Structuri de date și algoritmi
Grafuri – Acoperire & Flux

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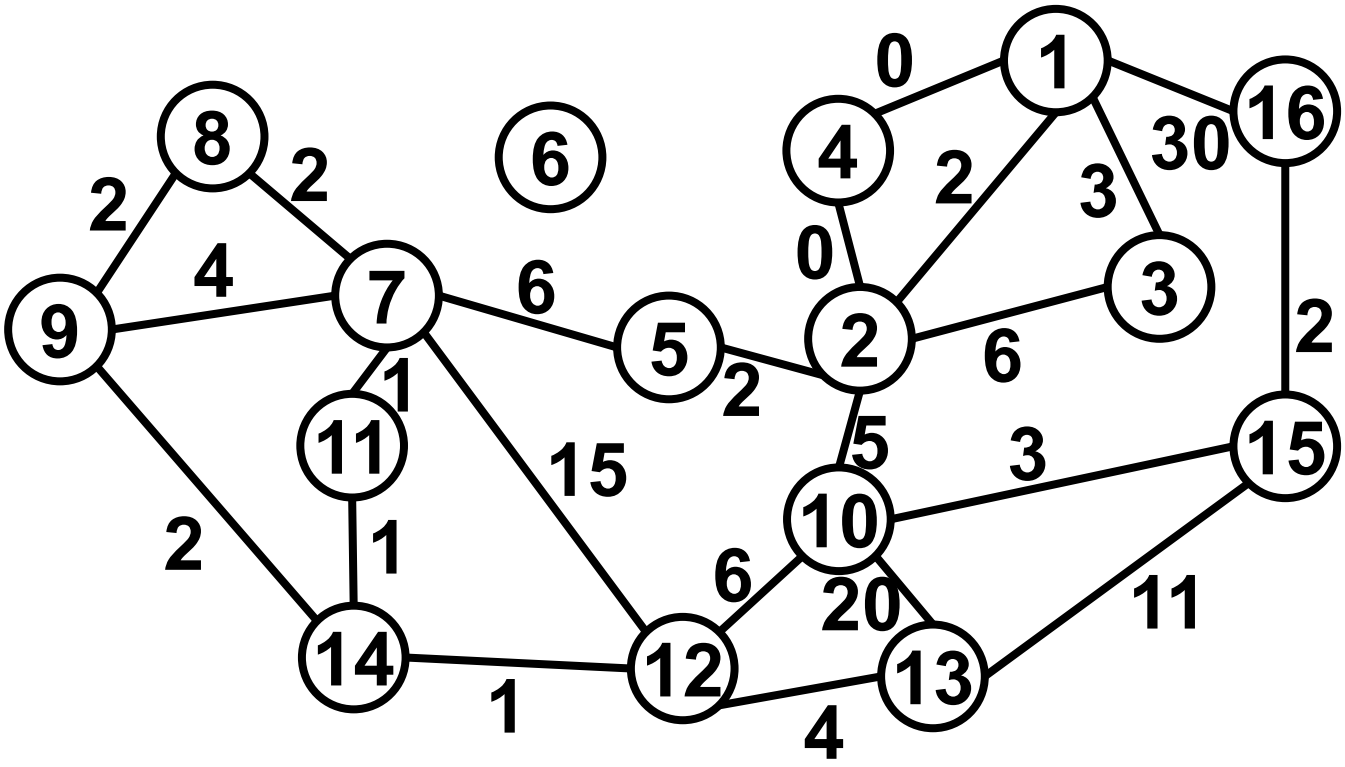
PER ASPERA AD ASTRA

Arbori minimi de acoperire



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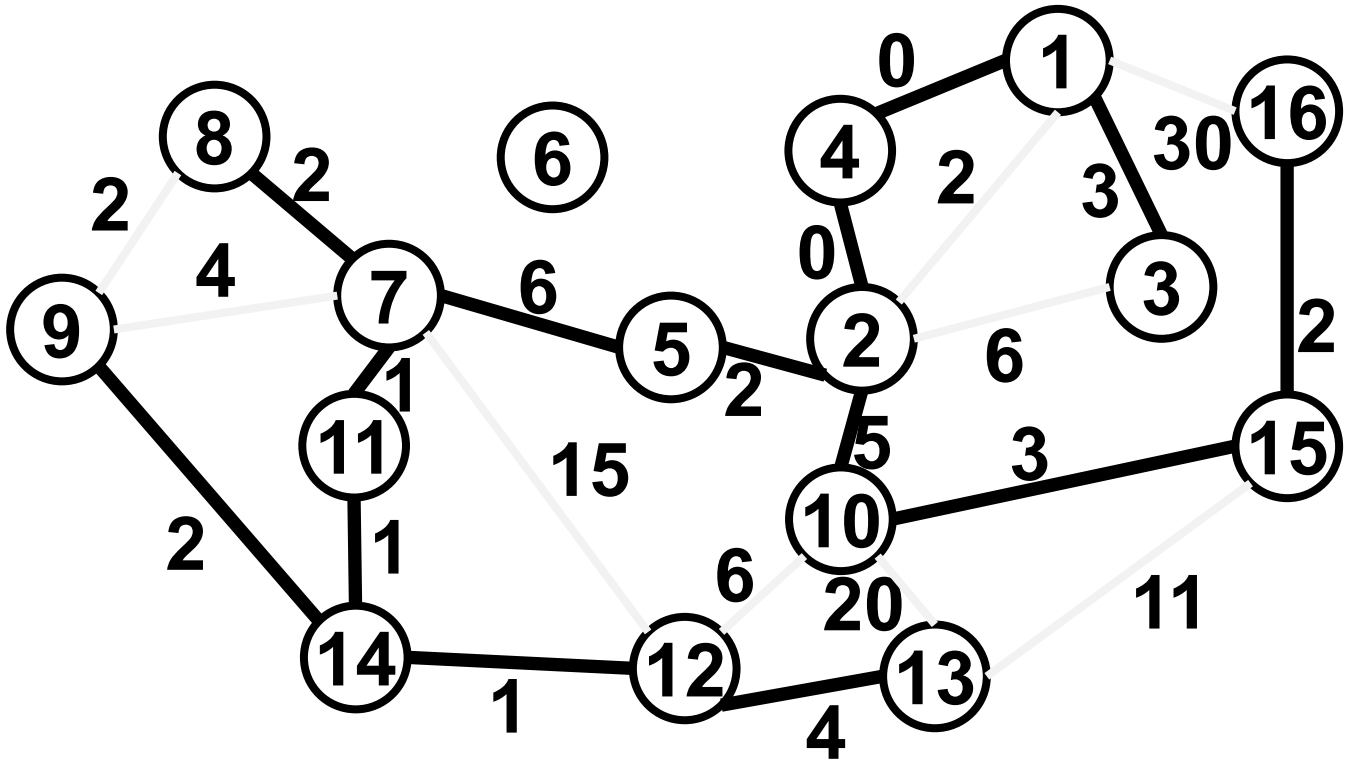

Algoritmul lui Kruskal

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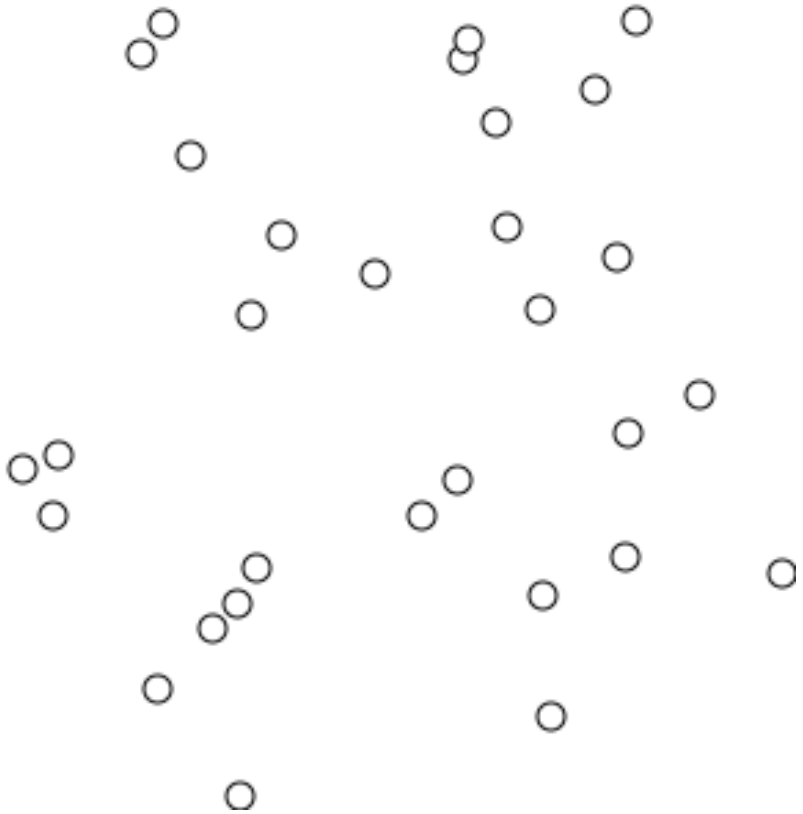

