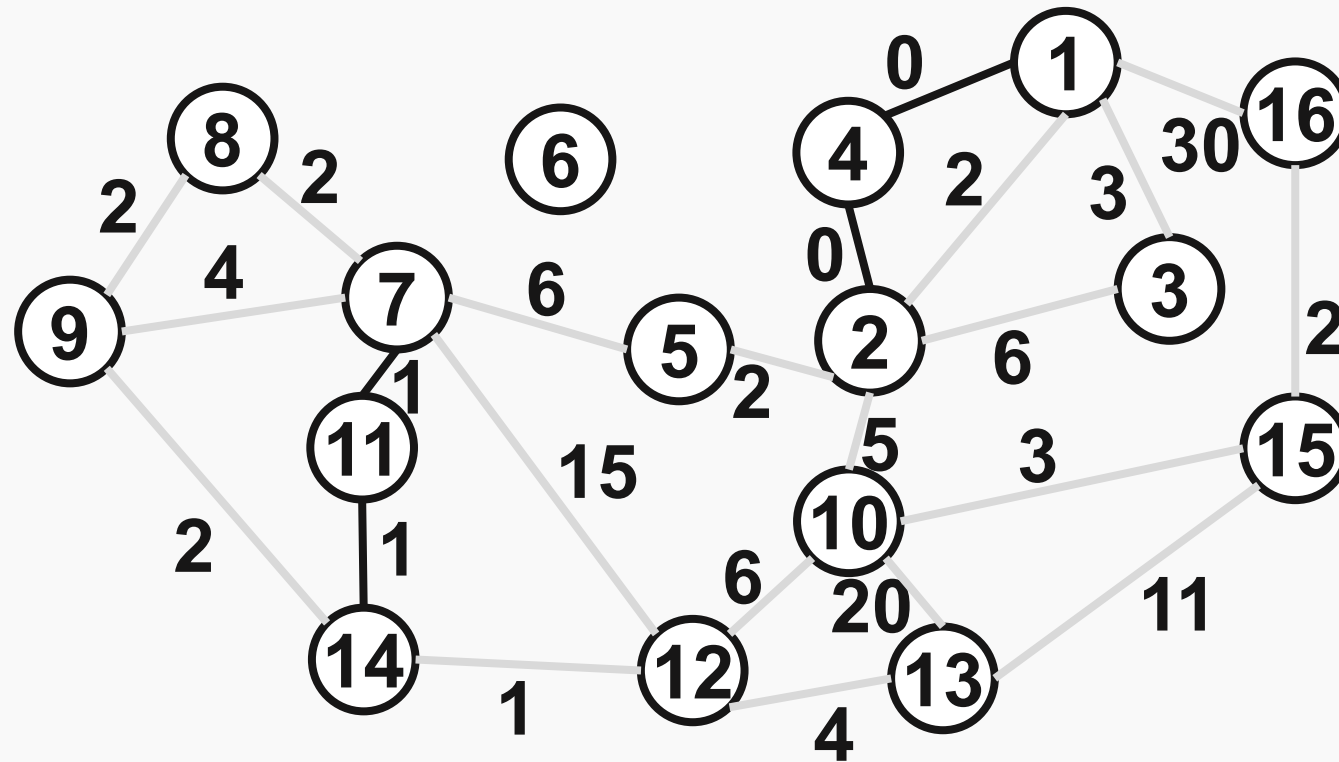


Algoritmul lui Kruskal



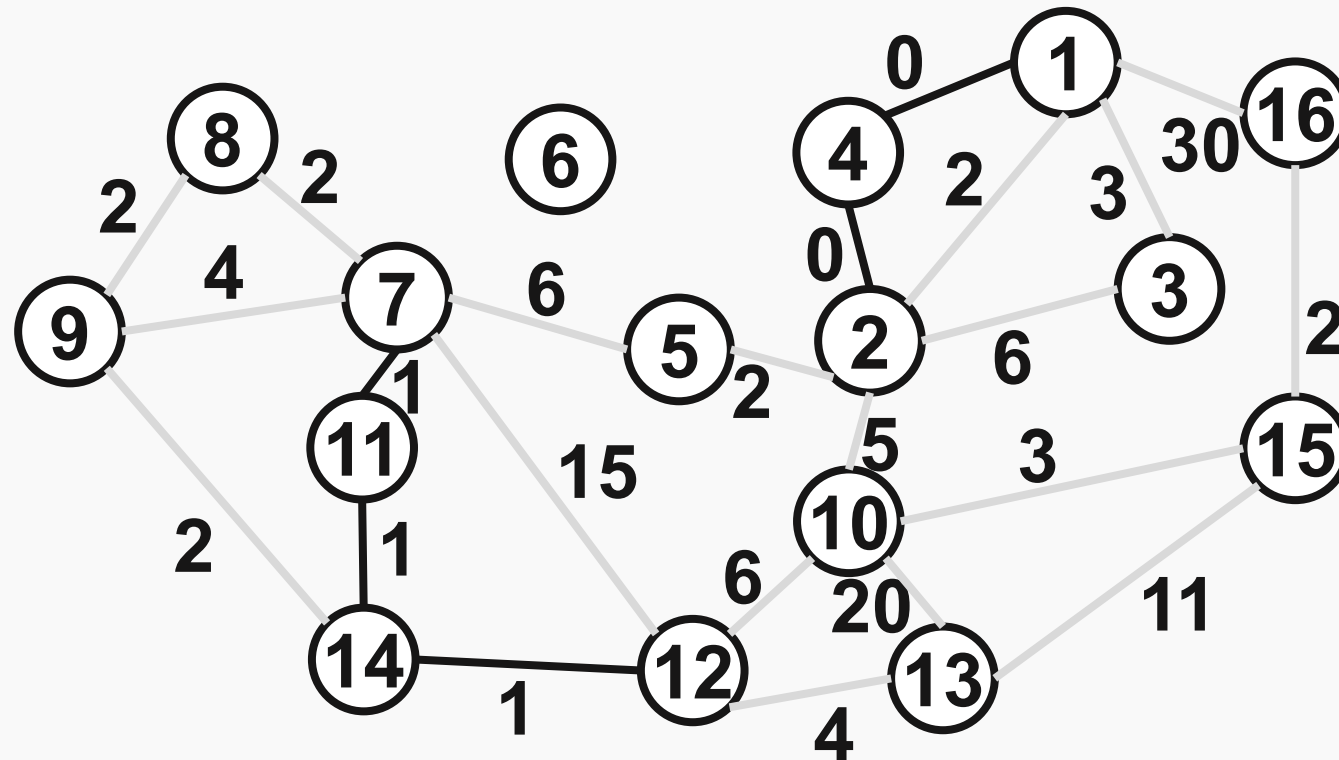


Algoritmul lui Kruskal



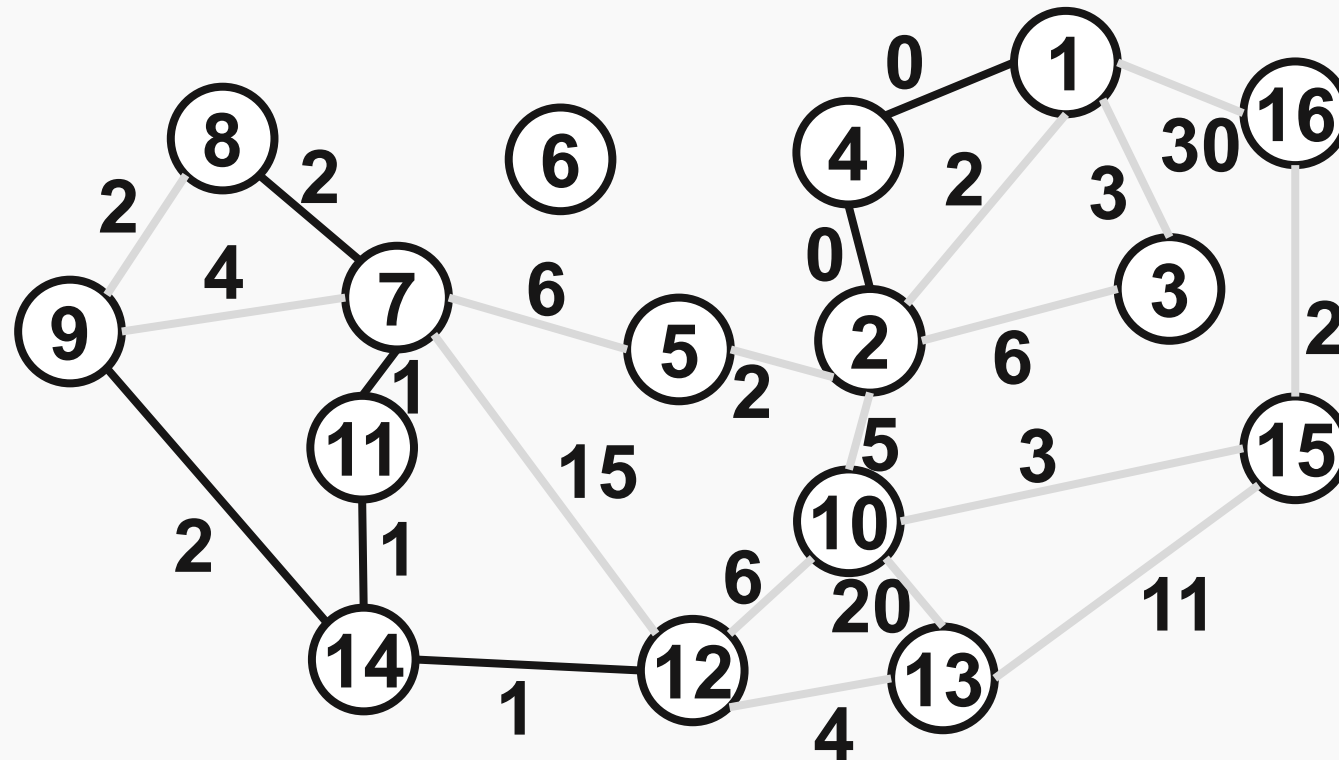


Algoritmul lui Kruskal



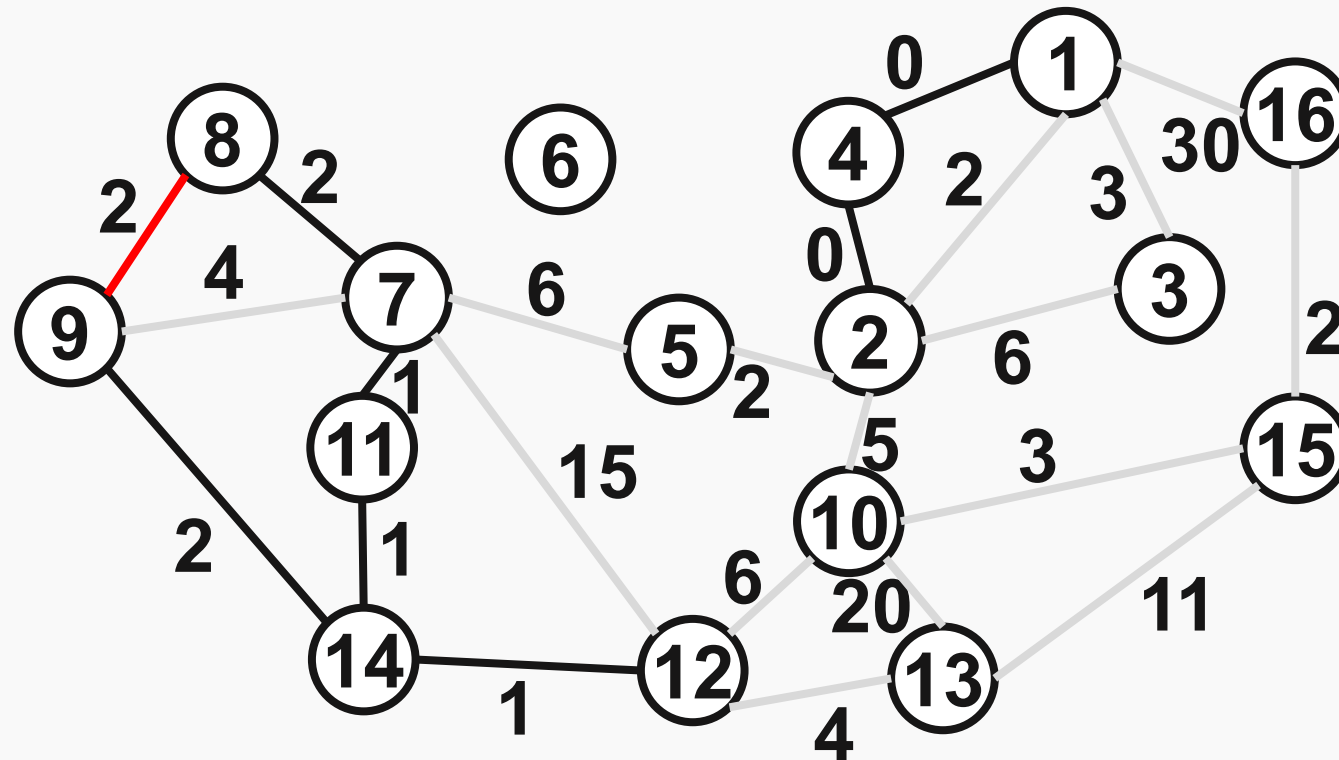


Algoritmul lui Kruskal



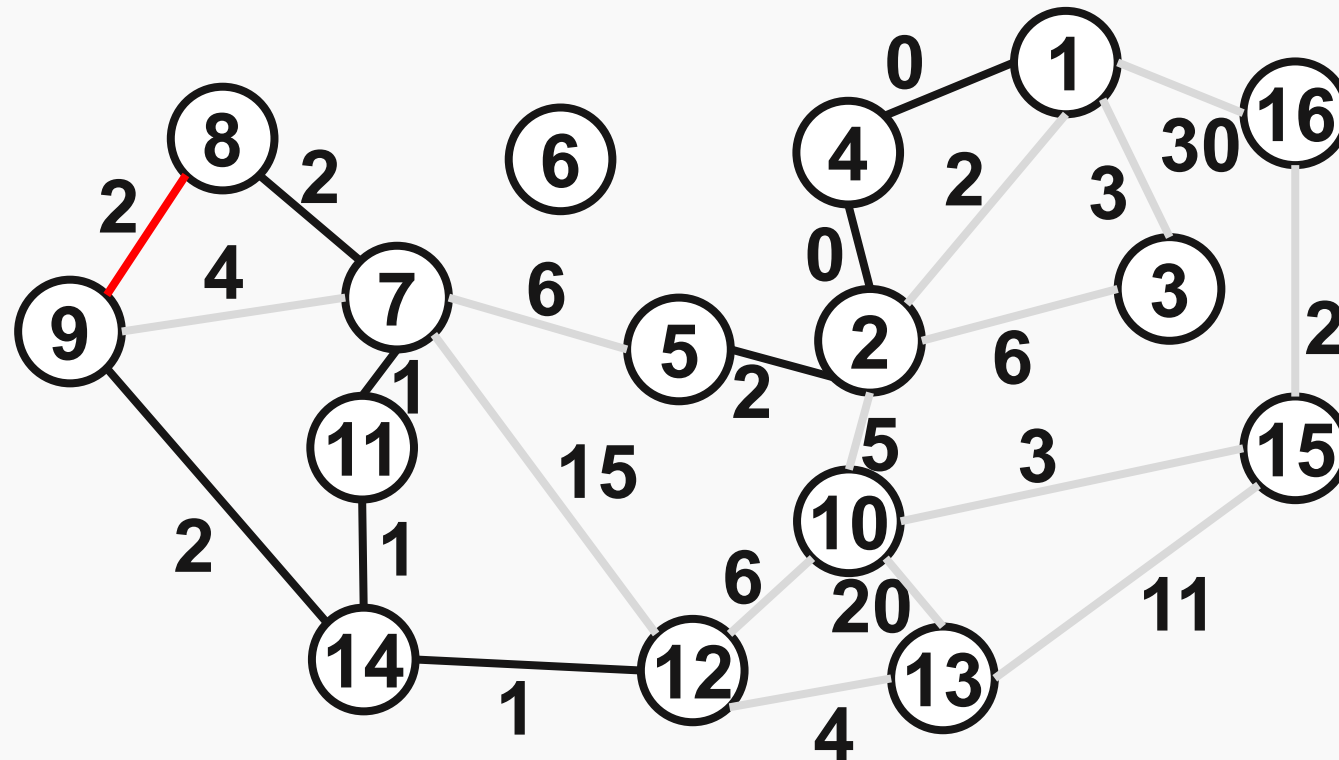


Algoritmul lui Kruskal



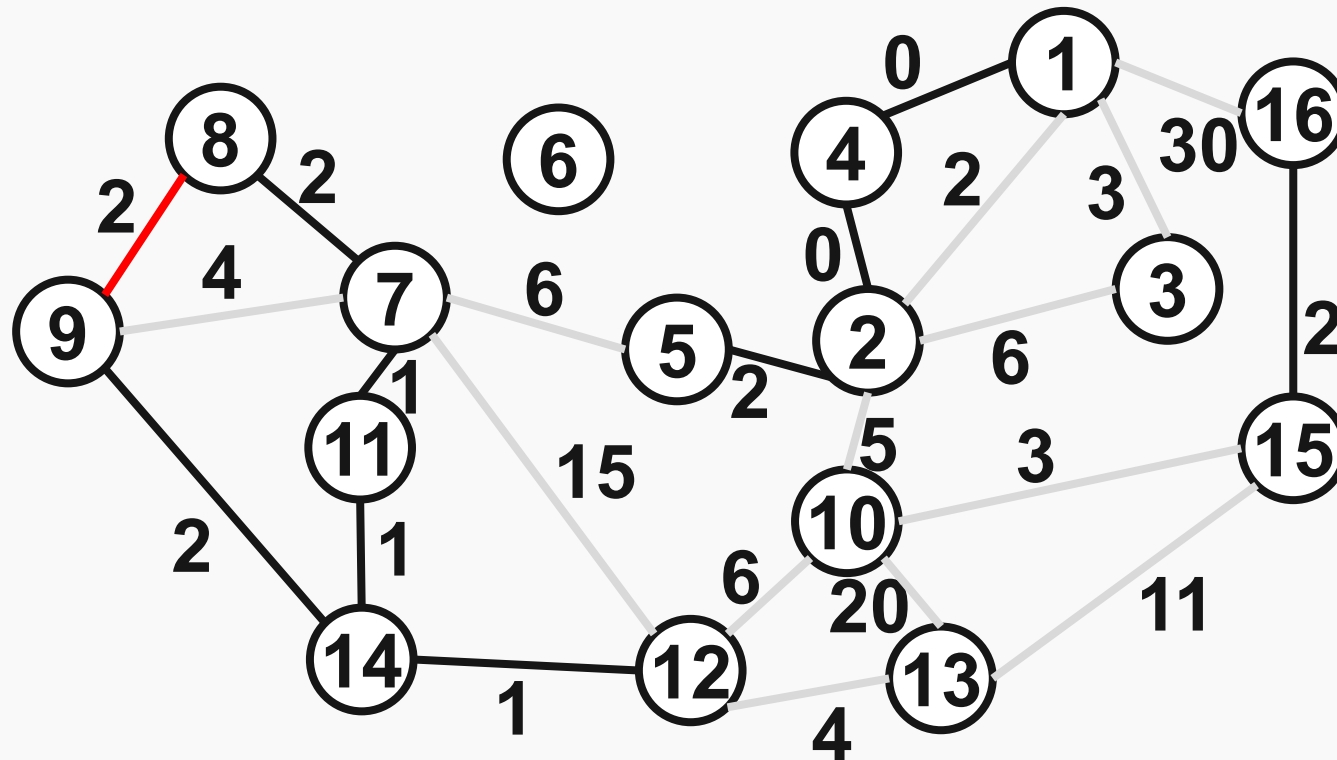


Algoritmul lui Kruskal



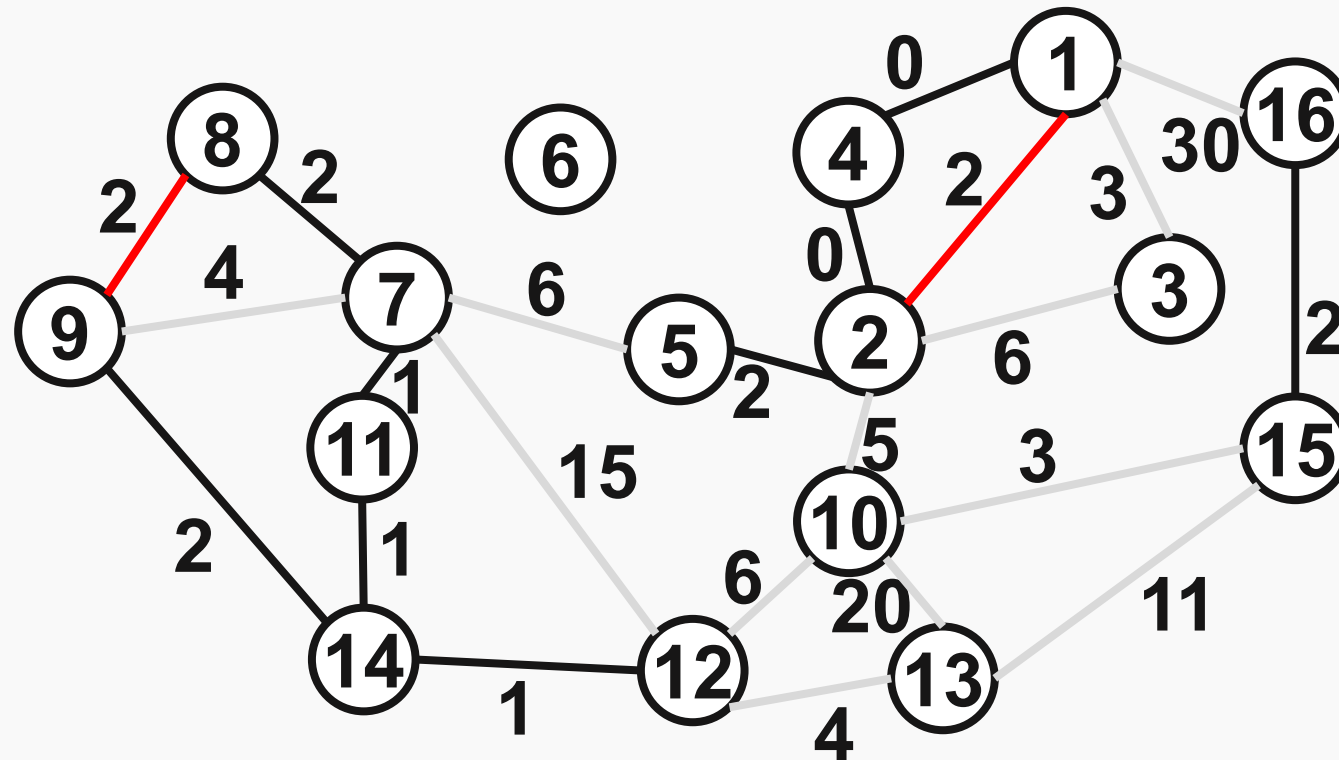


Algoritmul lui Kruskal



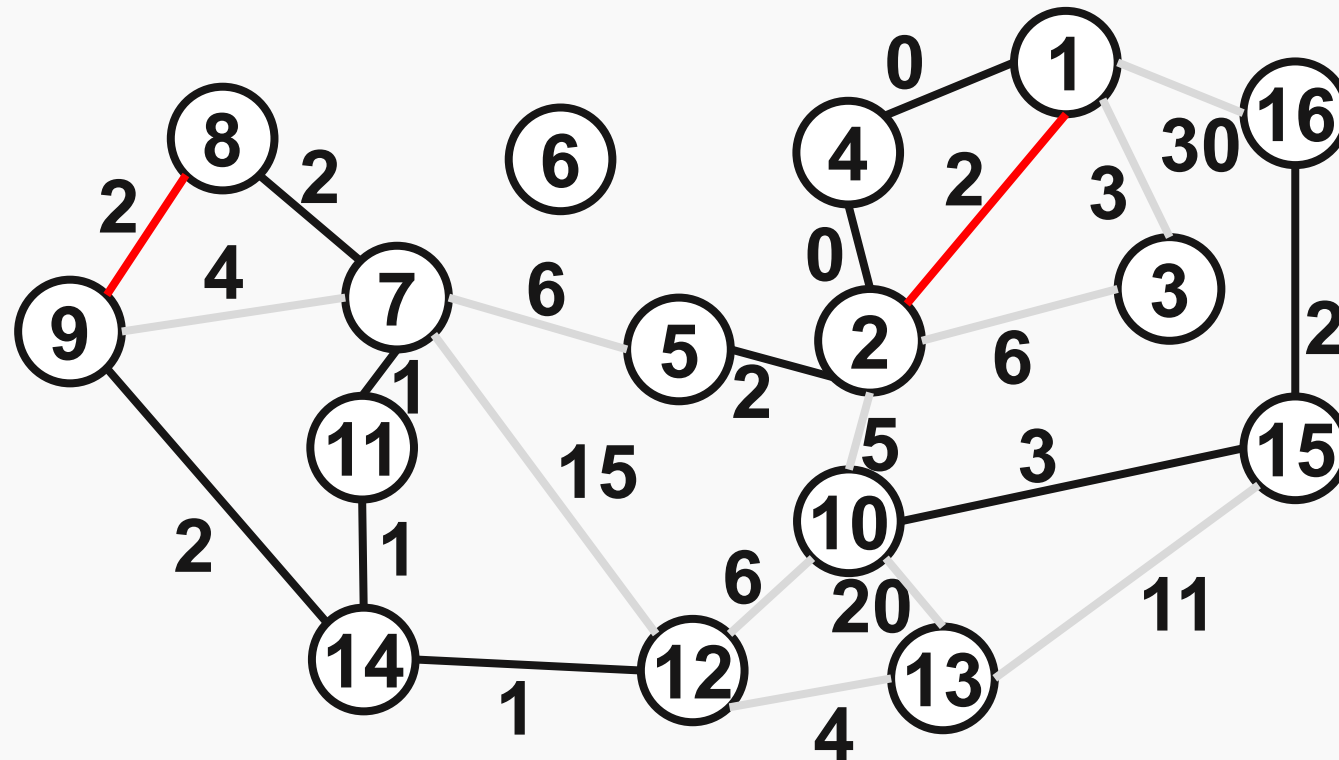


Algoritmul lui Kruskal



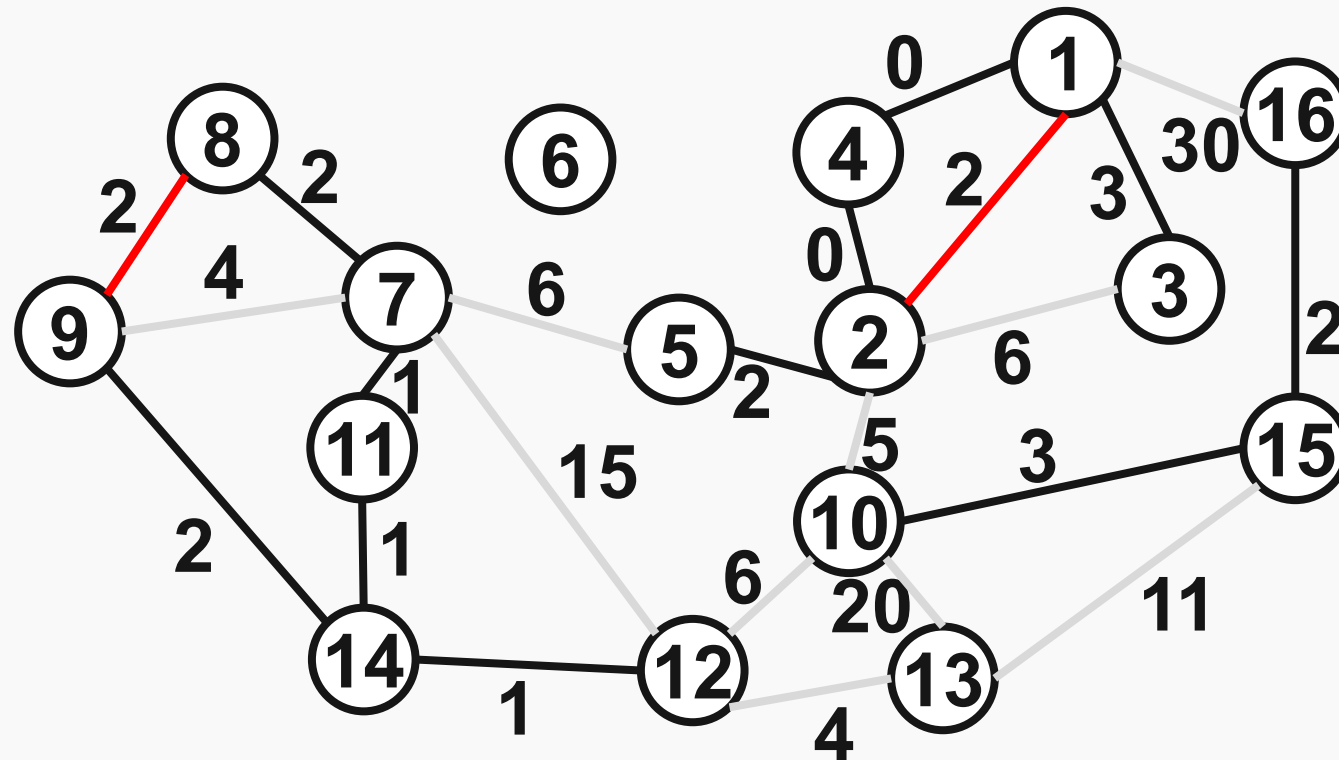