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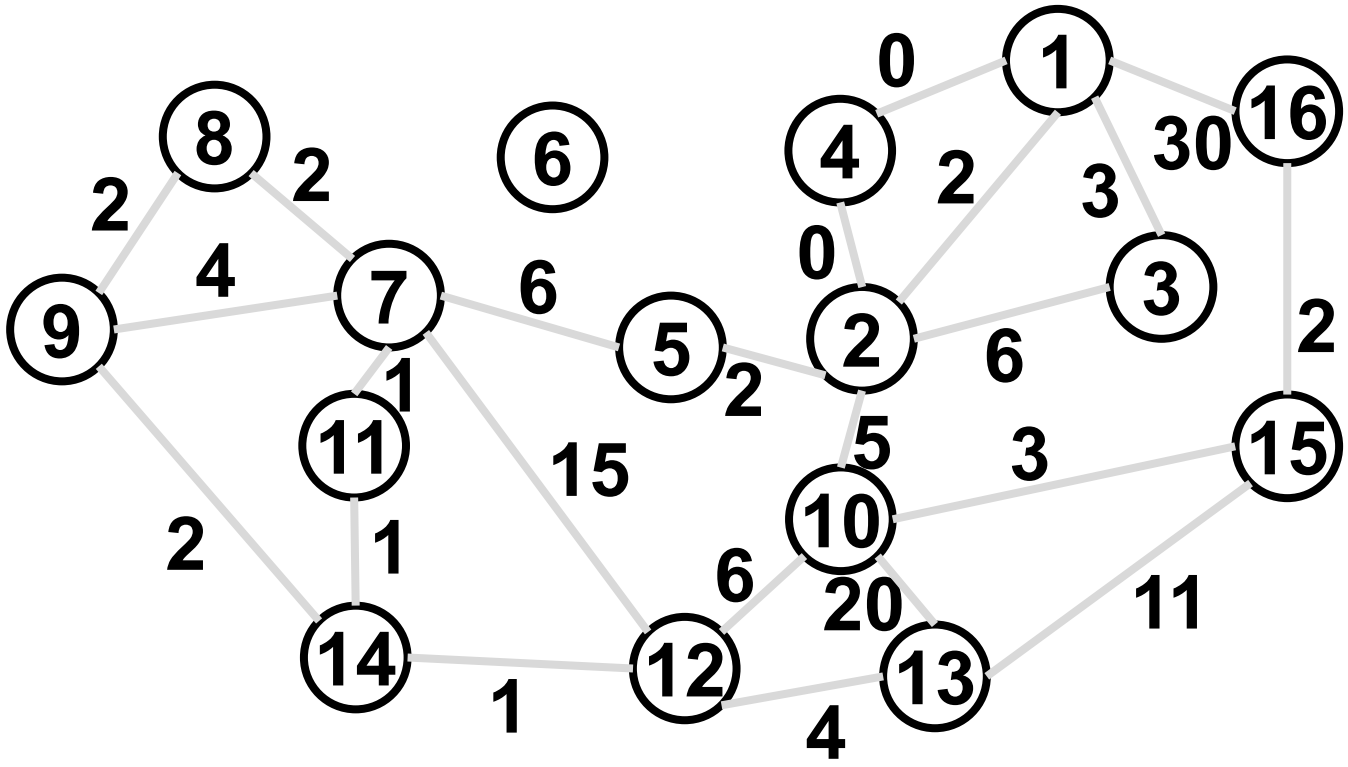

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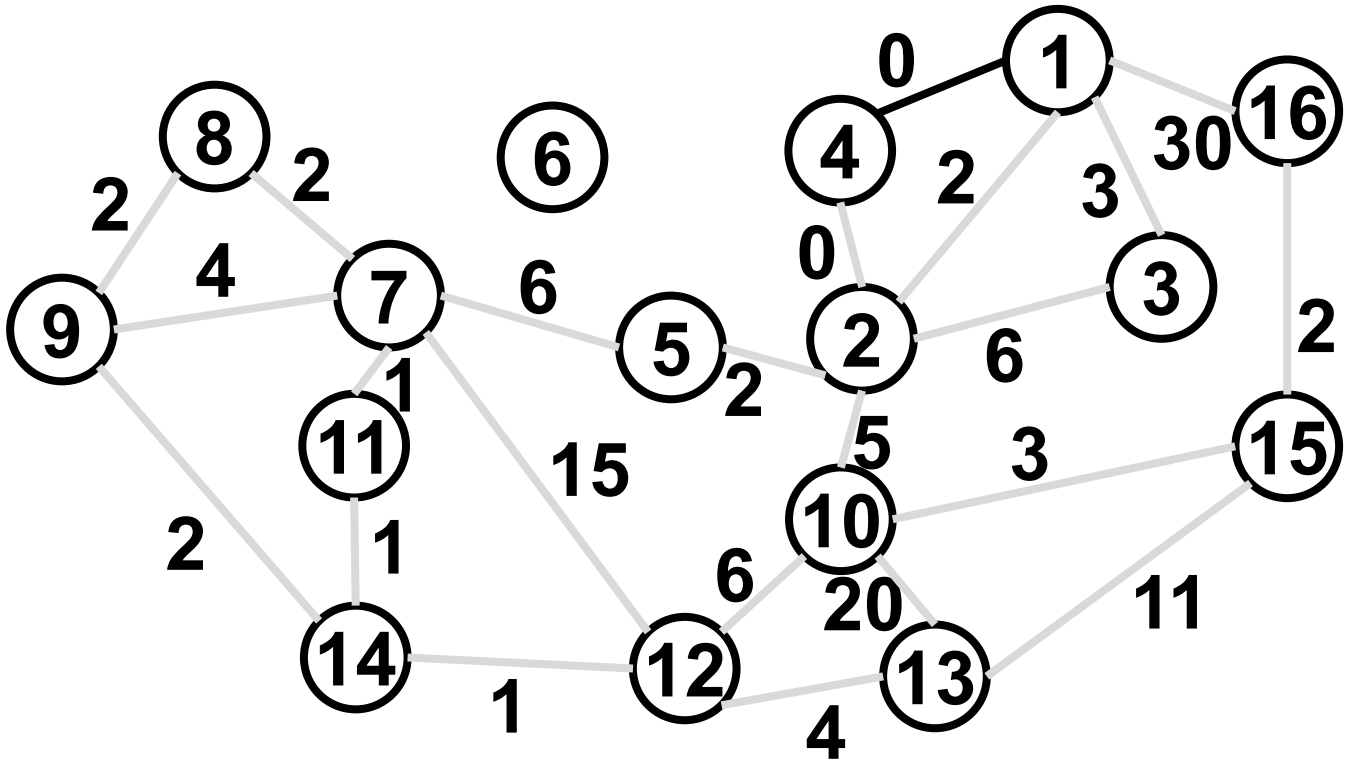

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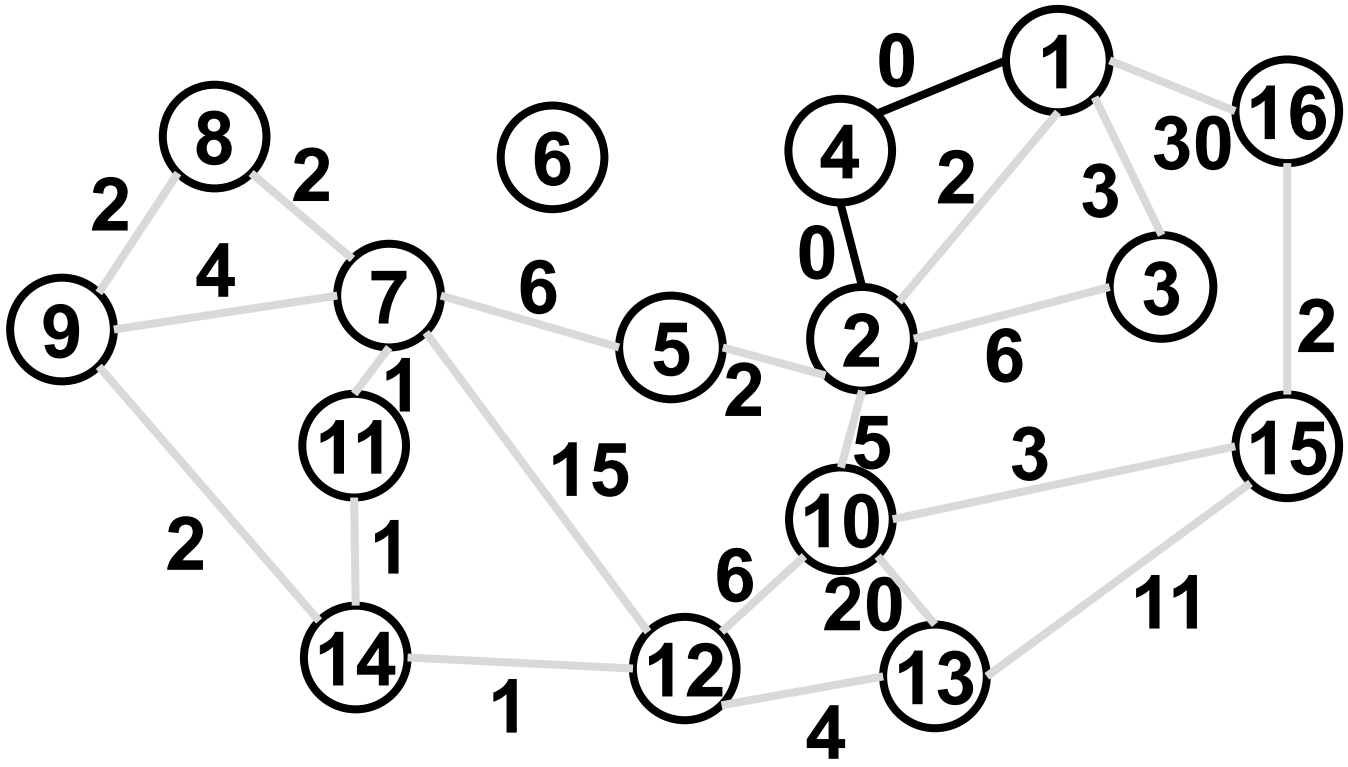