Algoritmul lui Kruskal



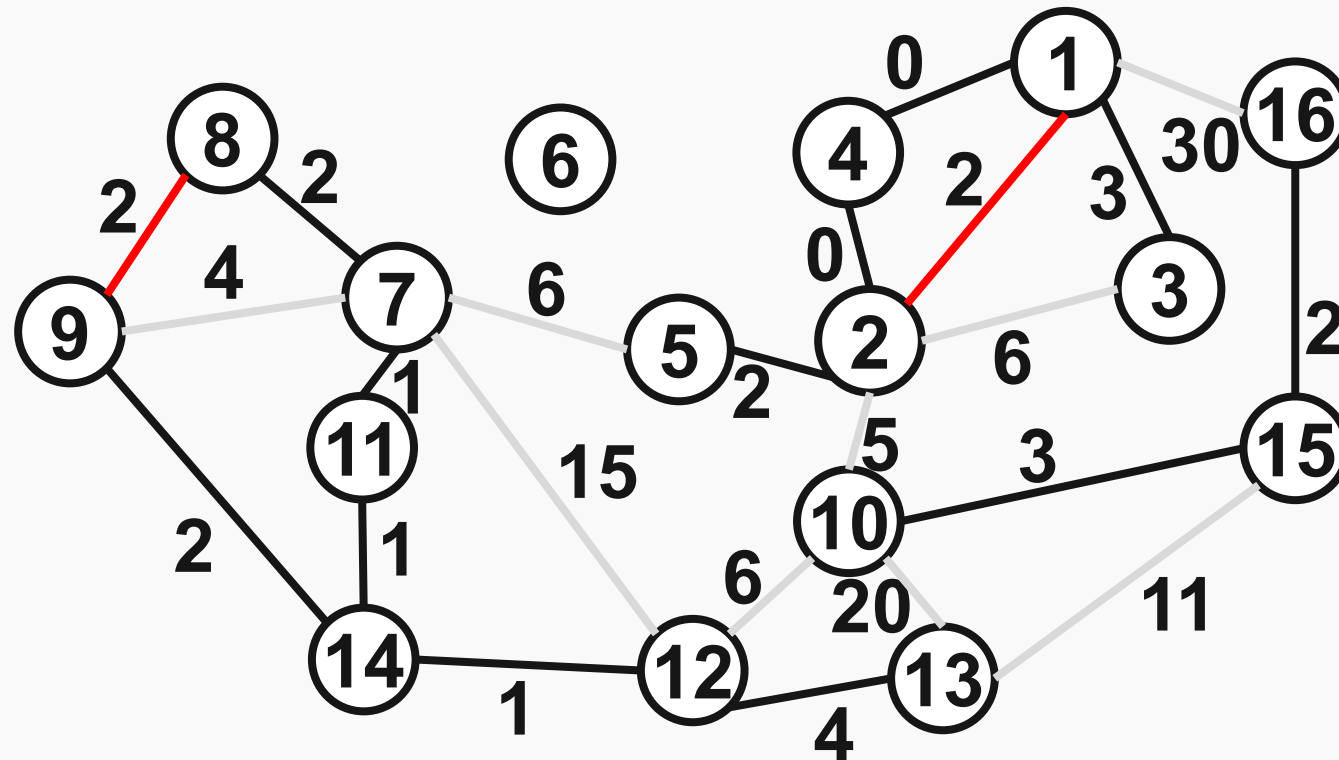


Algoritmul lui Kruskal



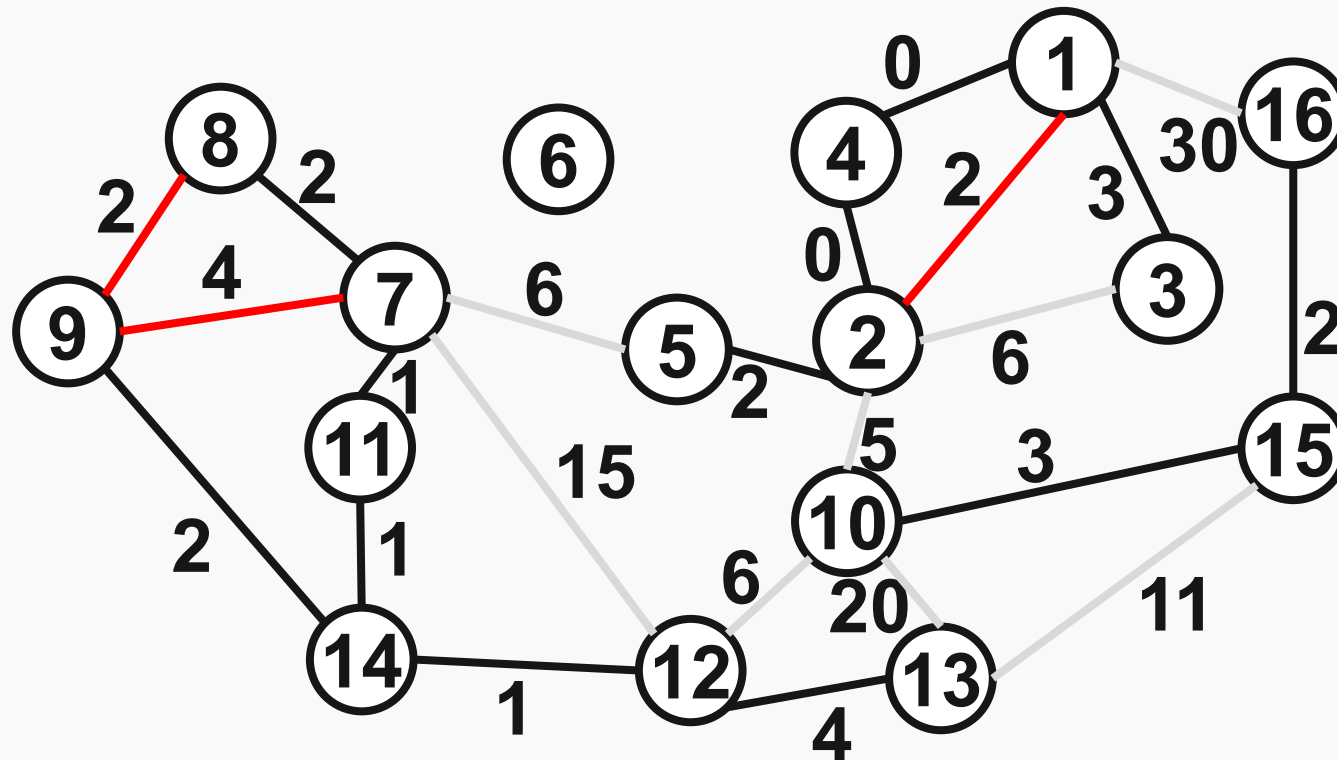


Algoritmul lui Kruskal



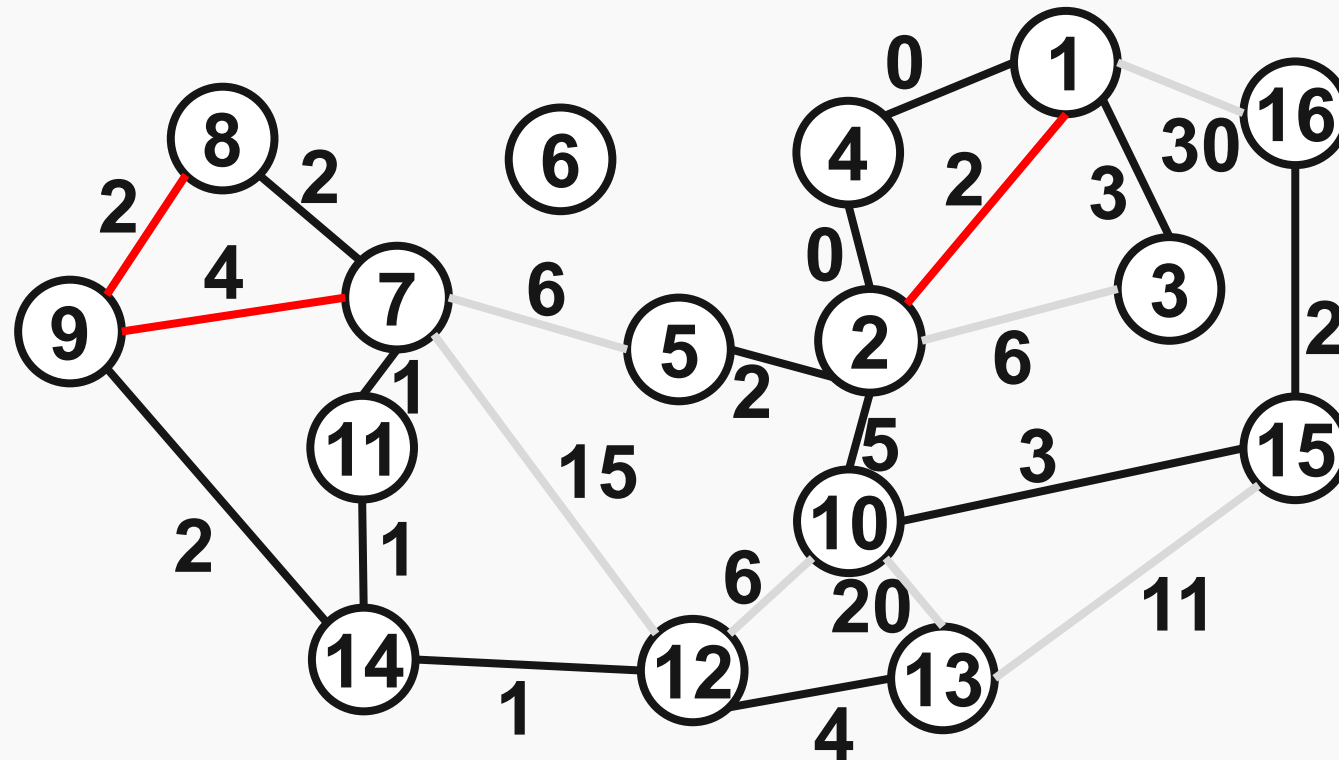


Algoritmul lui Kruskal



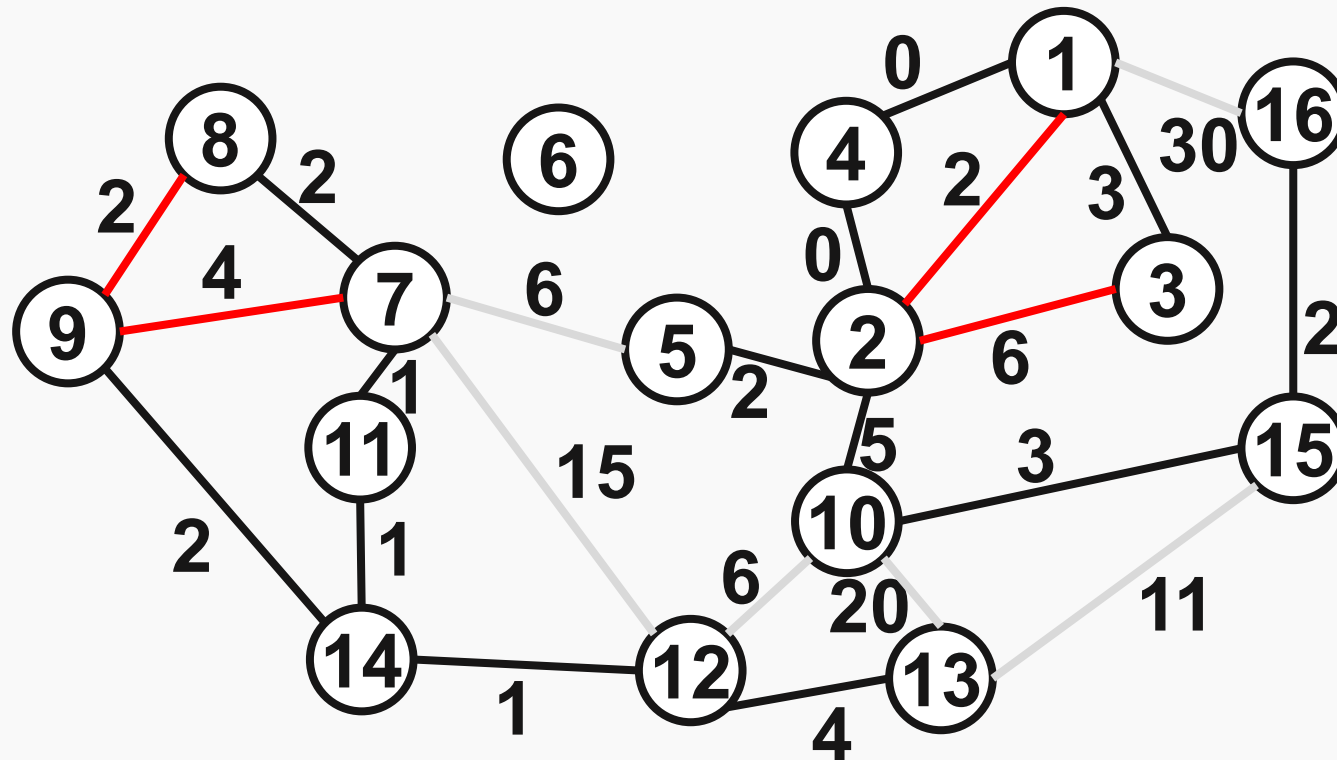


Algoritmul lui Kruskal



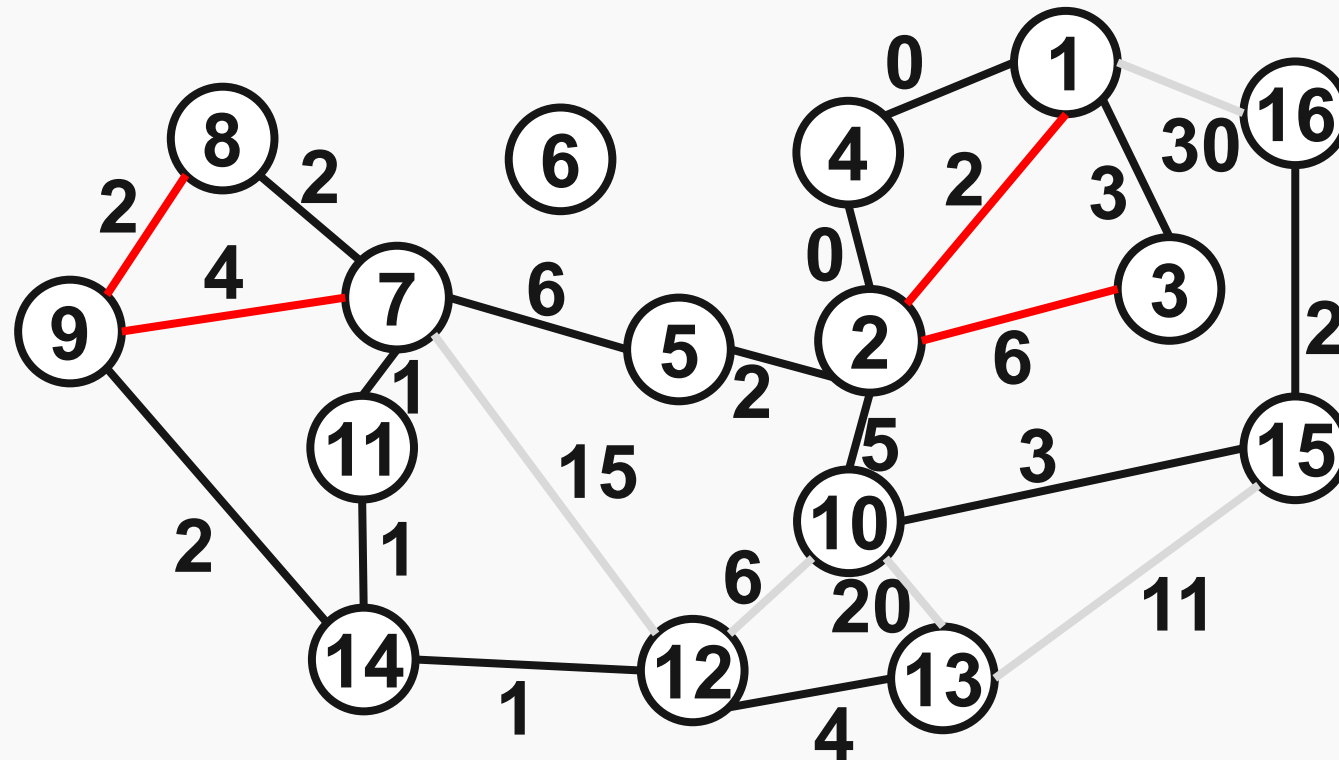


Algoritmul lui Kruskal



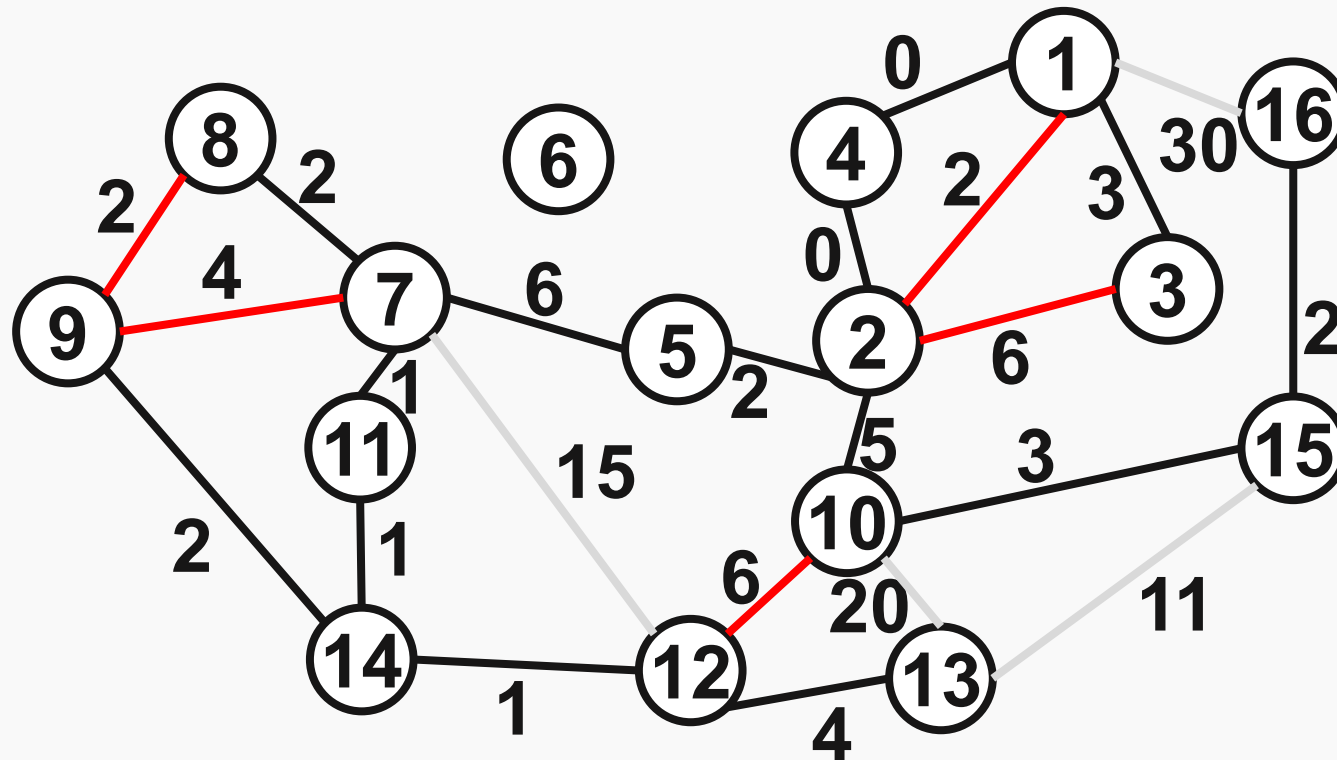


Algoritmul lui Kruskal



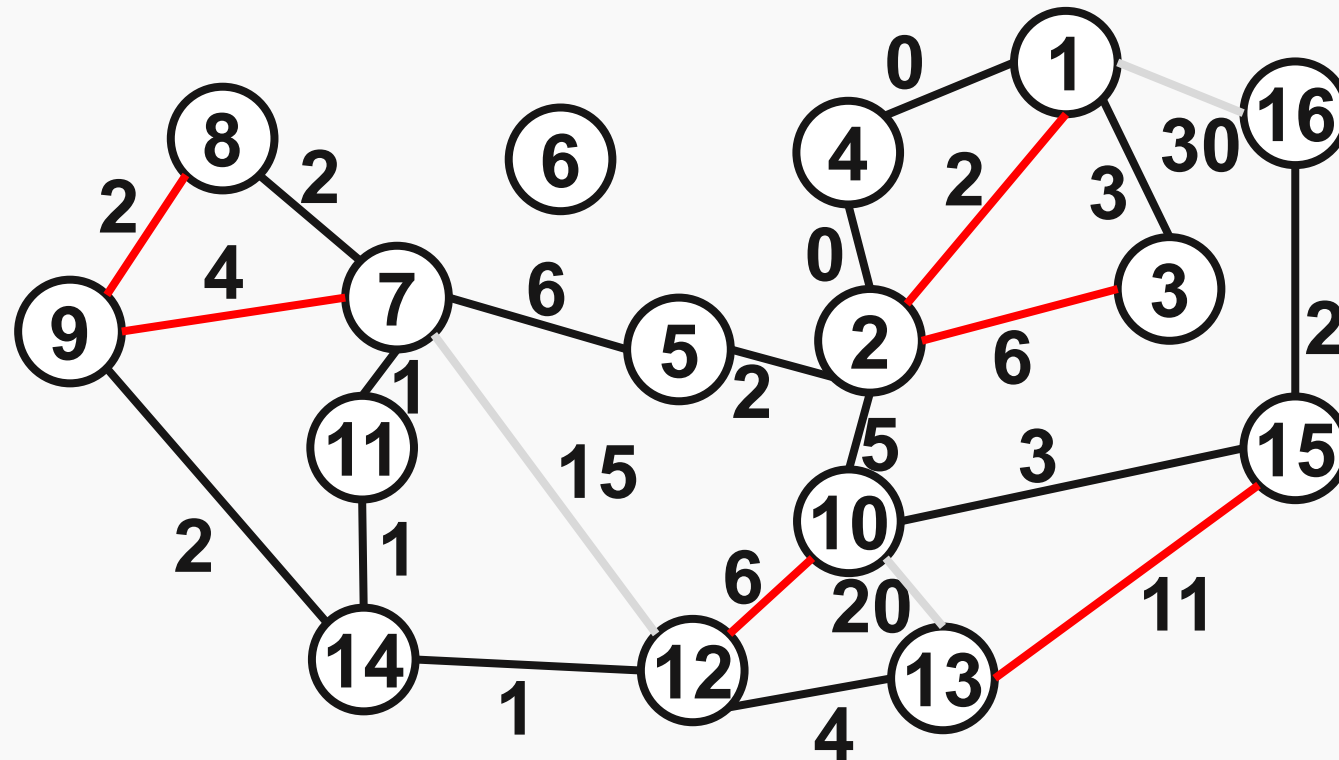


Algoritmul lui Kruskal



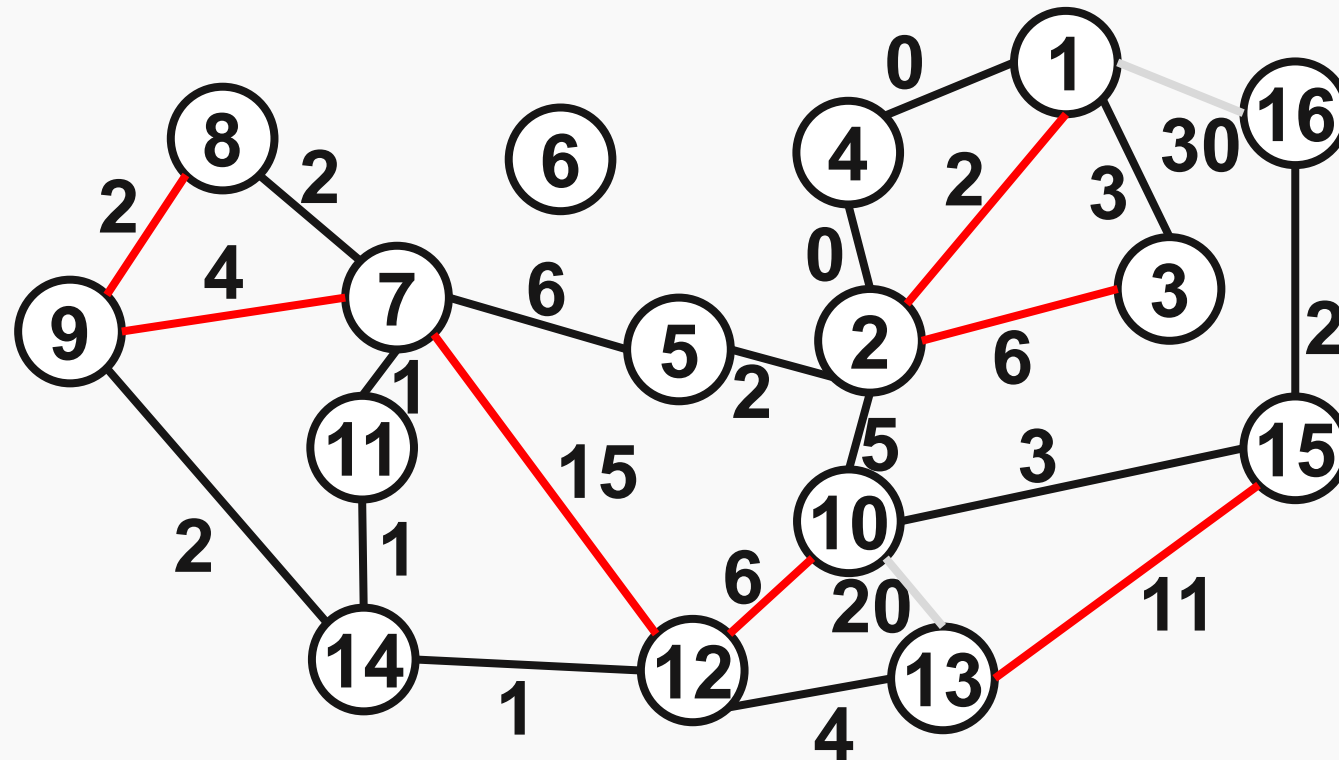


Algoritmul lui Kruskal



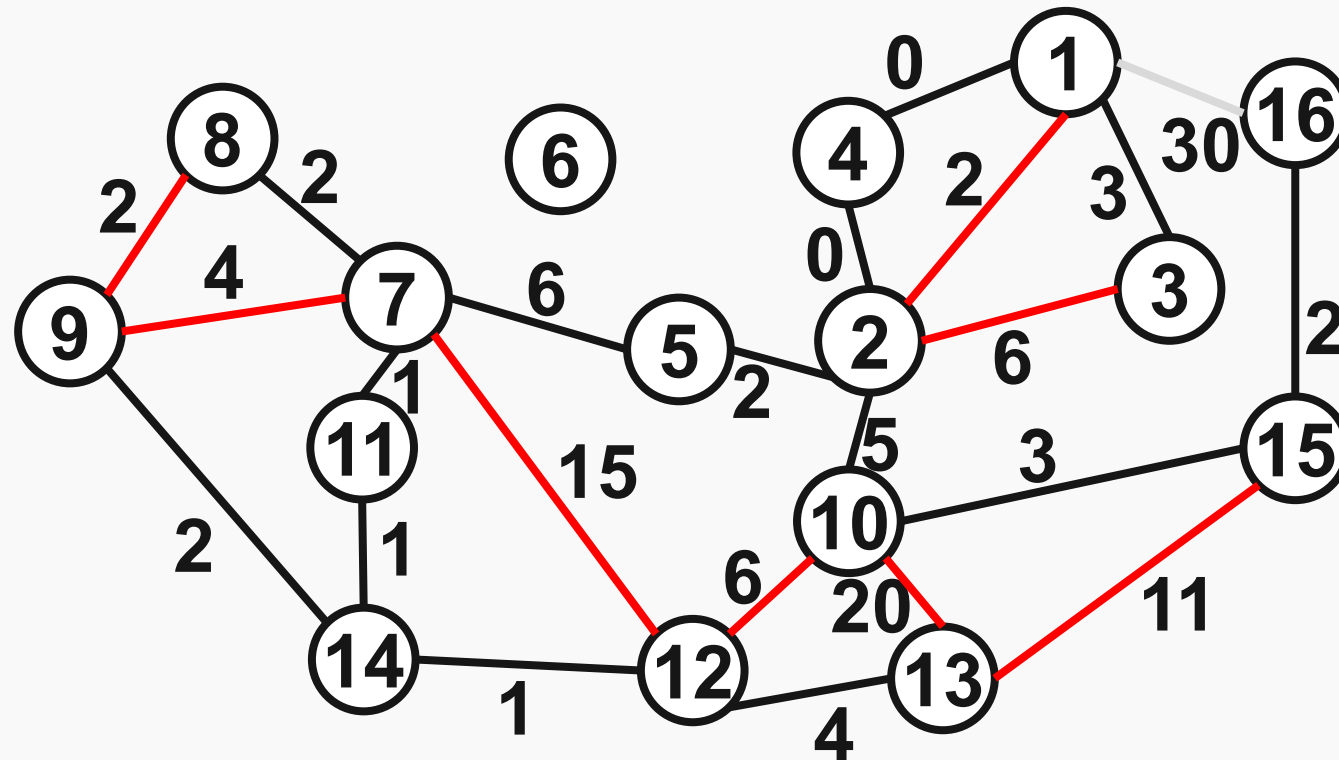


Algoritmul lui Kruskal



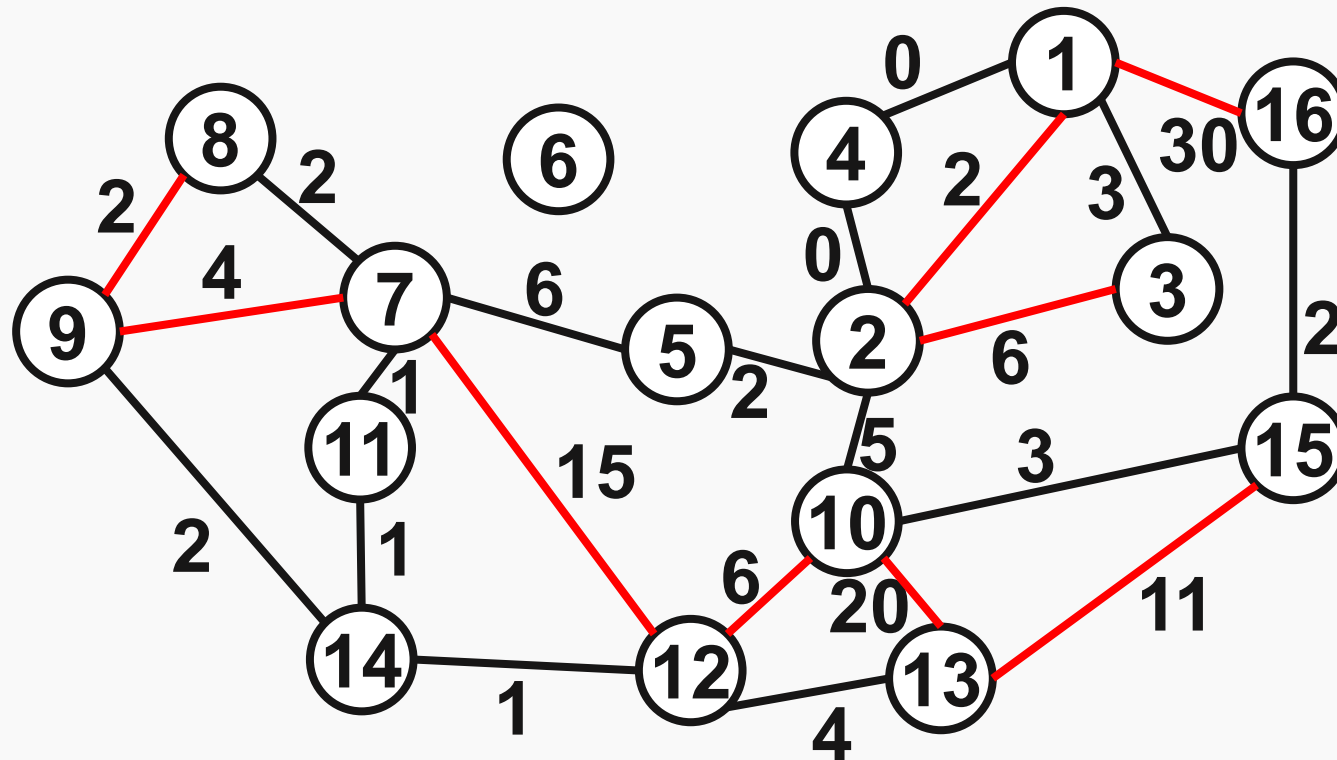


Algoritmul lui Kruskal





Algoritmul lui Kruskal





Complexitate?

```
tree Kruskal(G) {  
    sort(G.E); // sort by weight  
    A = {};  
    for each (node in G.V)  
        Make_set(node);  
    for each ((u, v) in G.E) {  
        if (Find_set(u) != Find_set(v)) {  
            A = A U {(u, v)};  
            Union(Find_set(u), Find_set(v));  
        }  
    }  
    return A;  
}
```




Complexitate?

$$O(E \log(E))$$



Flux maxim



Graf capacitate

- În general valoarea de pe muchie reprezintă o distanță.