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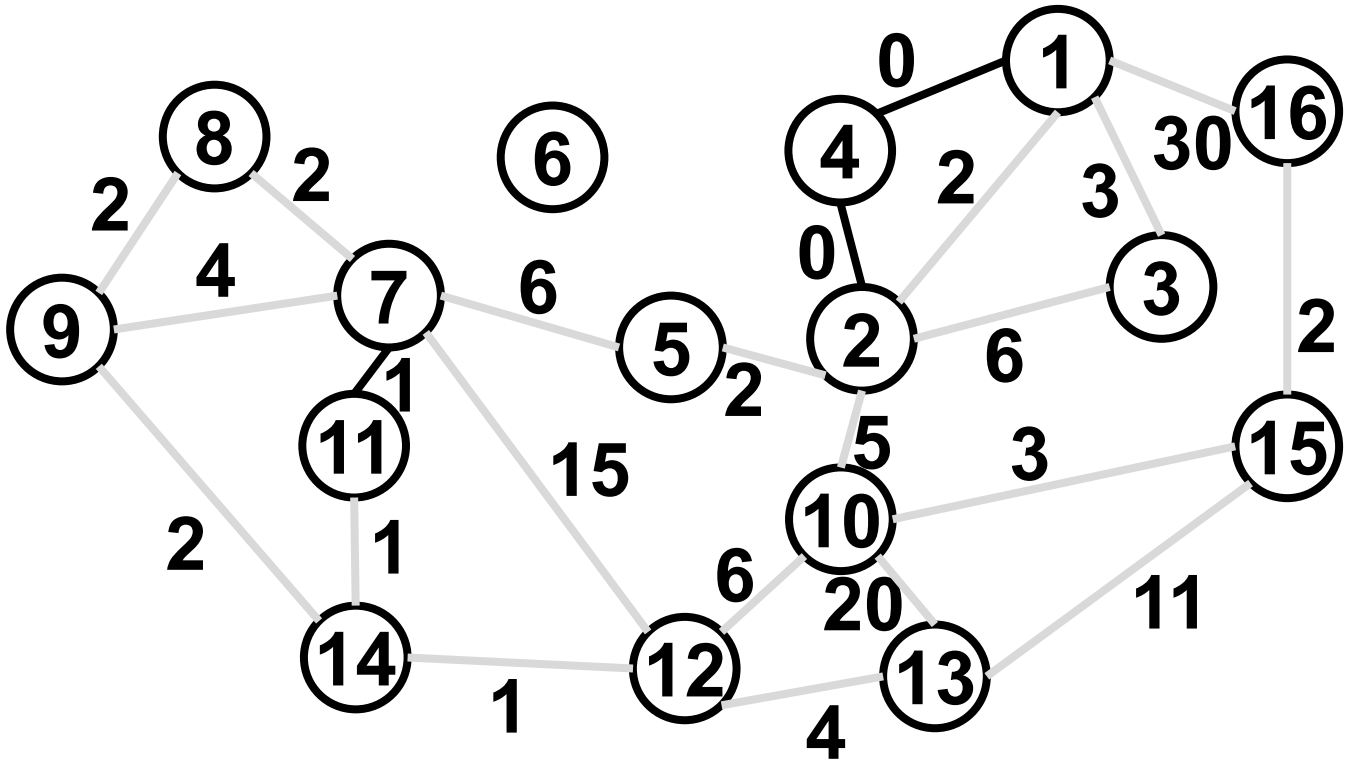

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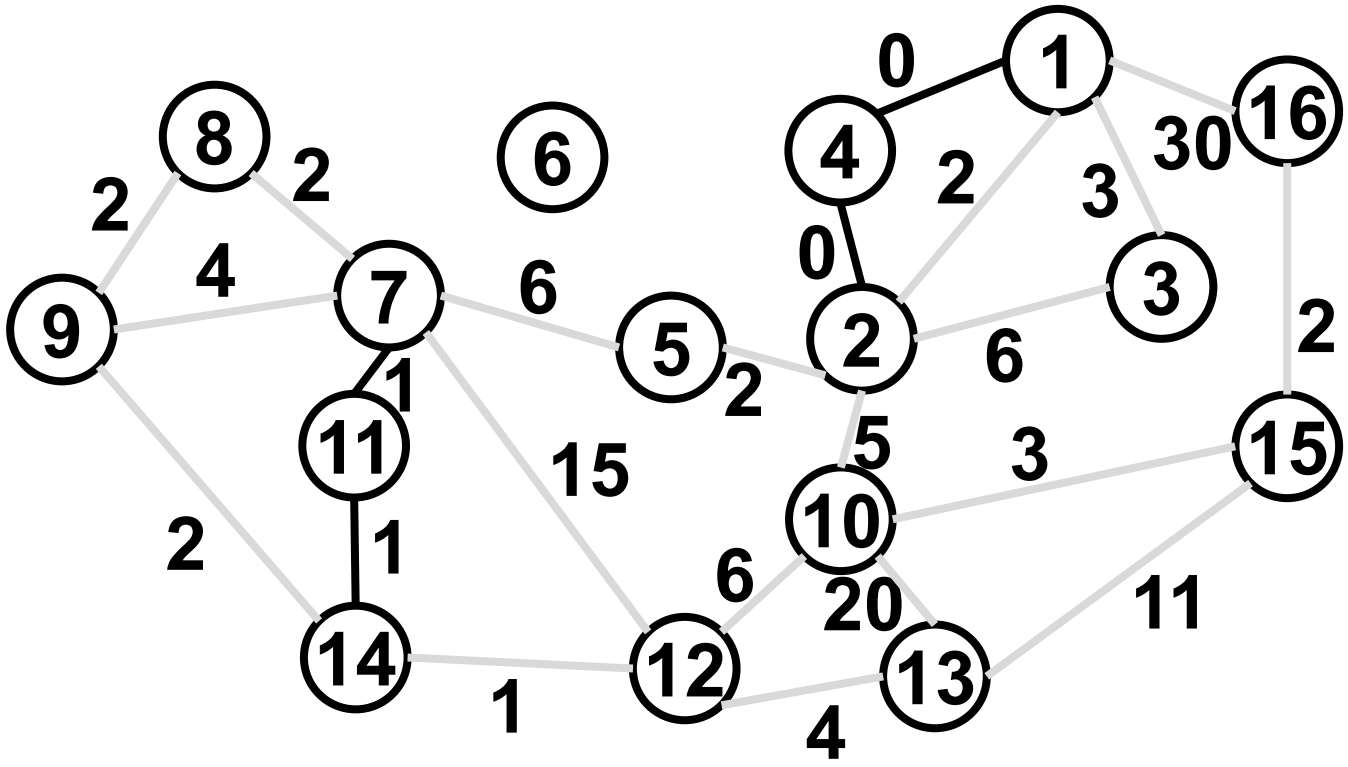

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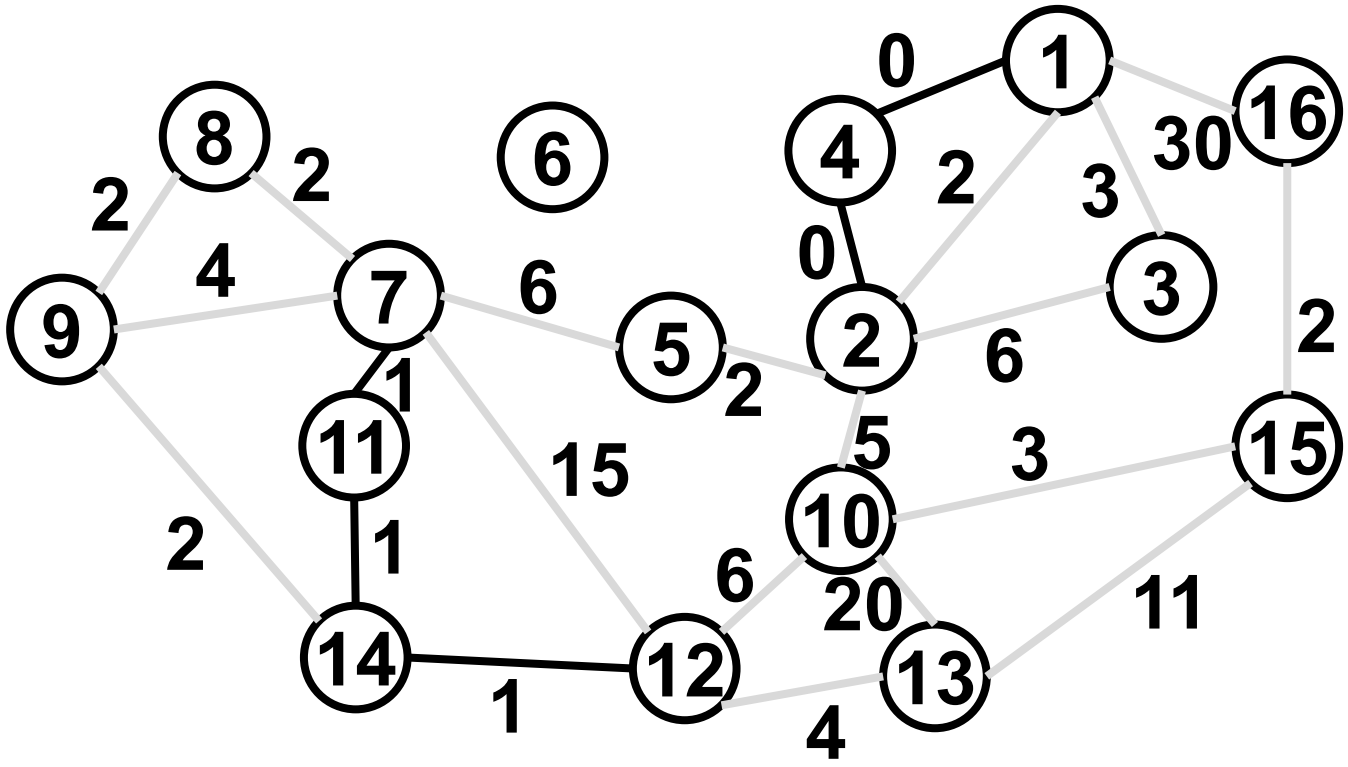

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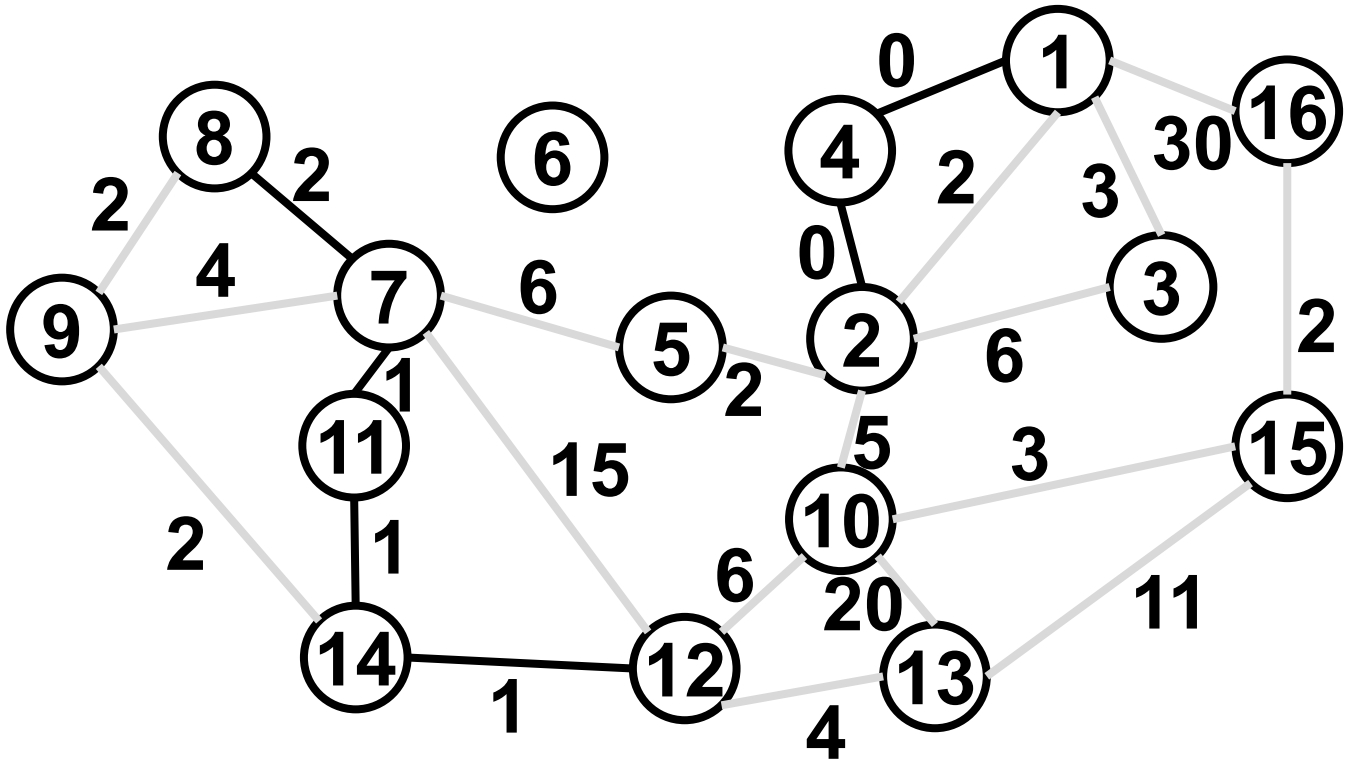

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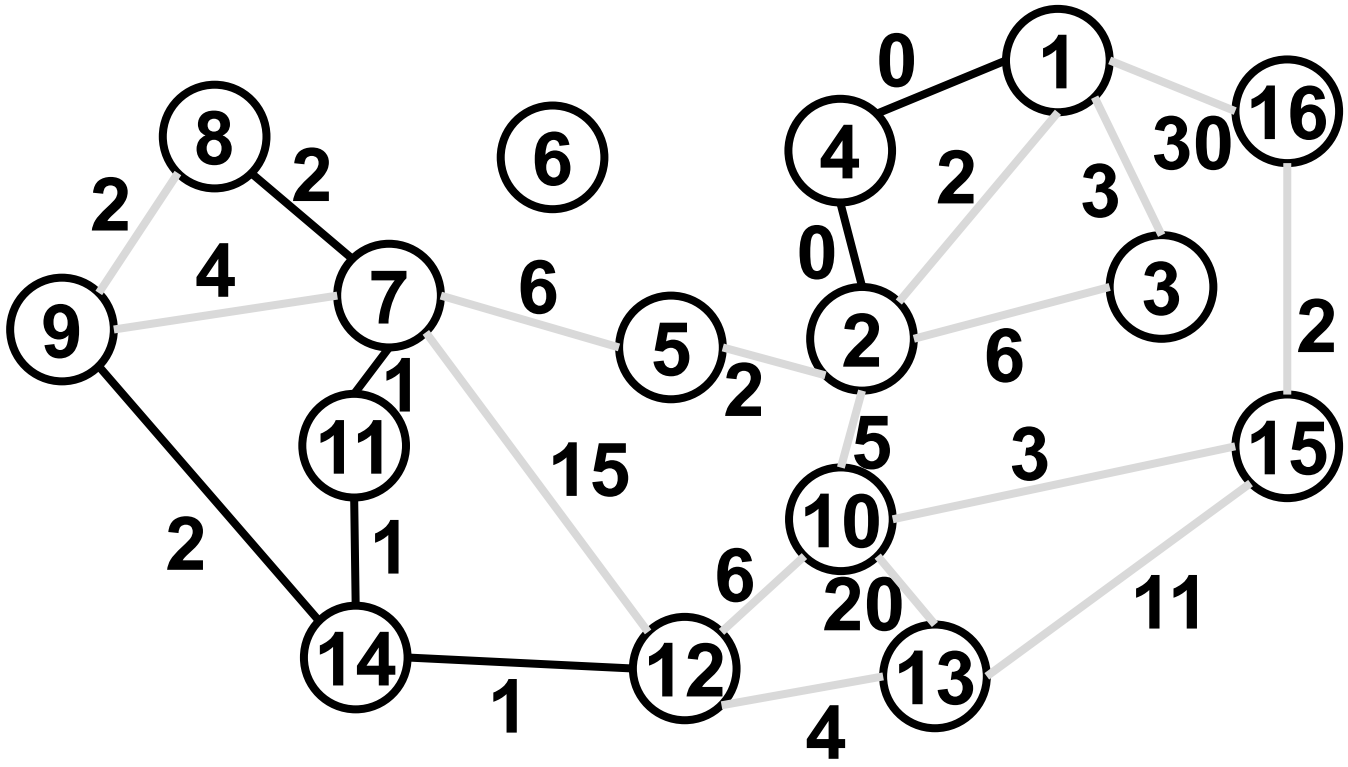