- O distanță mai mare face muchia mai greu de parcurs.
- Valoarea muchiei poate reprezenta o capacitate.
 - A graph with two nodes, labeled 1 and 2, connected by a horizontal edge. The text 0/2 is written below the edge, representing the capacity of the edge.
 - Similar apei/curentului, cu cât capacitatea e mai mare cu atât e mai ușor de parcurs.
- Șoselele au și distanță și capacitate (număr benzi/viteză max)



Flux maxim Algoritmul Ford-Fulkerson

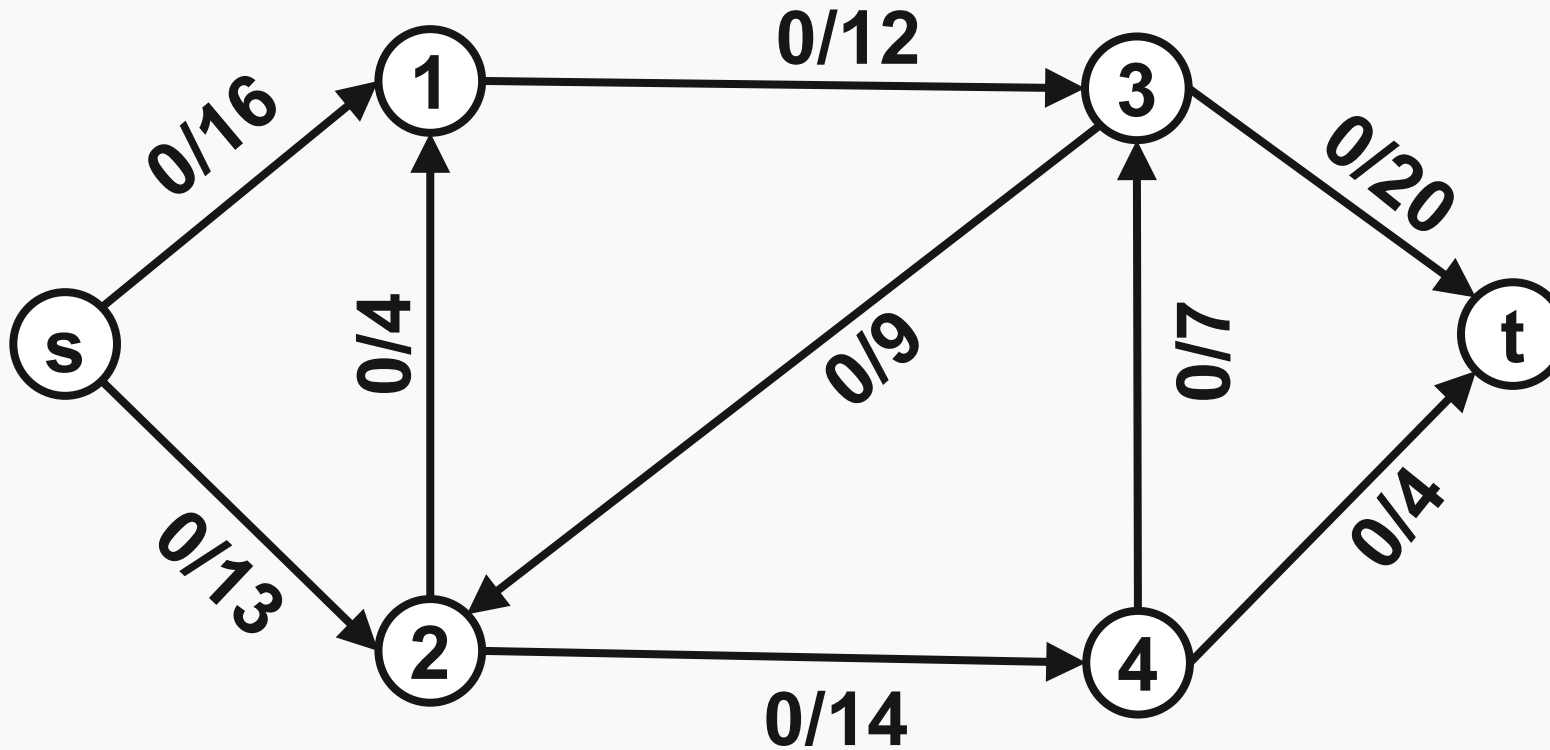
- c capacitate muchie
- f flow muchie. Capacitate folosită
- $c_f(u, v) = c(u, v) - f(u, v)$ diferența de capacitate
- G_f graful cu muchii c_f

FORD-FULKERSON(G, s, t)

```
1  for each edge  $(u, v) \in G.E$ 
2       $(u, v).f = 0$ 
3  while there exists a path  $p$  from  $s$  to  $t$  in the residual network  $G_f$ 
4       $c_f(p) = \min \{c_f(u, v) : (u, v) \text{ is in } p\}$ 
5      for each edge  $(u, v)$  in  $p$ 
6           $(u, v).f = (u, v).f + c_f(p)$ 
7           $(v, u).f = (v, u).f - c_f(p)$ 
```