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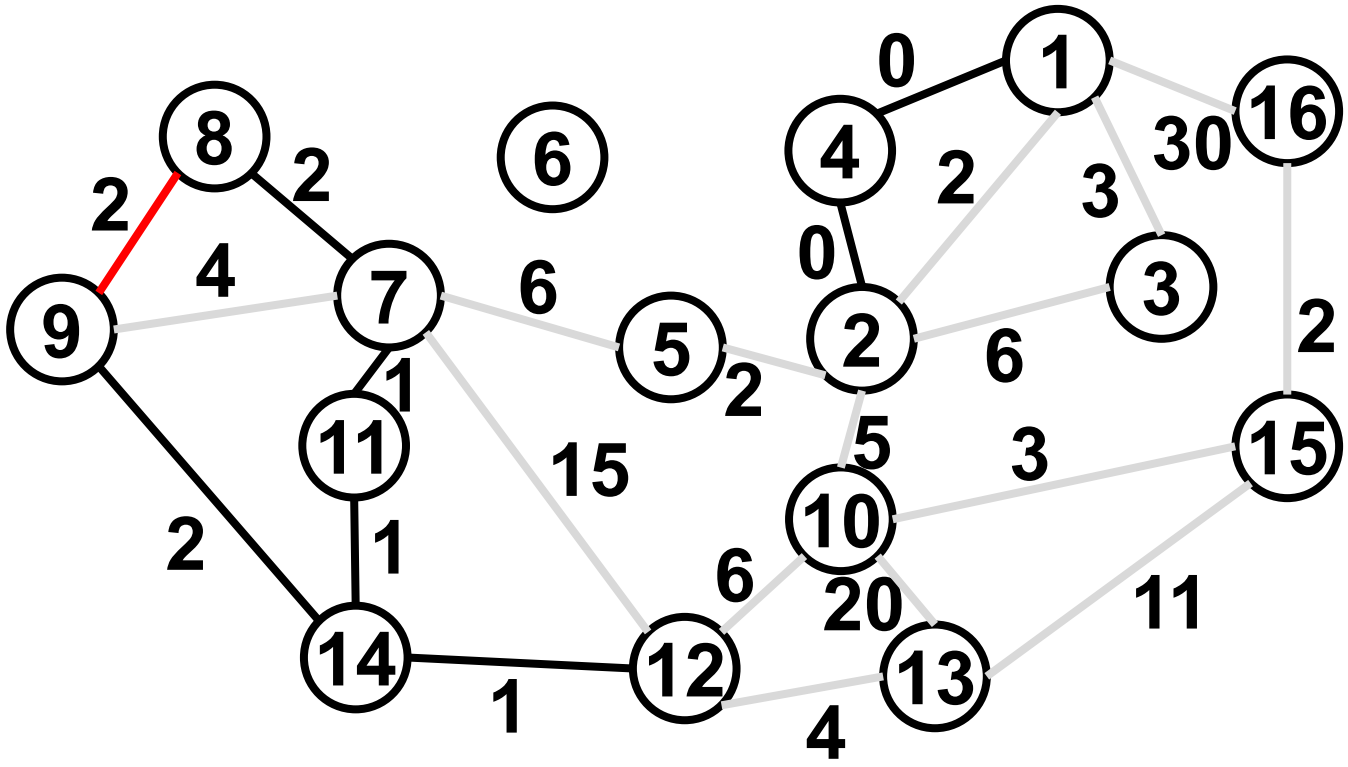

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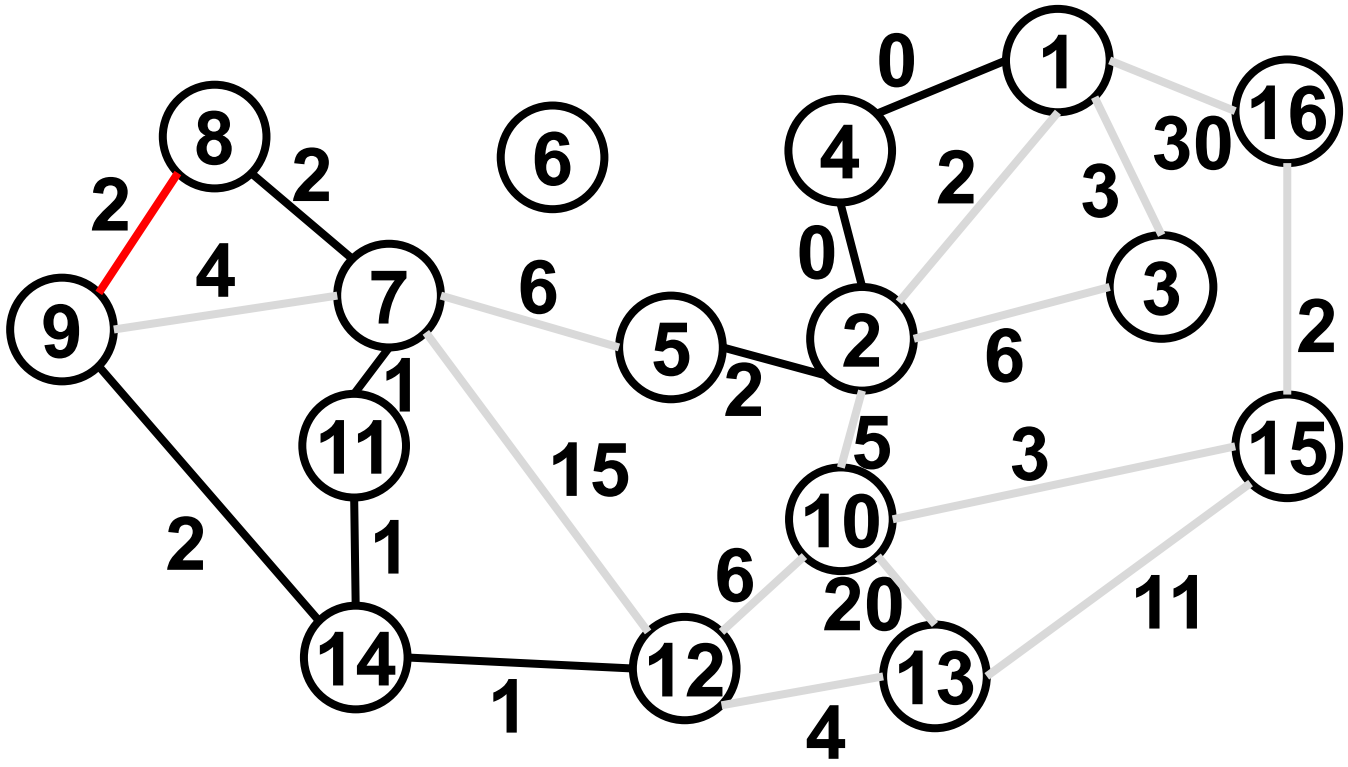

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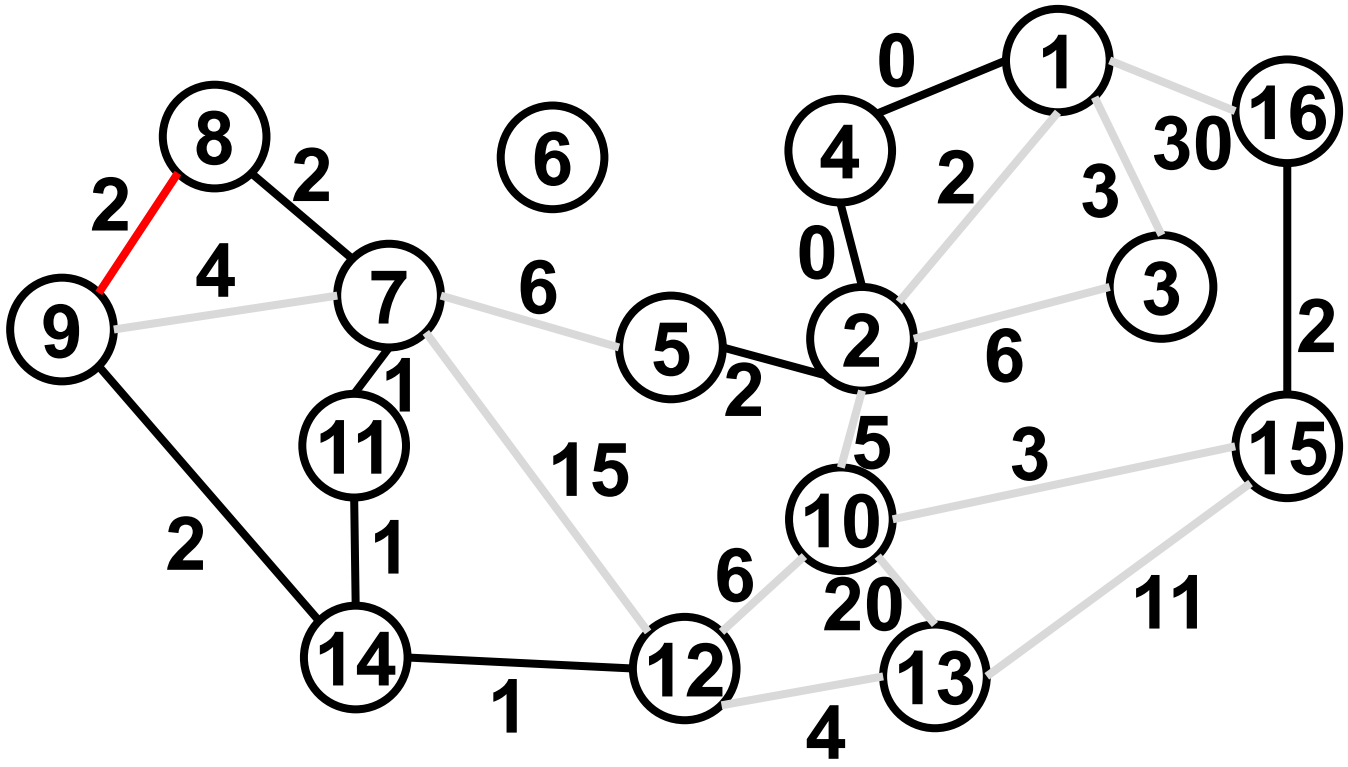

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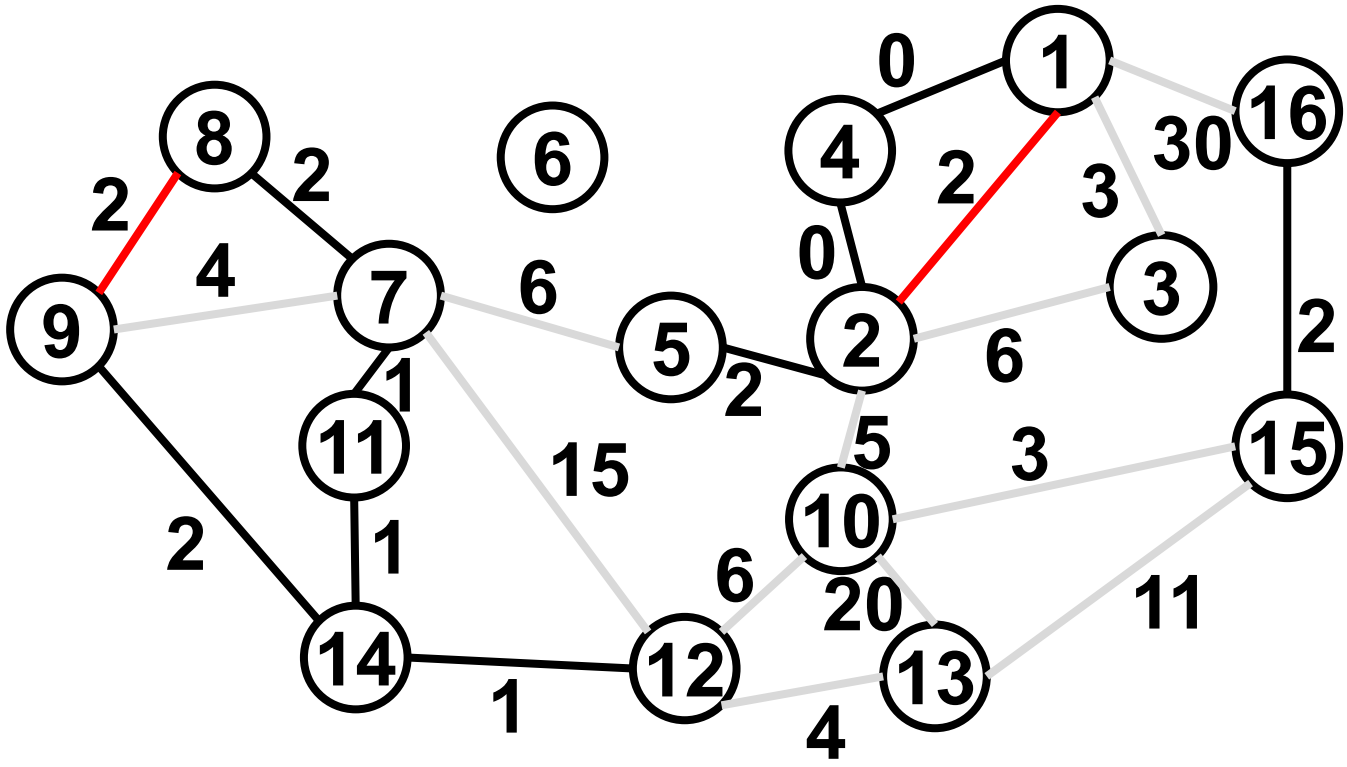

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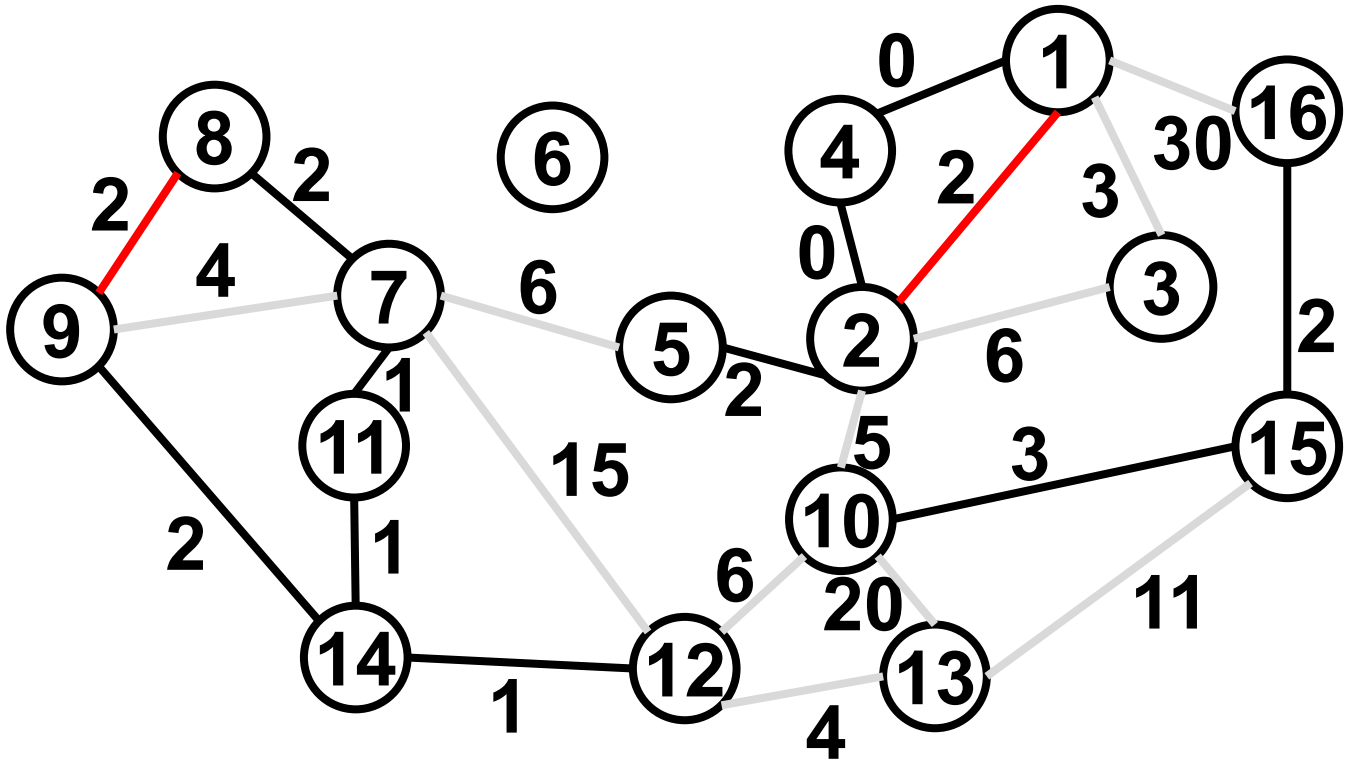

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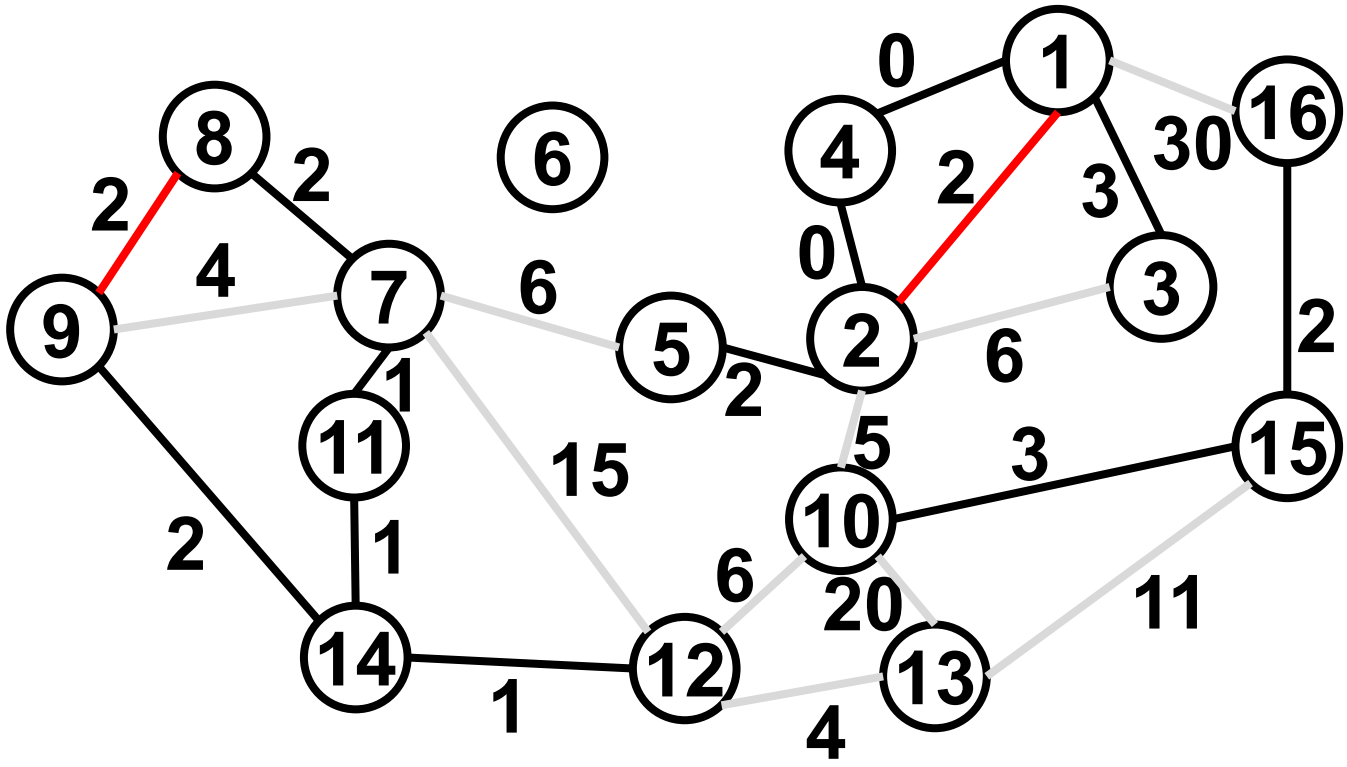