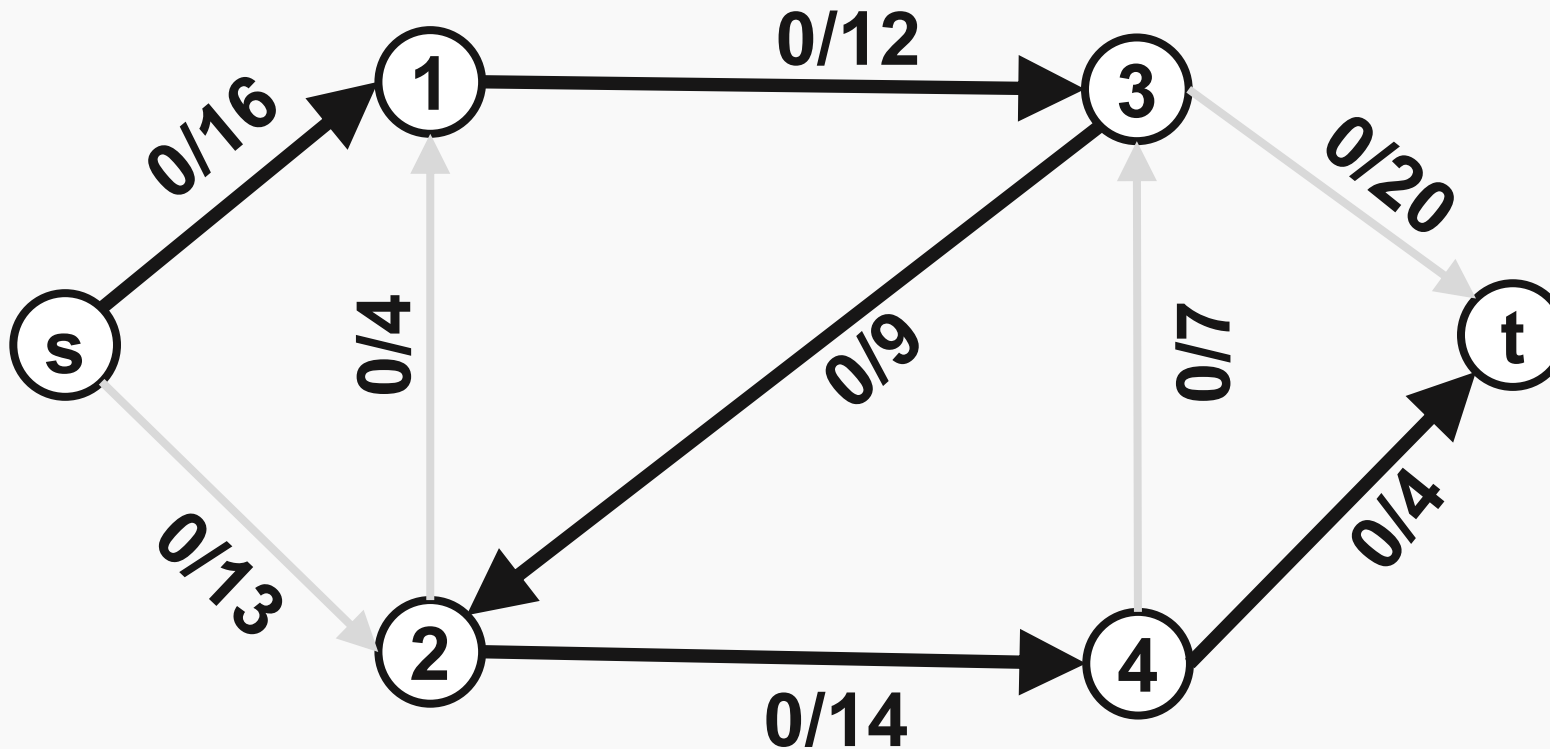


Algoritmul Ford-Fulkerson



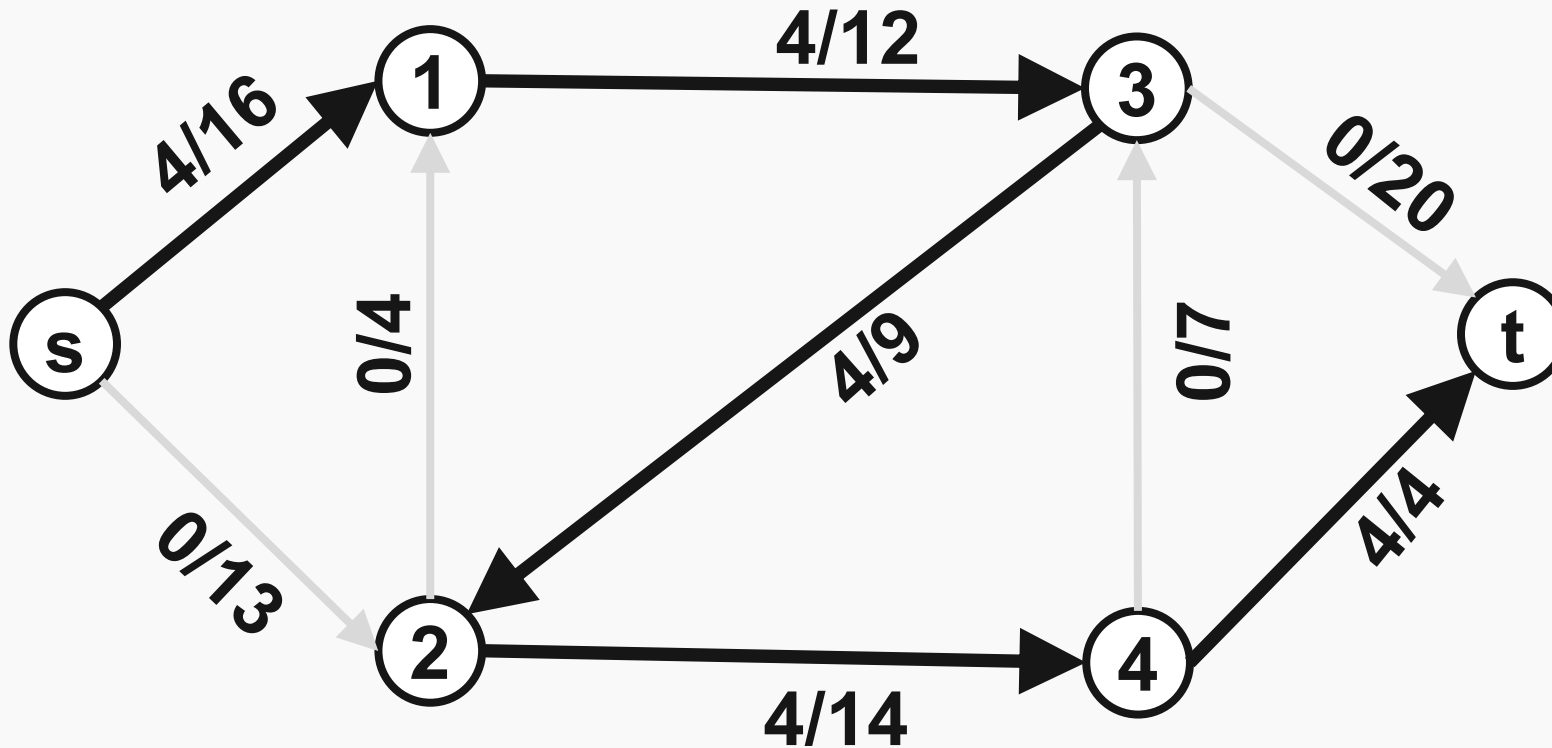


Algoritmul Ford-Fulkerson



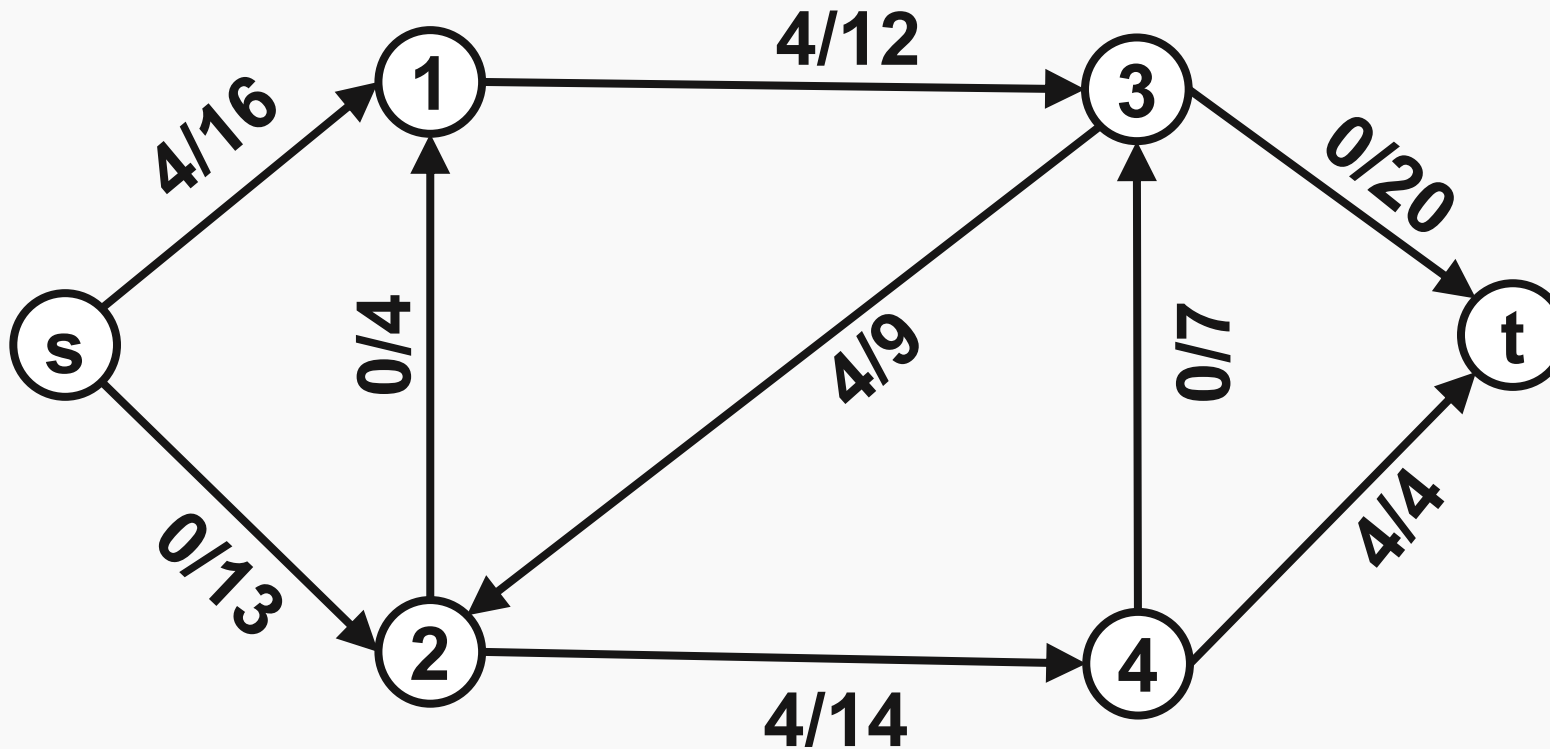


Algoritmul Ford-Fulkerson



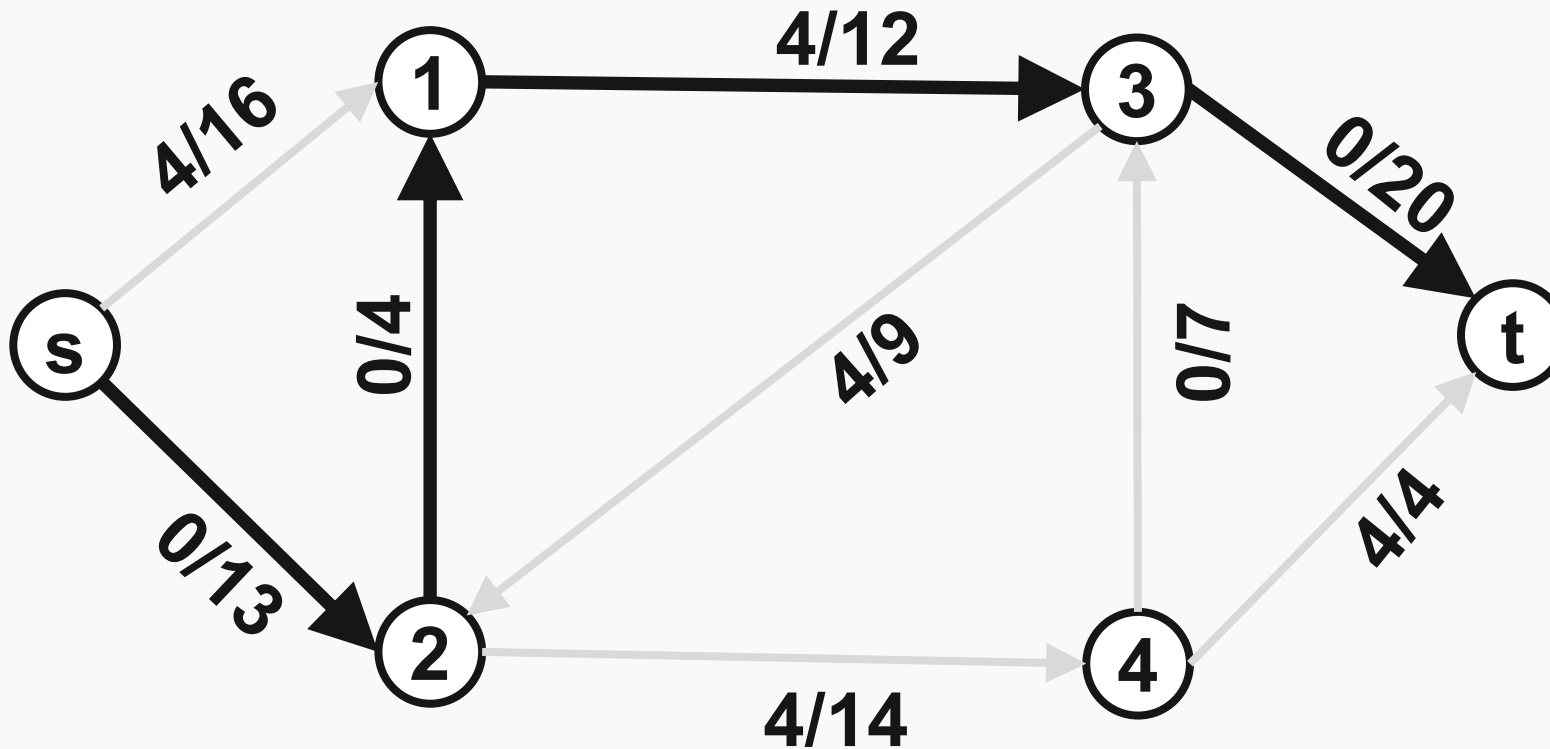


Algoritmul Ford-Fulkerson



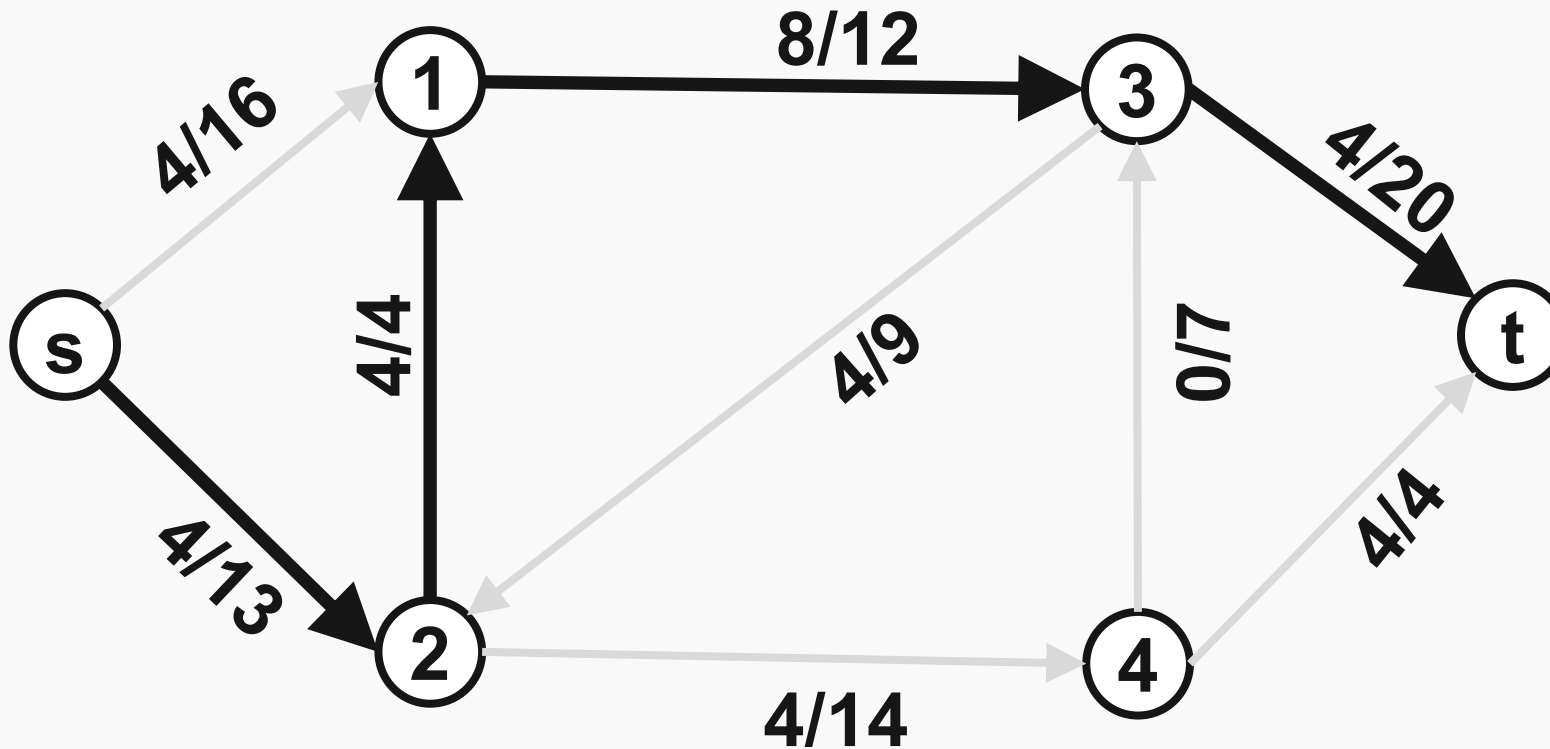


Algoritmul Ford-Fulkerson



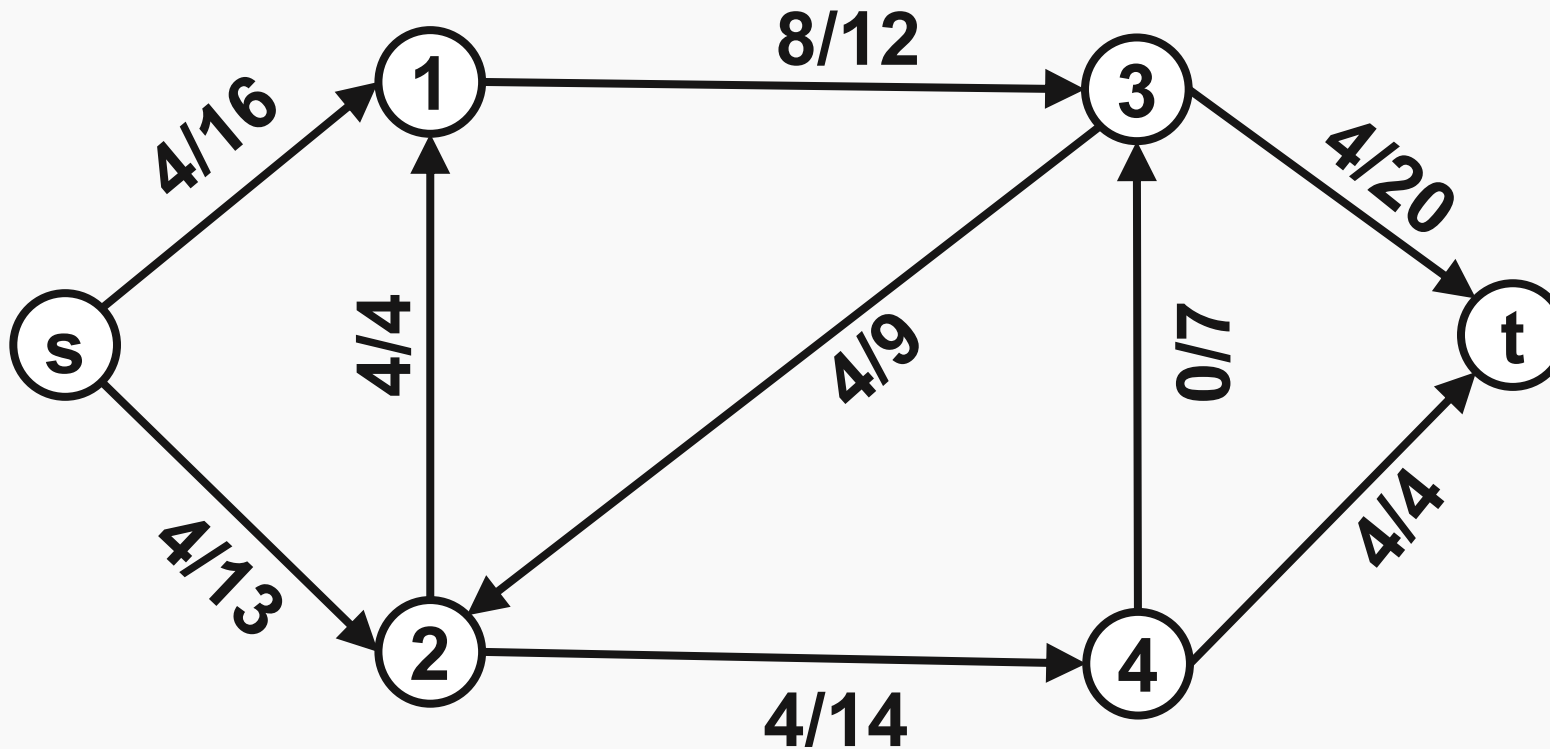


Algoritmul Ford-Fulkerson



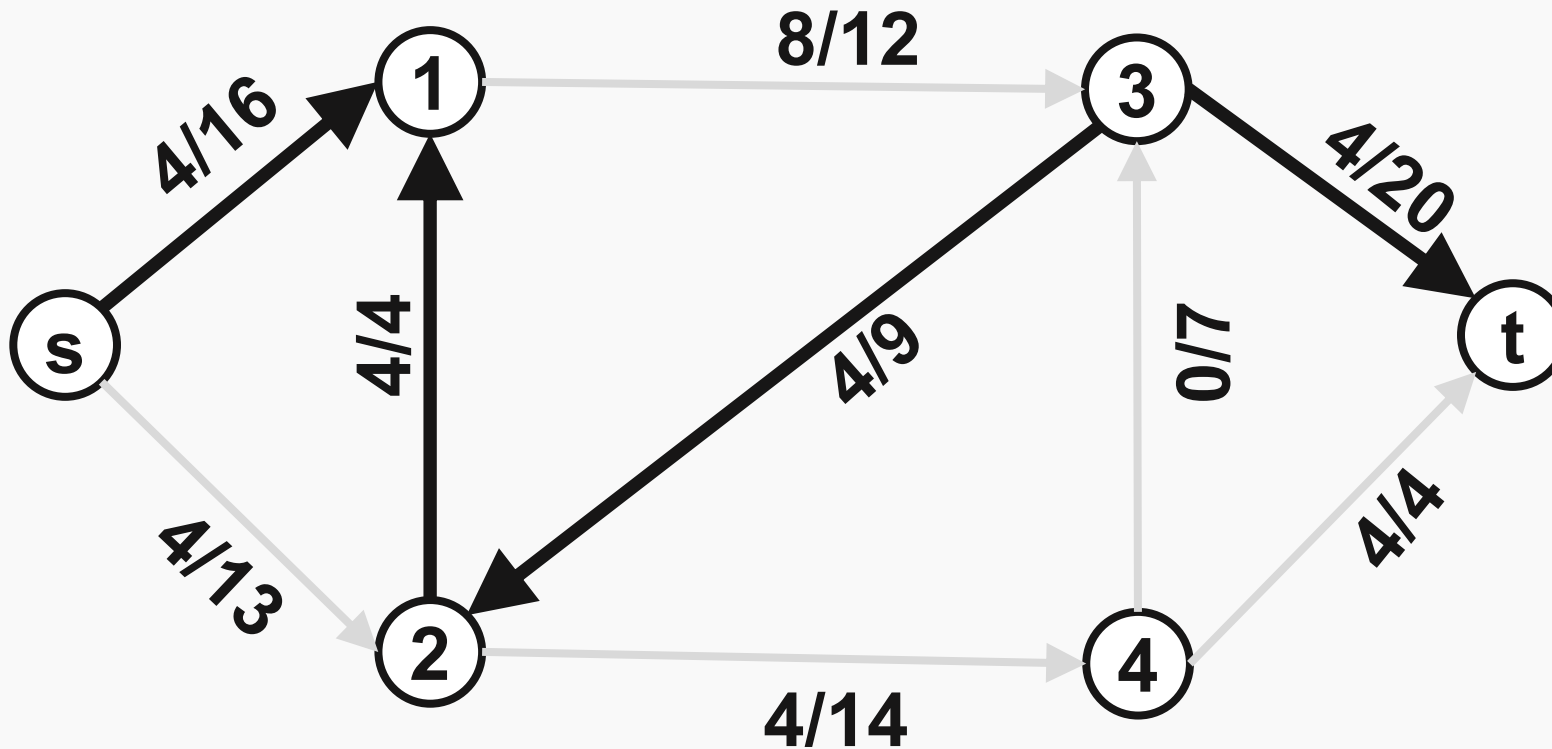


Algoritmul Ford-Fulkerson