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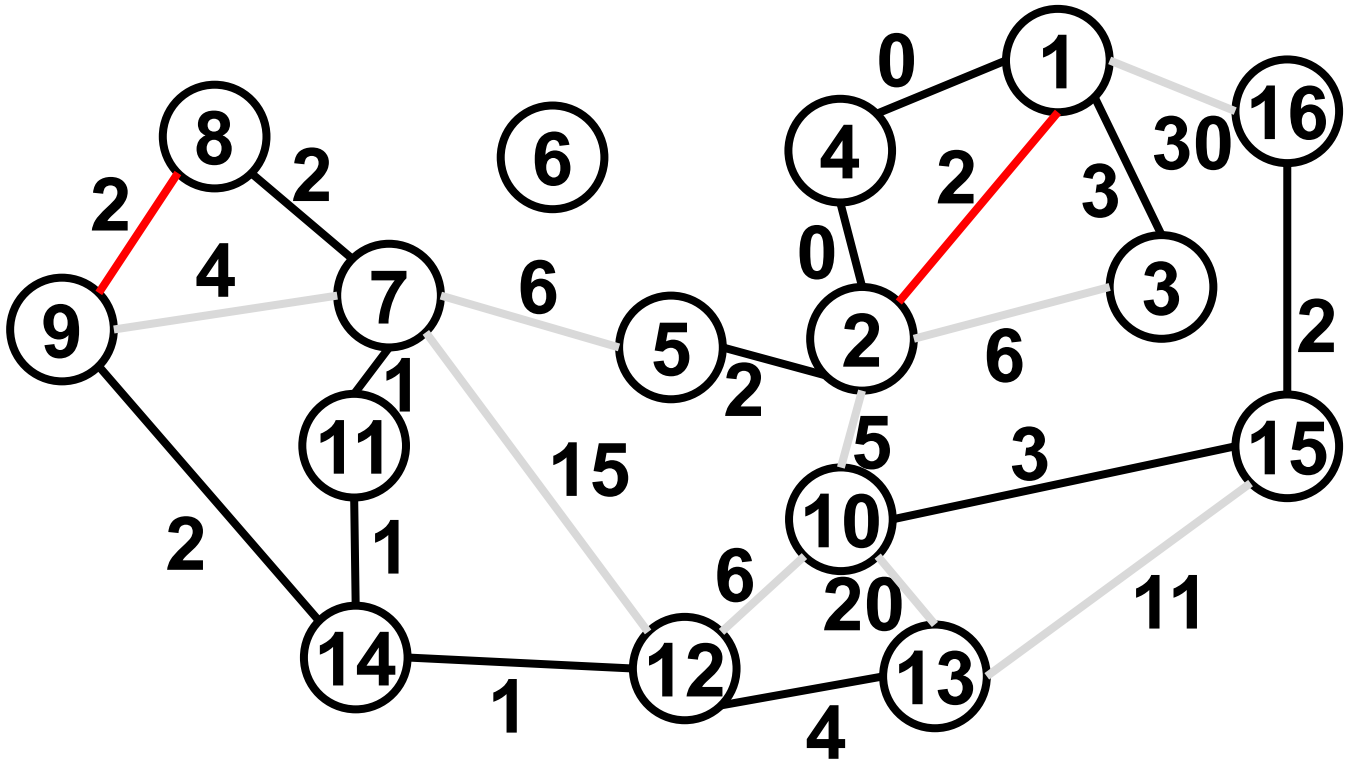

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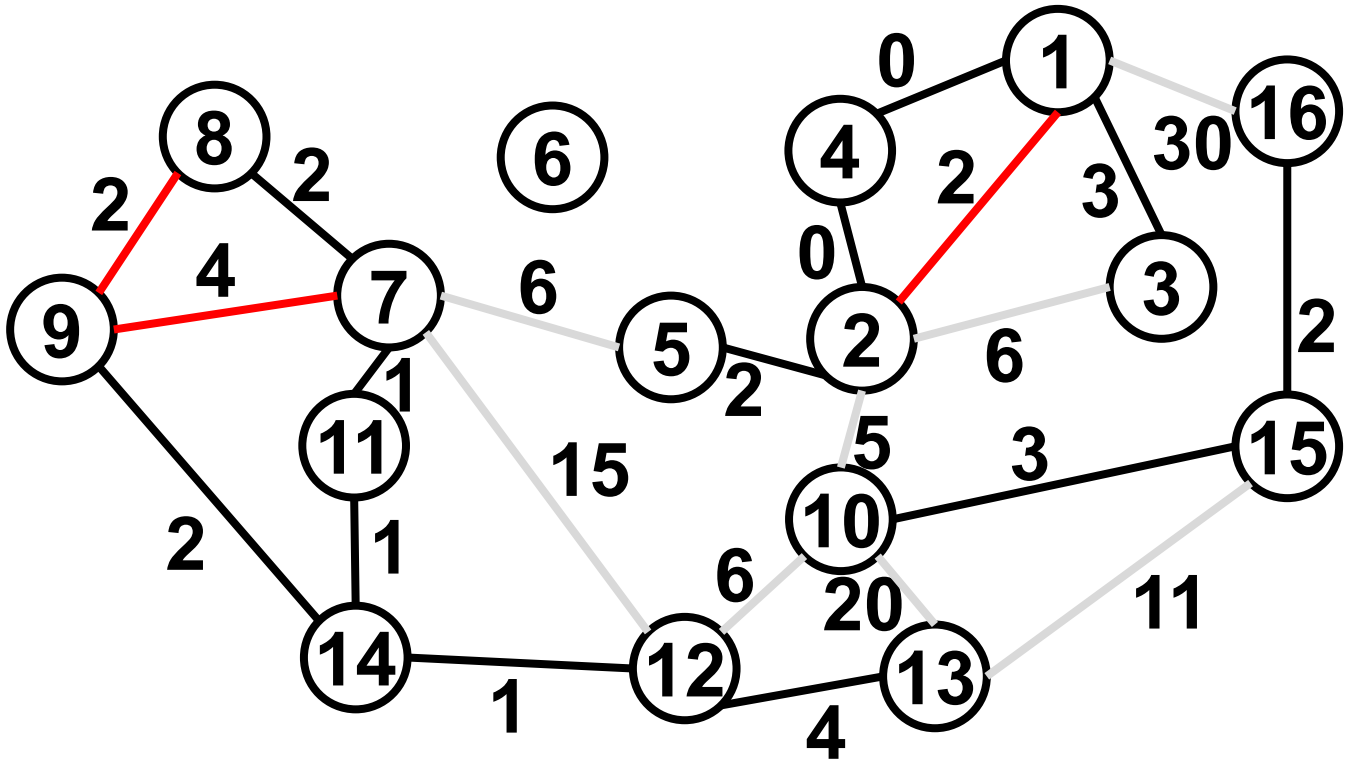