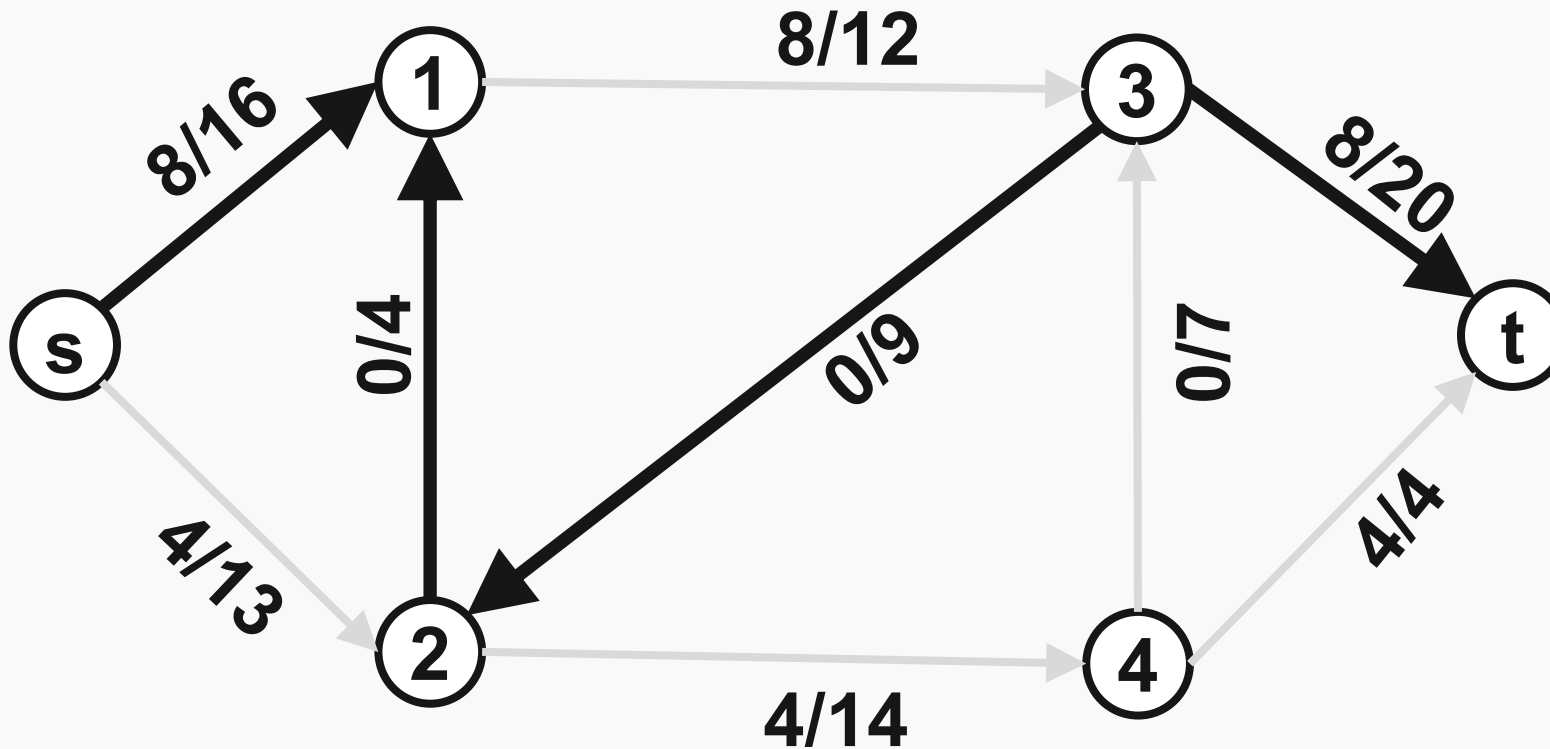


Algoritmul Ford-Fulkerson



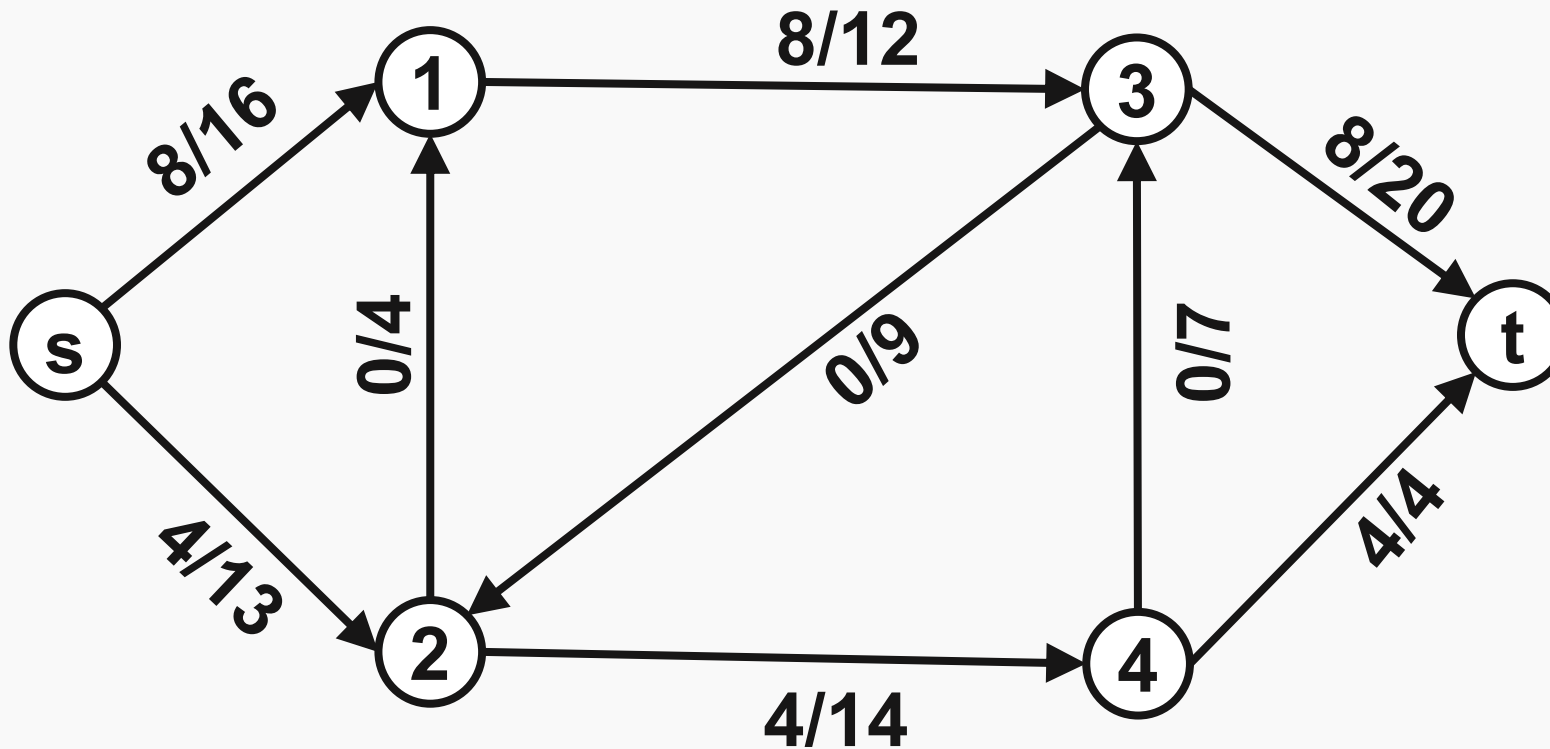


Algoritmul Ford-Fulkerson



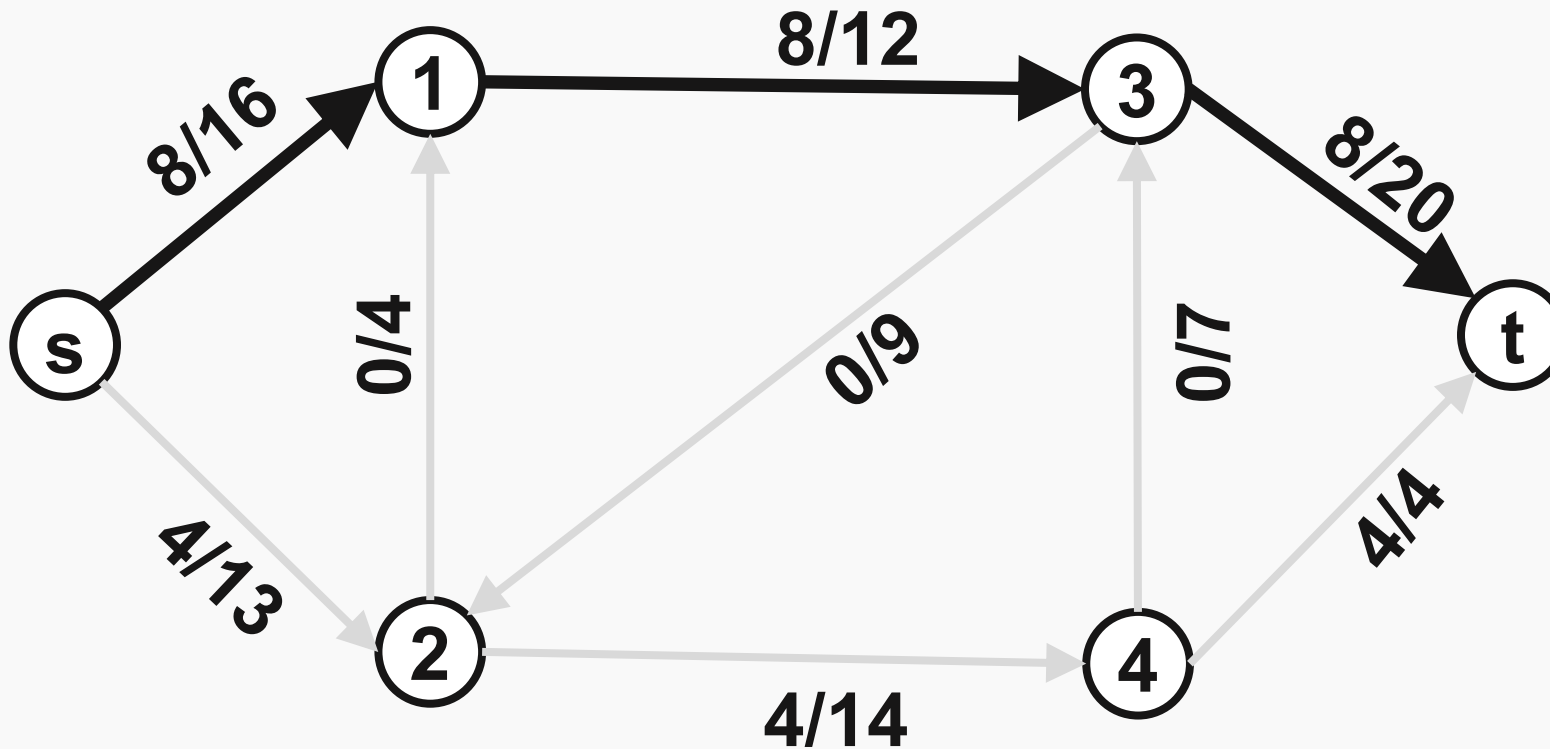


Algoritmul Ford-Fulkerson



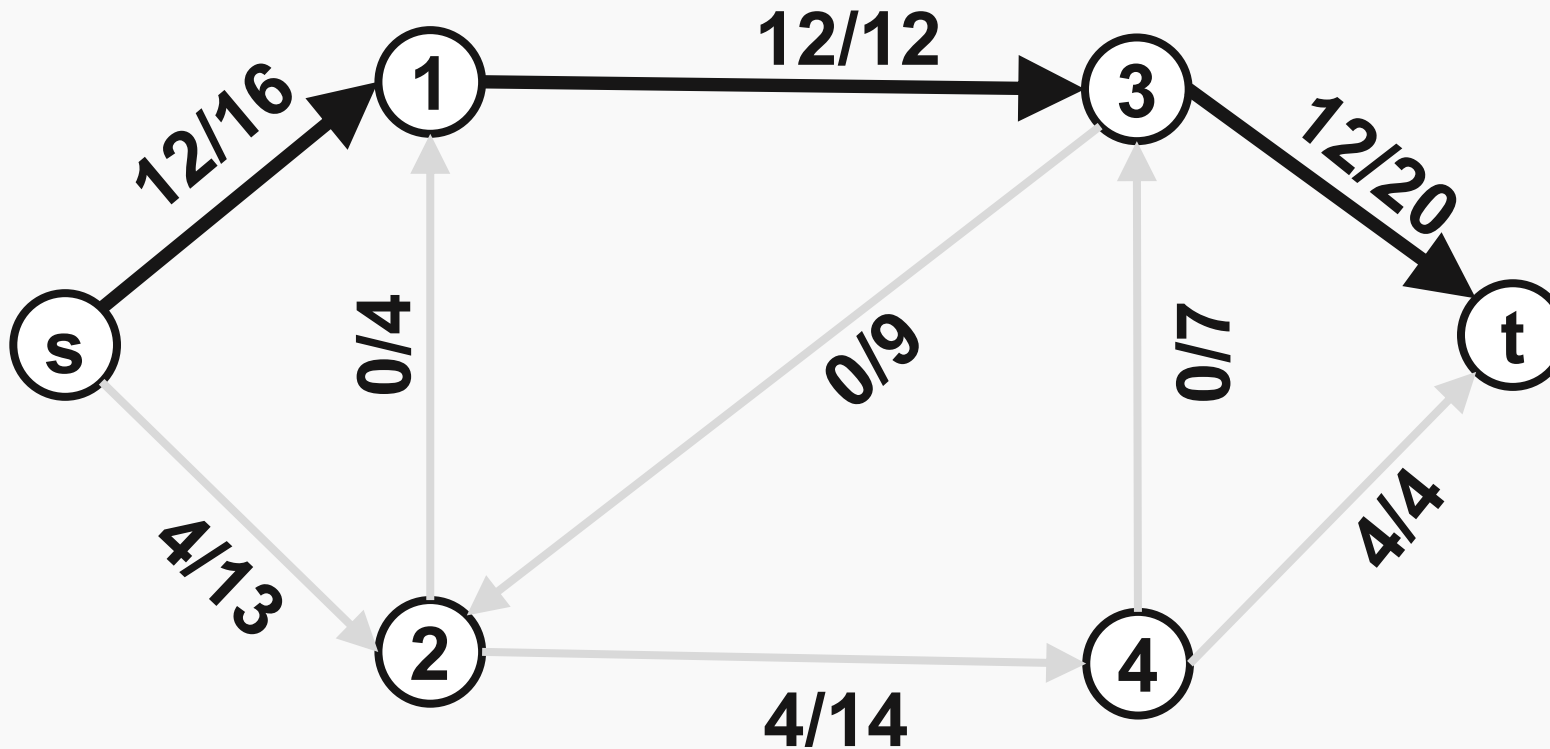


Algoritmul Ford-Fulkerson



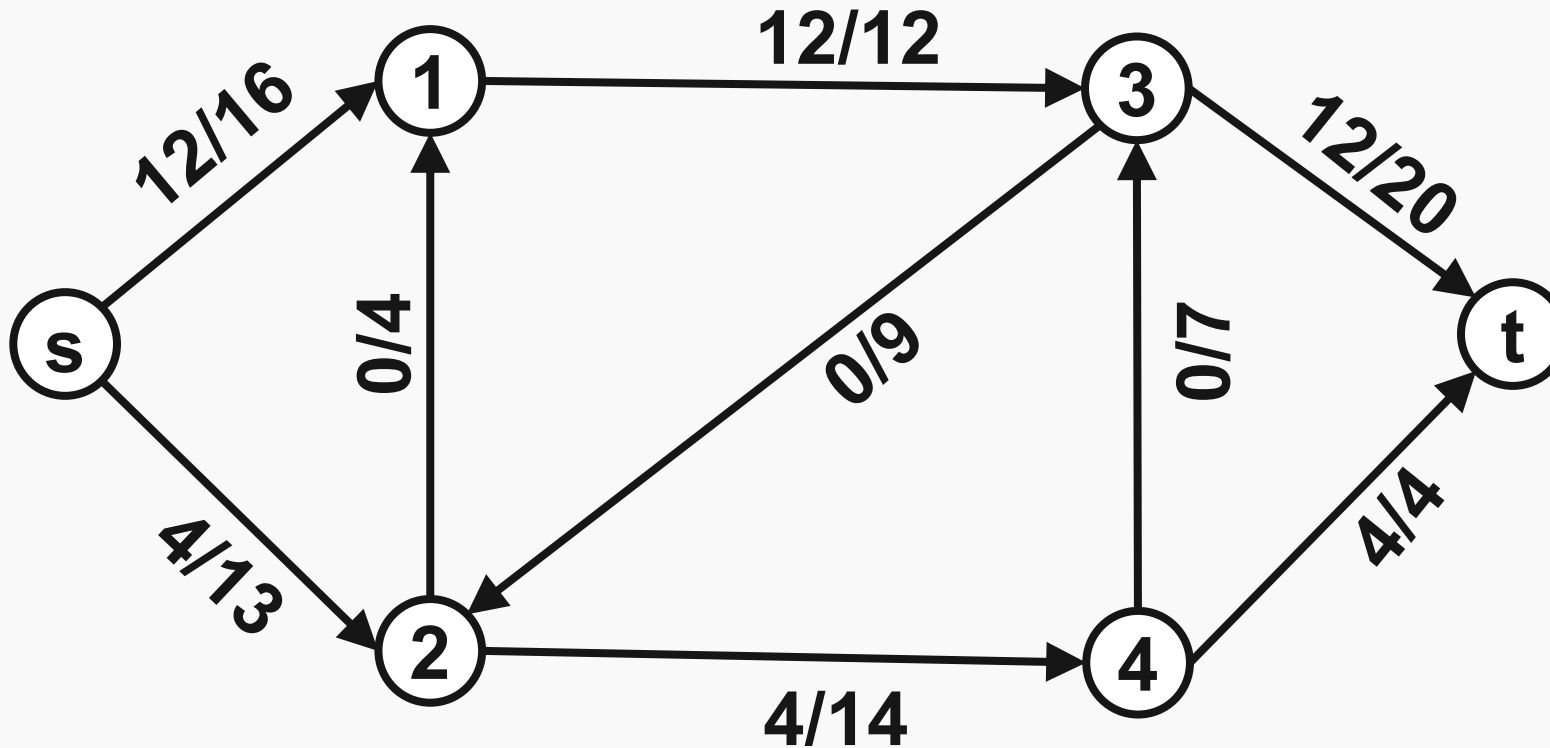


Algoritmul Ford-Fulkerson



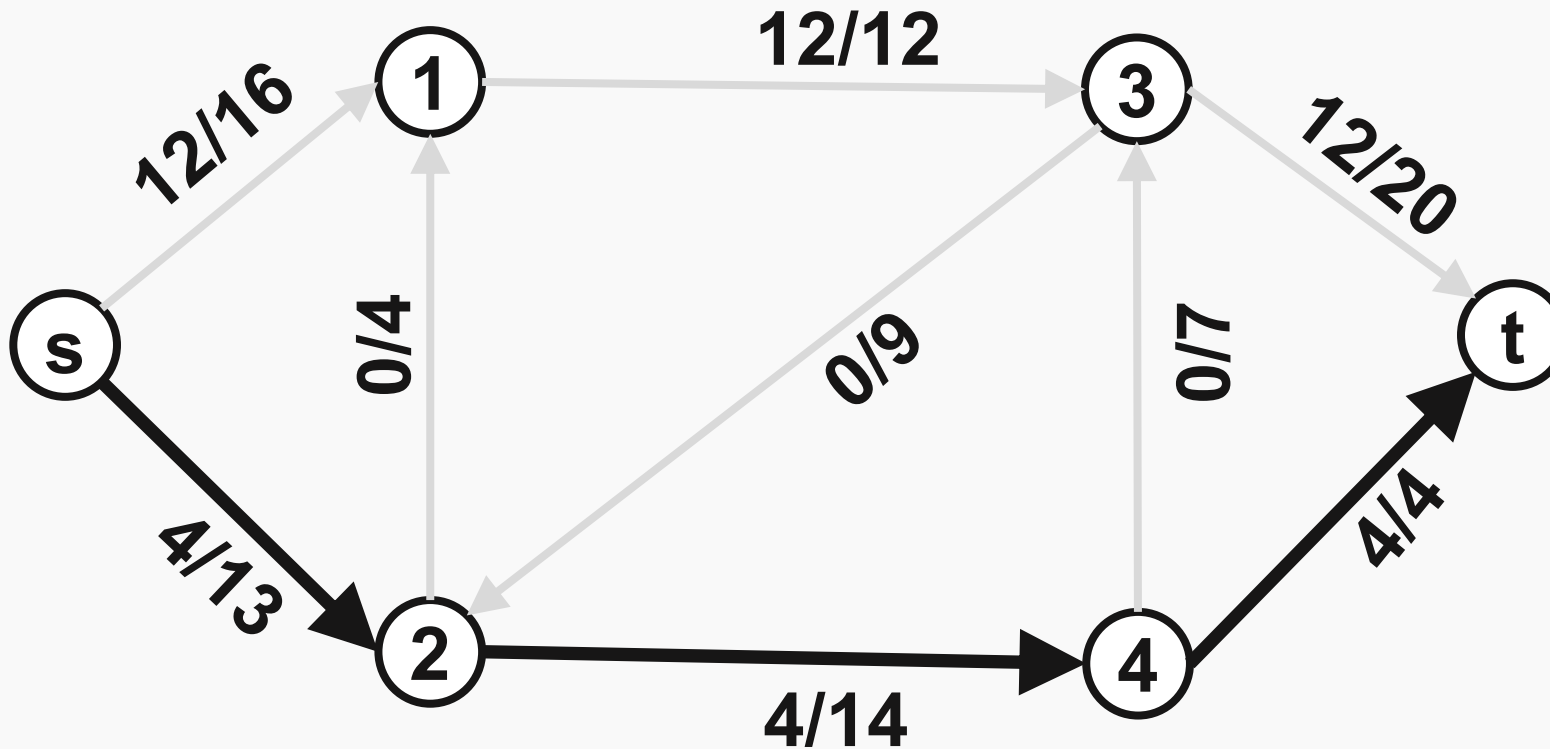


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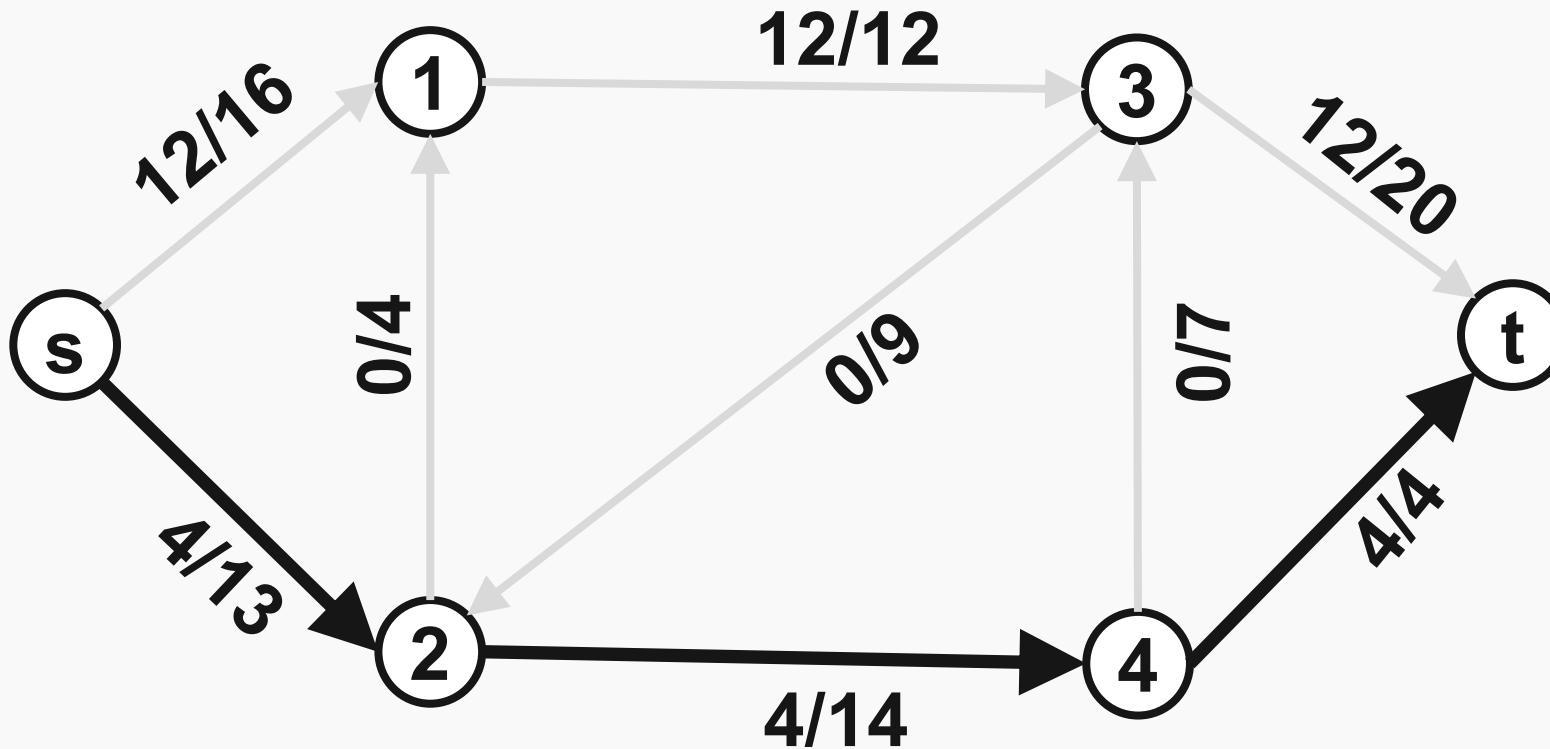


Algoritmul Ford-Fulkerson



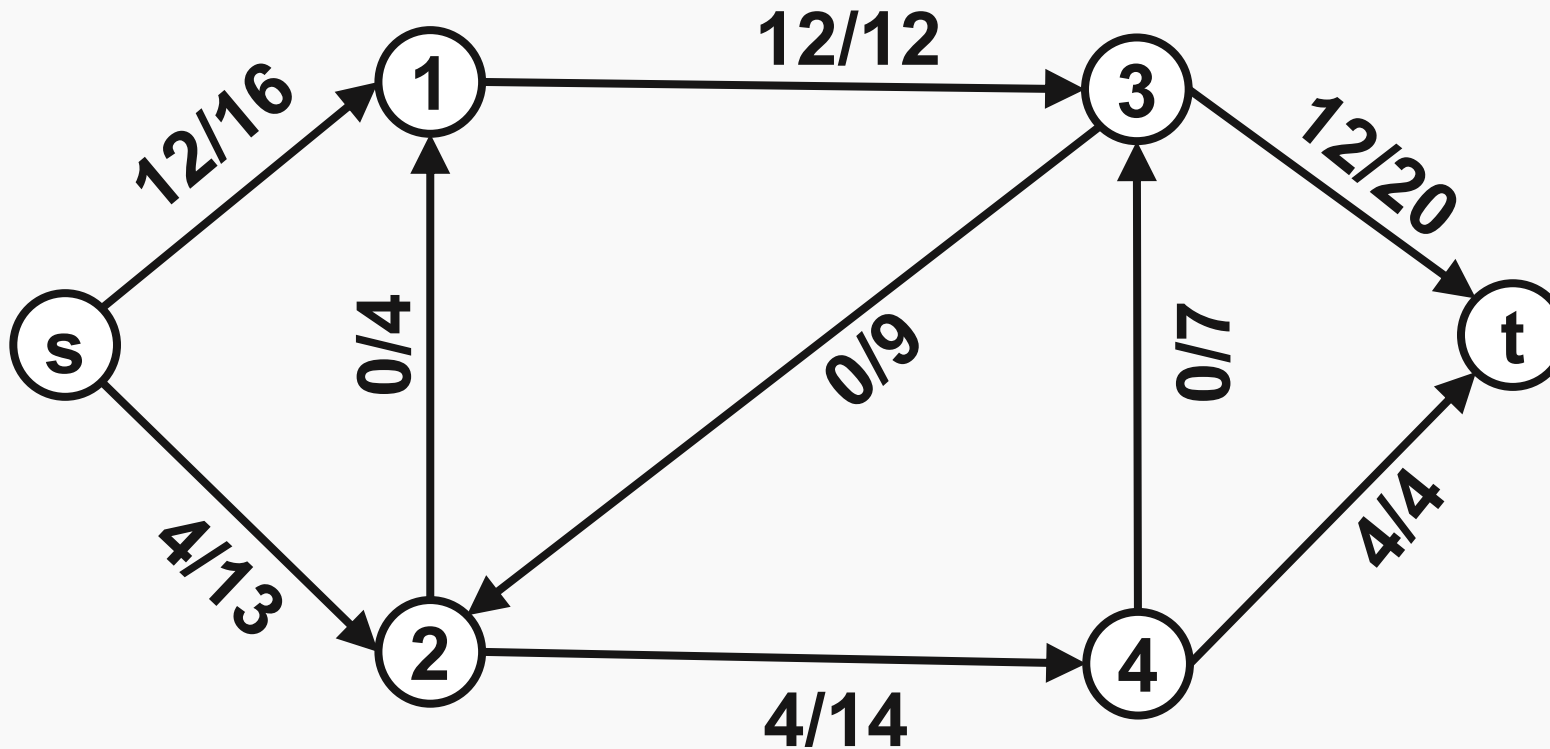


Algoritmul Ford-Fulkerson



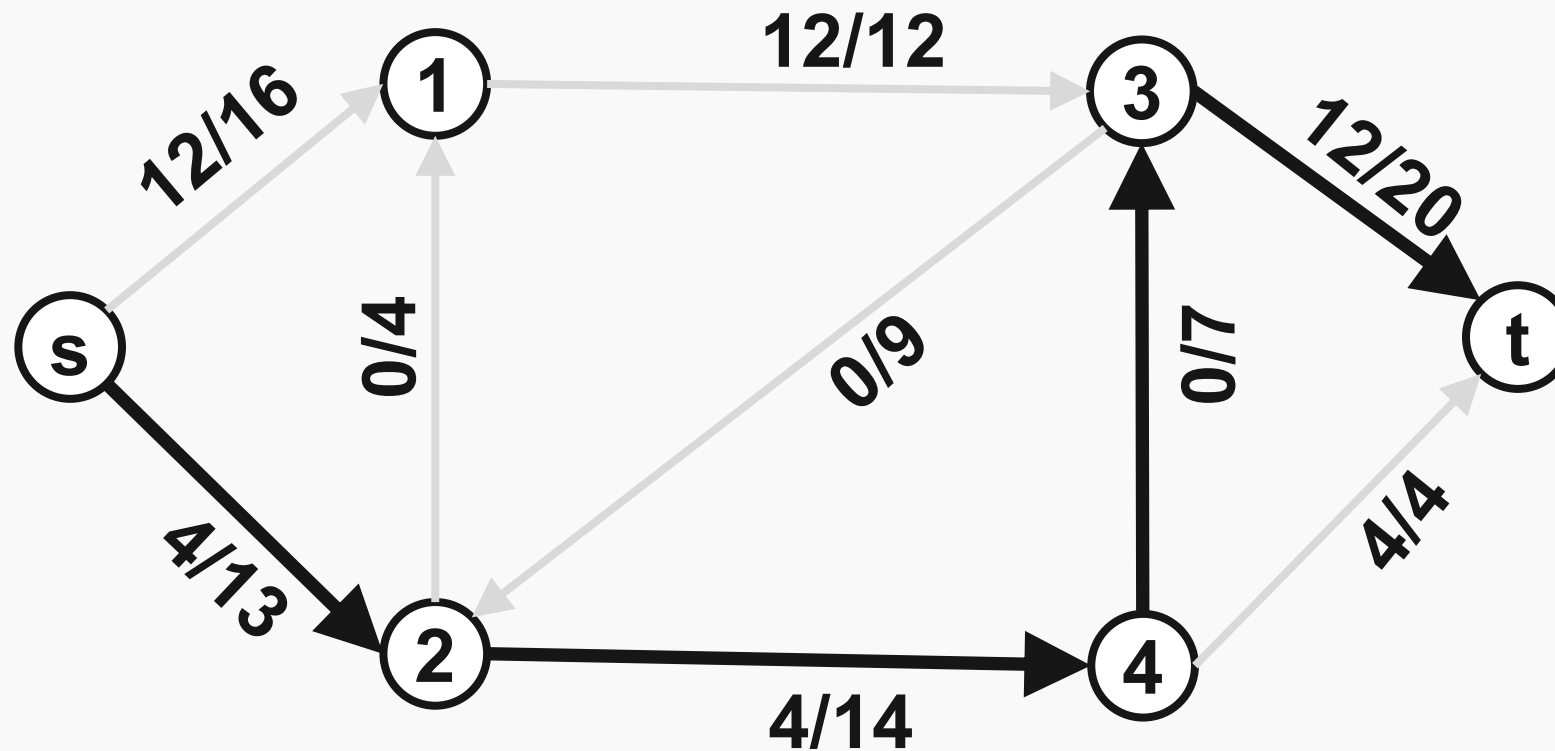


Algoritmul Ford-Fulkerson



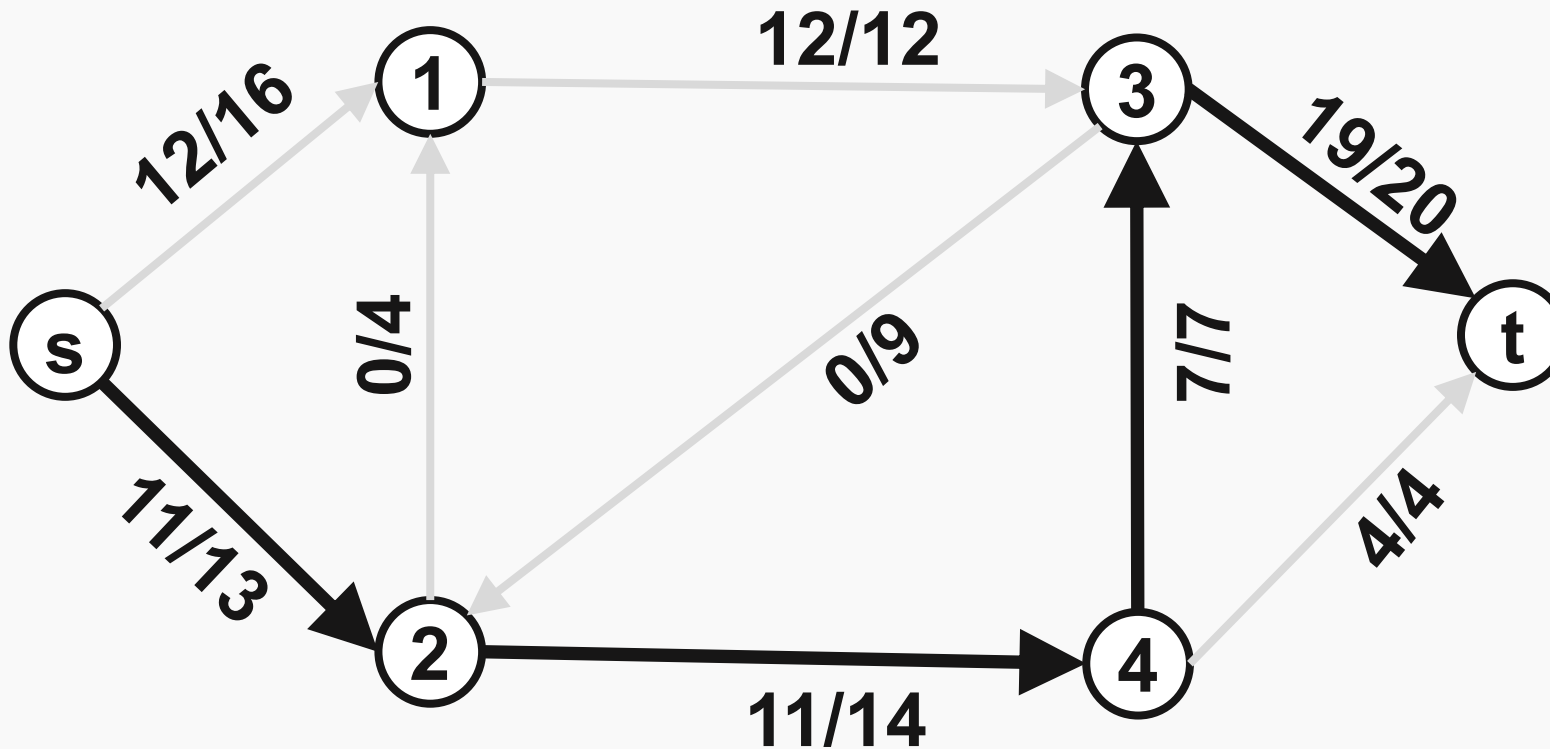


Algoritmul Ford-Fulkerson



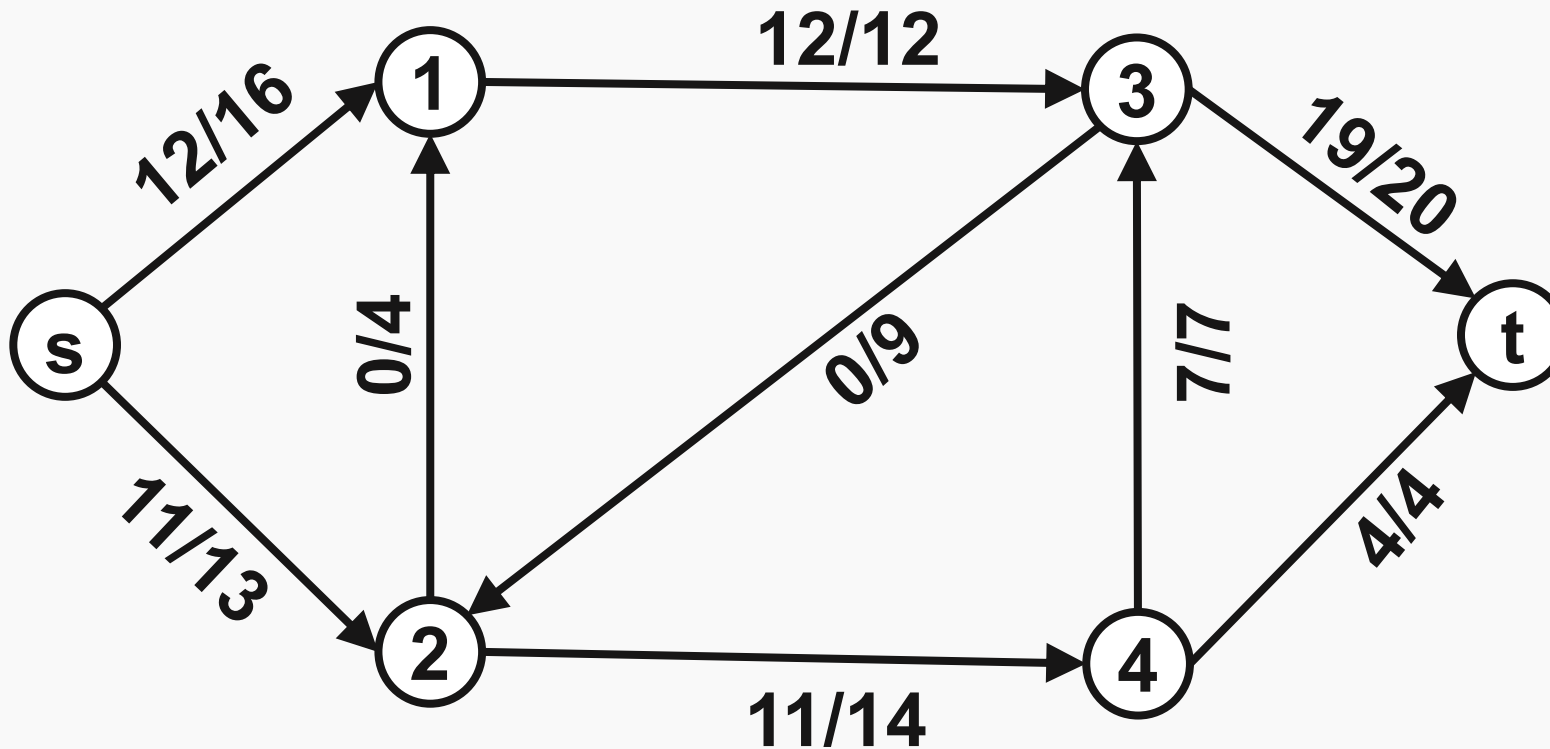


Algoritmul Ford-Fulkerson





Algoritmul Ford-Fulkerson





Alte considerente grafuri

- Se pot schimba în timp.
- LineGraph – Pentru un graf non-direcțional muchiile devin noduri și nodurile muchii.

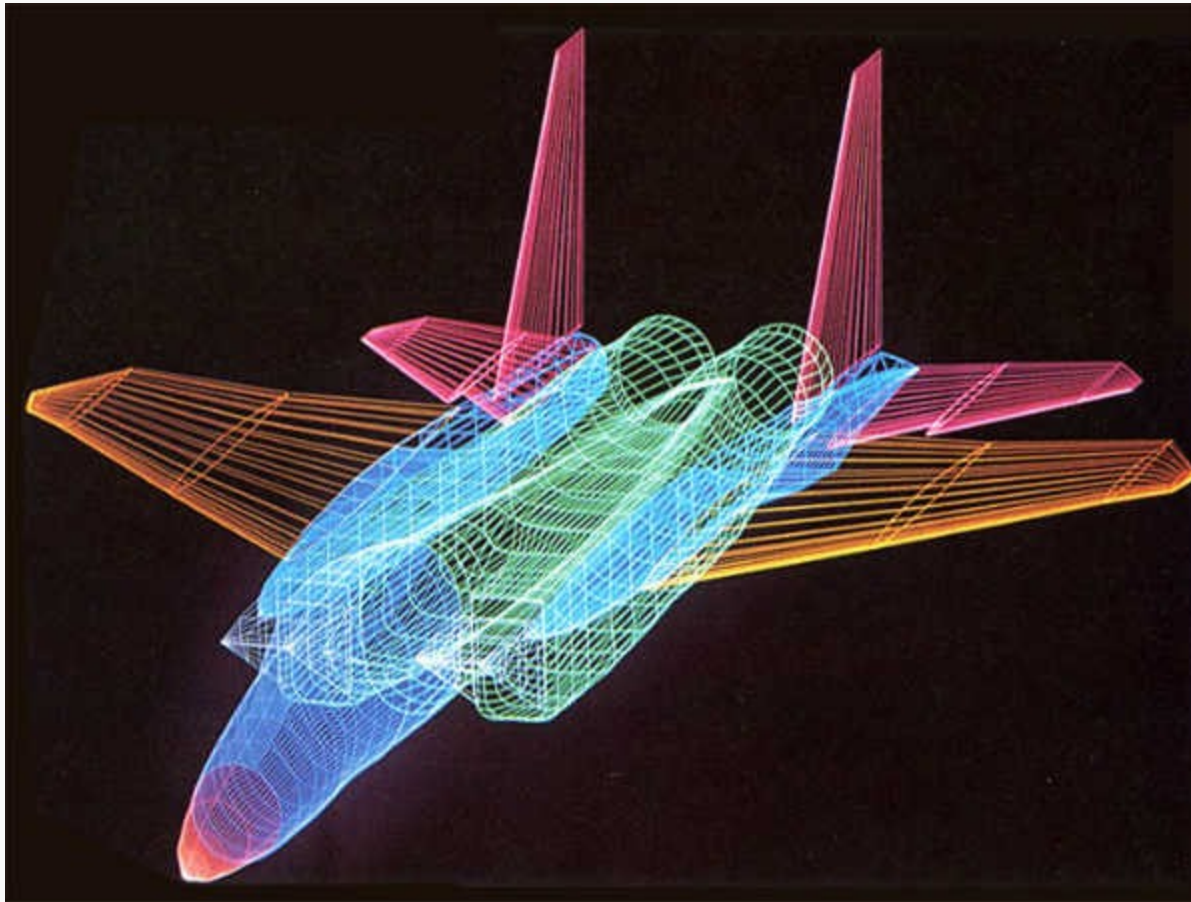


Use case grafuri – Granițe



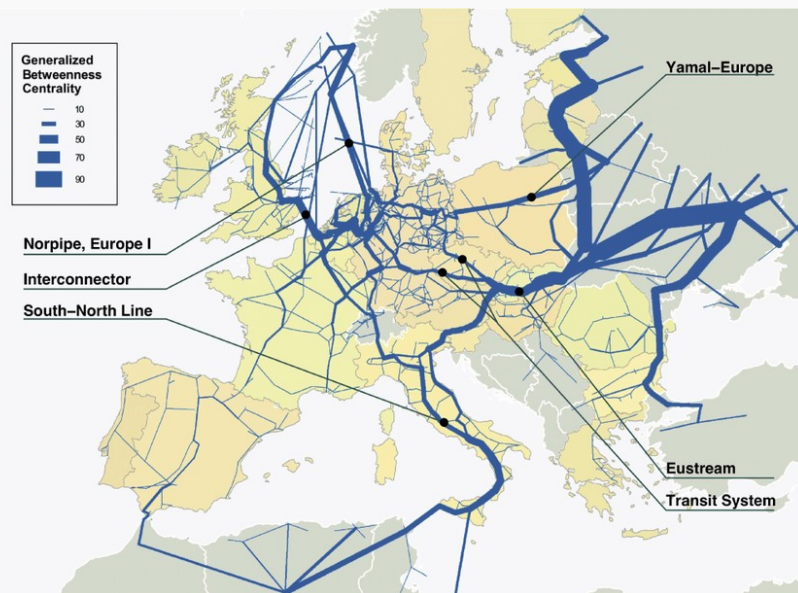


Use case grafuri – Grafică calculator



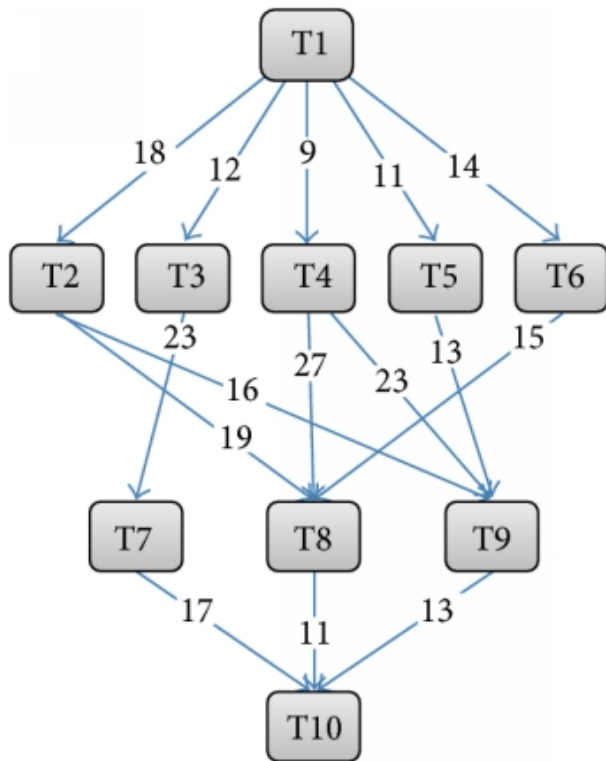


Use caseer grafuri – utilități

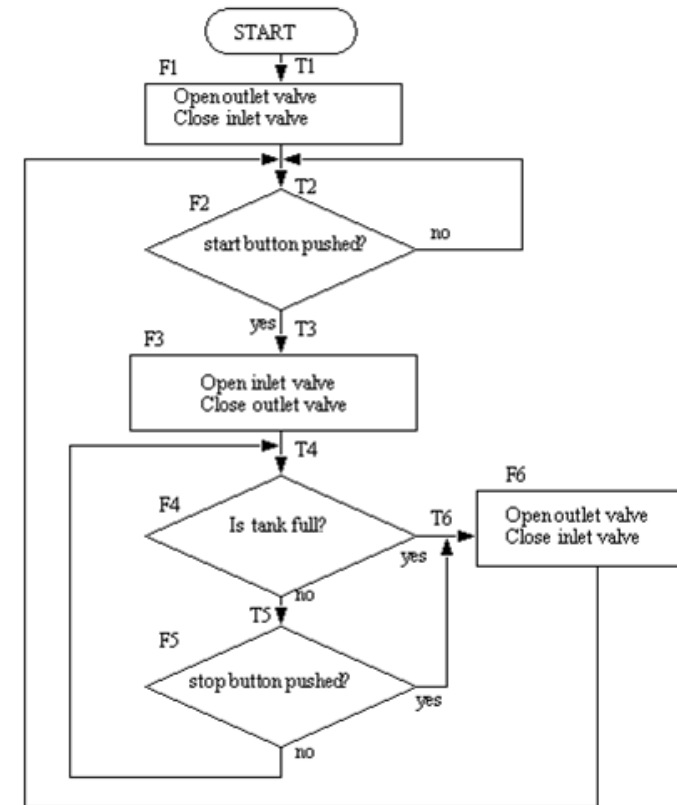




Use case grafuri – Code

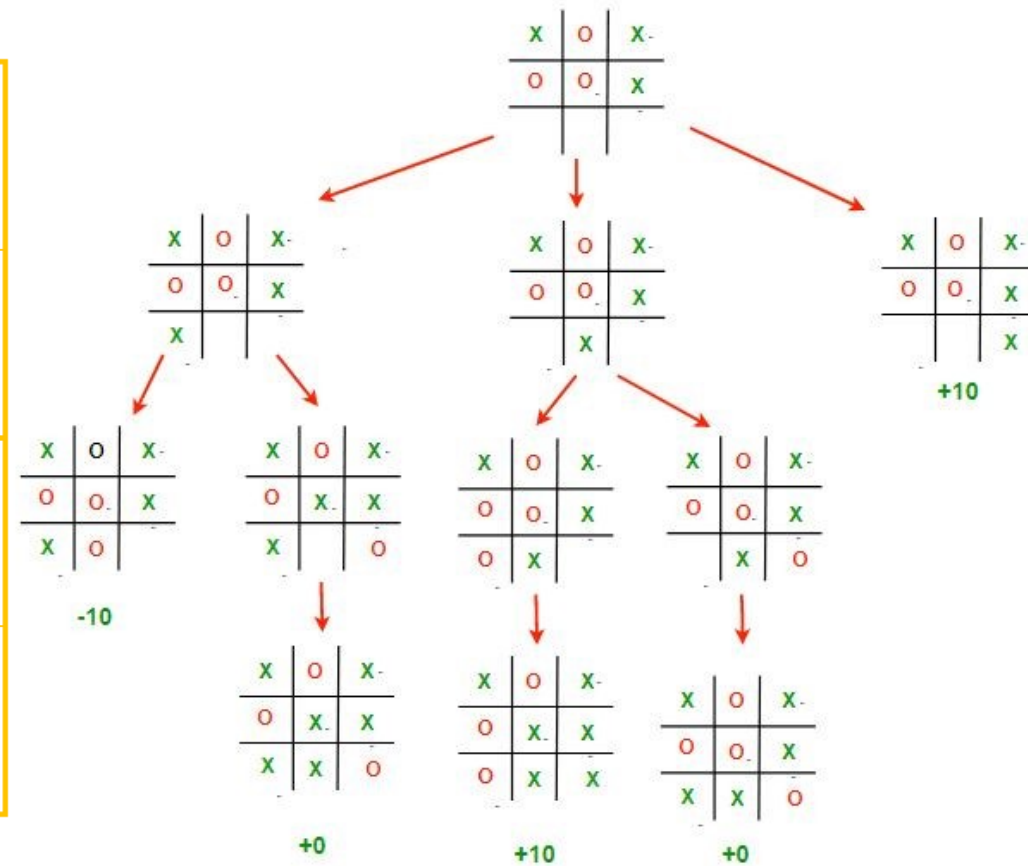
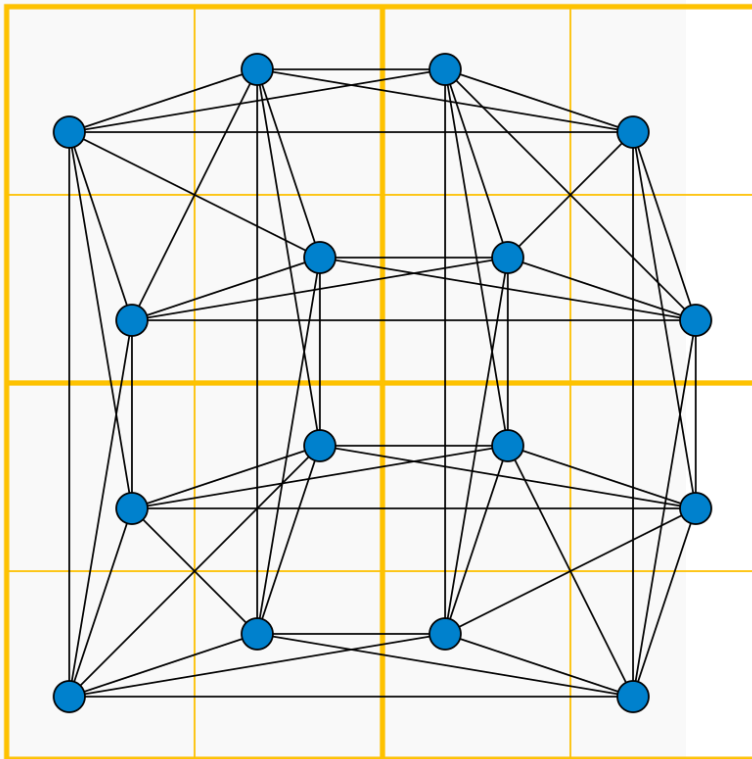


Task	P_1	P_2	P_3
T1	14	16	9
T2	13	19	18
T3	11	13	19
T4	13	8	7
T5	12	13	10
T6	13	16	9
T7	7	15	11
T8	5	11	14
T9	18	12	20
T10	21	7	16



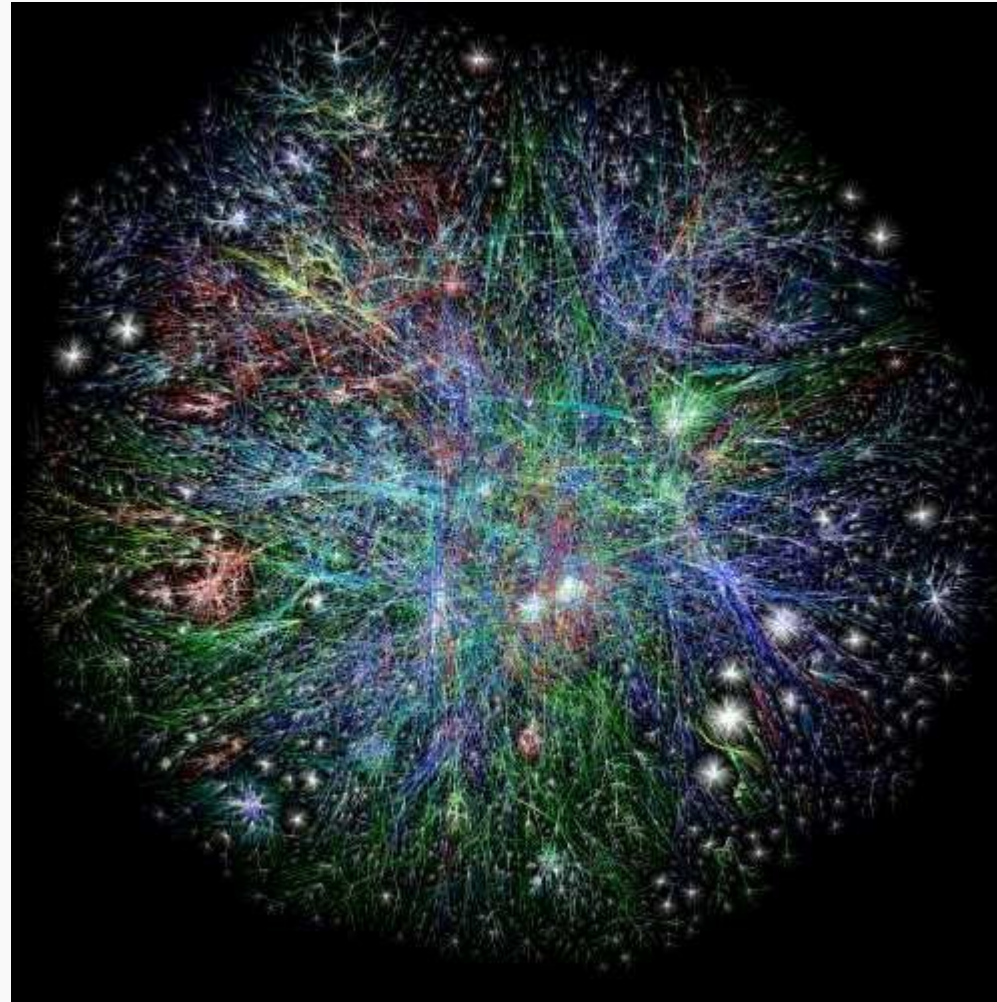


Use case grafuri – Reprezentare Jocuri



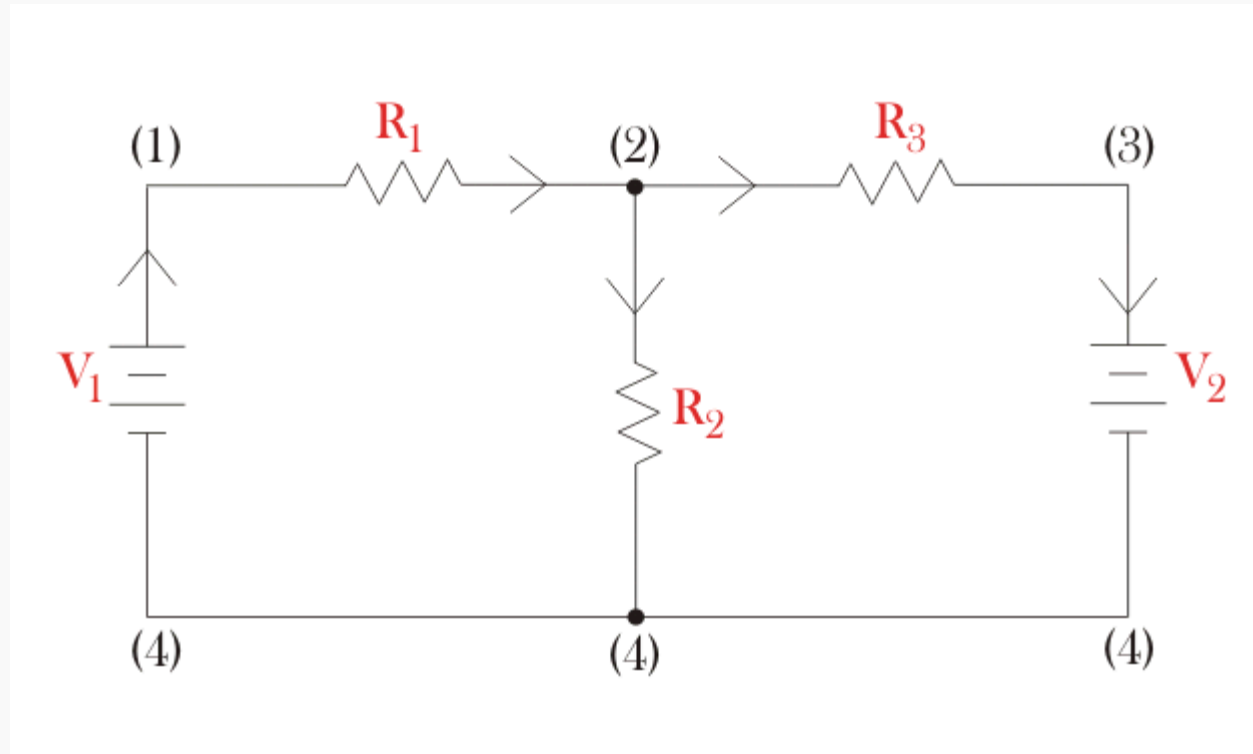


Use case grafuri - Internet



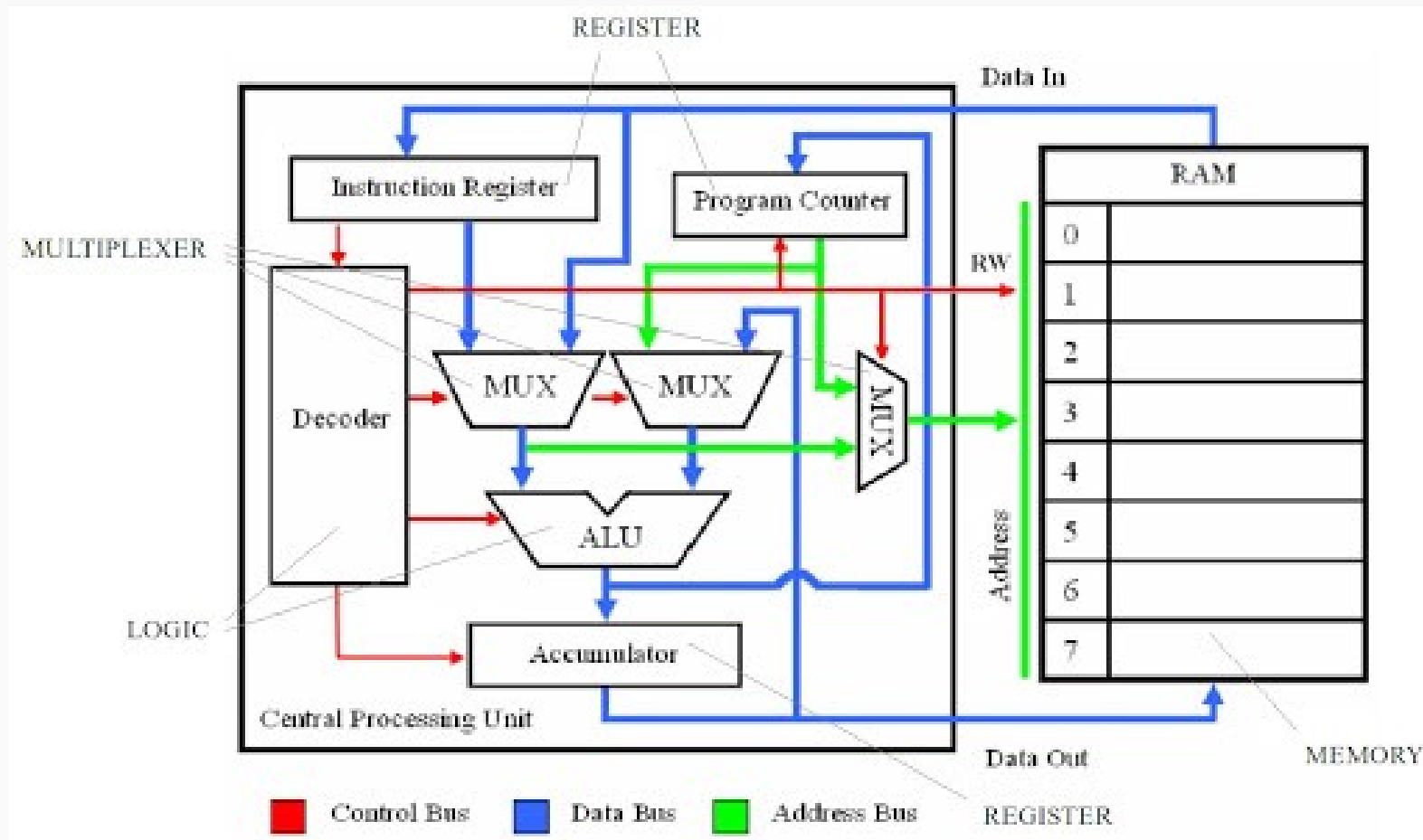


Use case grafuri – Circuite electrice





Use case grafuri – Circuite logice





Use case grafuri – Grafuri sociale





Use case-uri – Knowledge graph

as **Sundar Pichai** is an Indian American
of Alphabet ...
le: CEO of [Google](#) and [Alphabet](#)
rn: Pichai Sundararajan; June 10, 1972 (age ...
chnology · [Metallurgy](#)



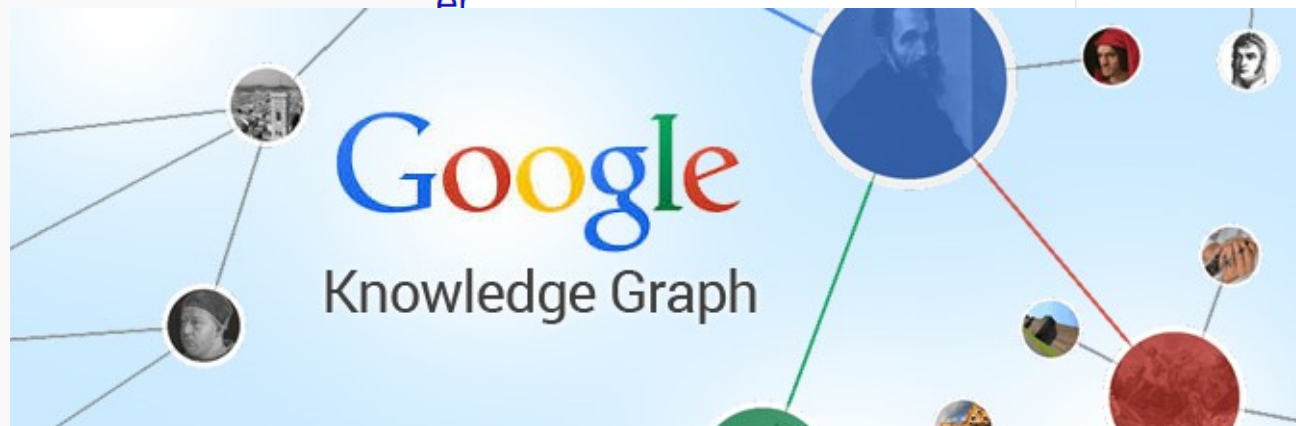
Sundar Pichai



Chief Executive Officer of Alphabet

Pichai Sundararajan, also known as Sundar Pichai, is

an business executive, the chief
of Alphabet Inc. and its subsidiary
nai began his career as a materials
ed Google as a management
4. [Wikipedia](#)





Use case-uri – Organigrame