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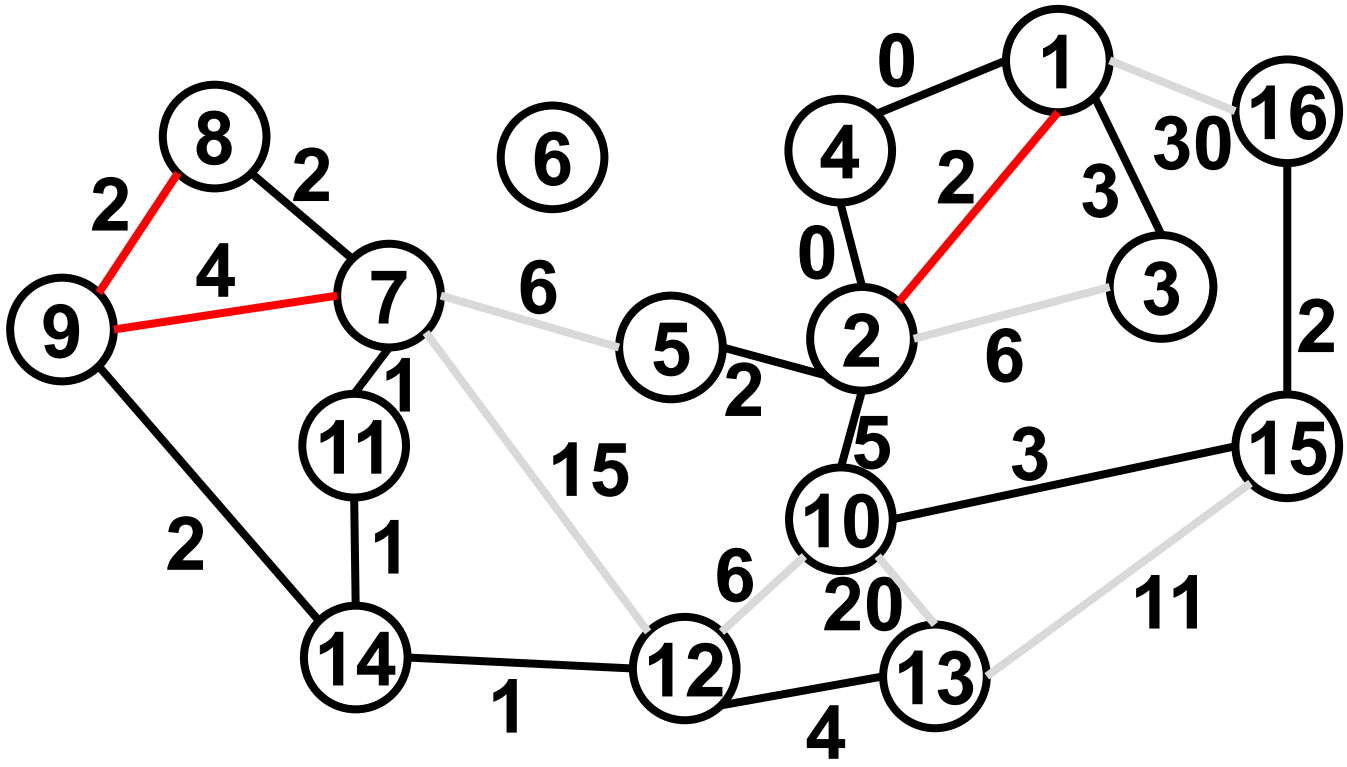

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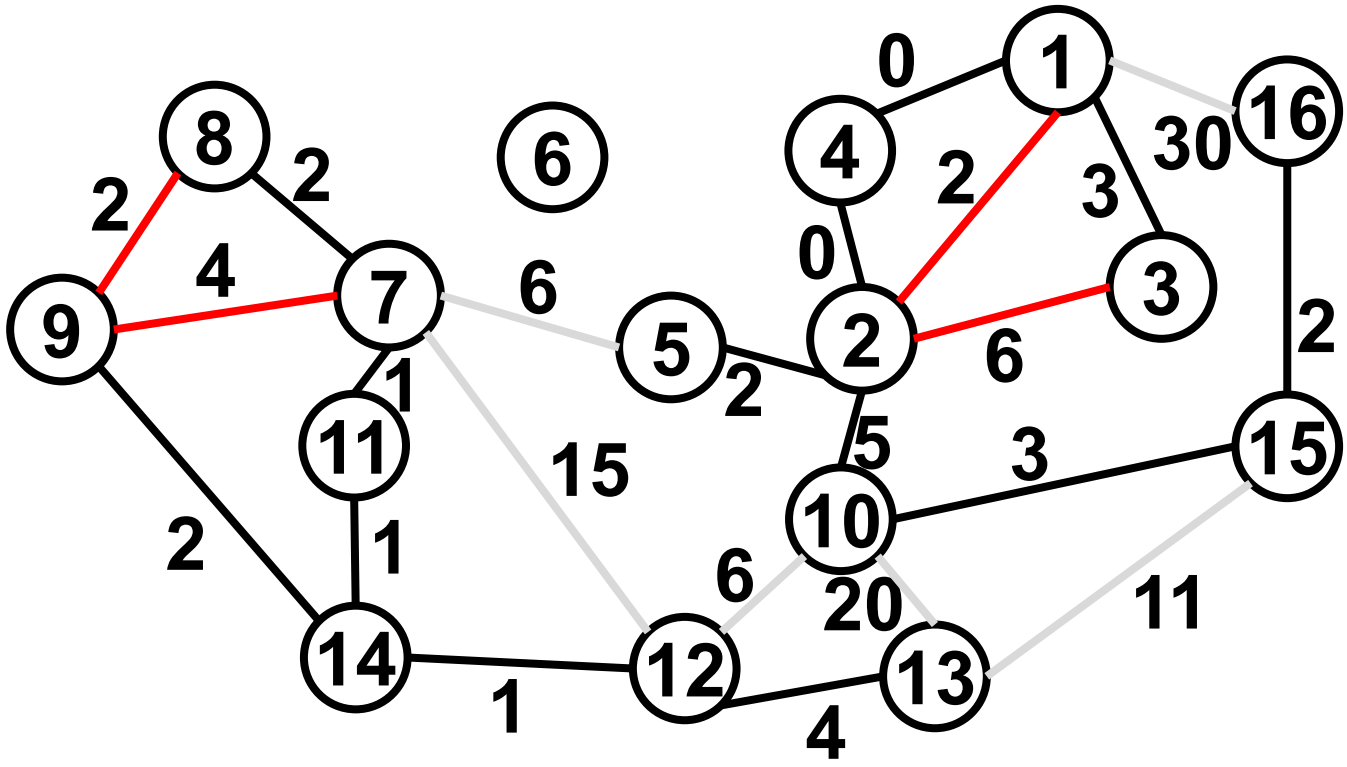

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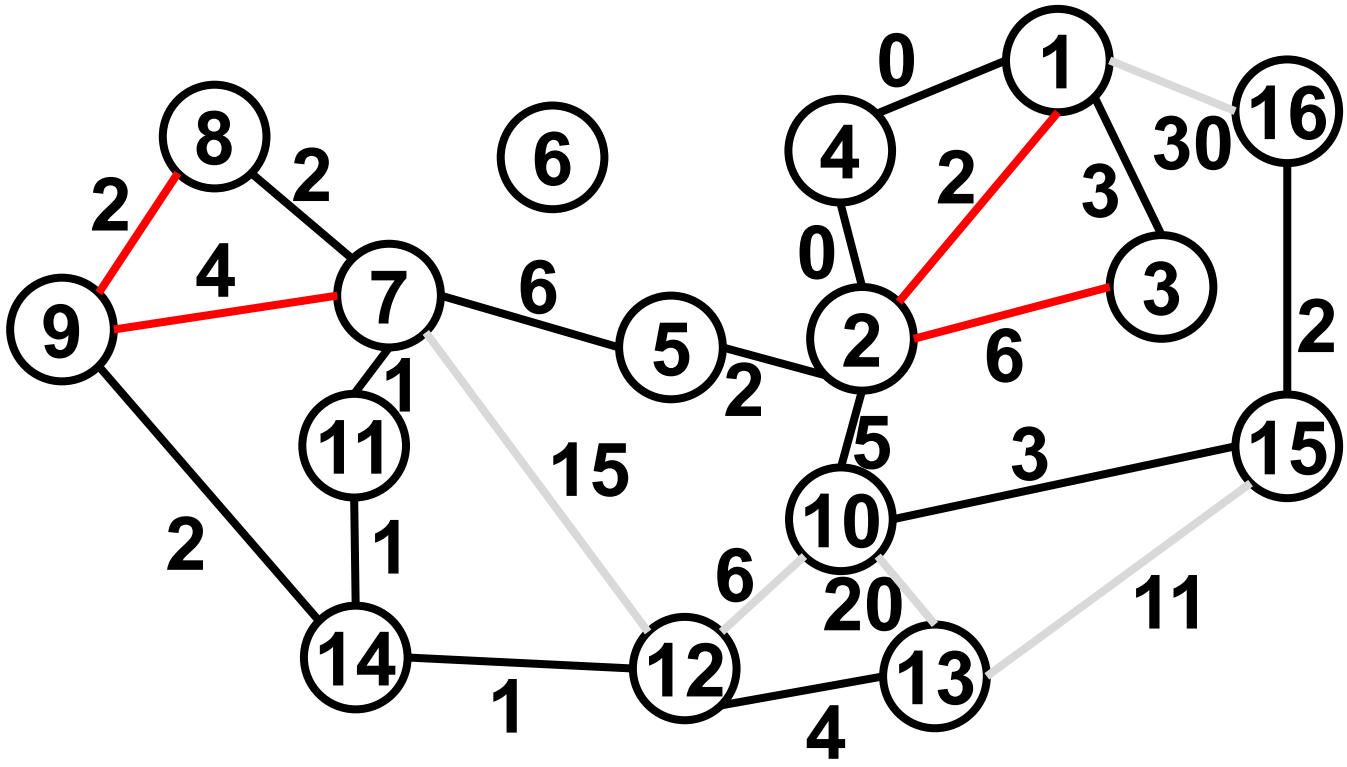

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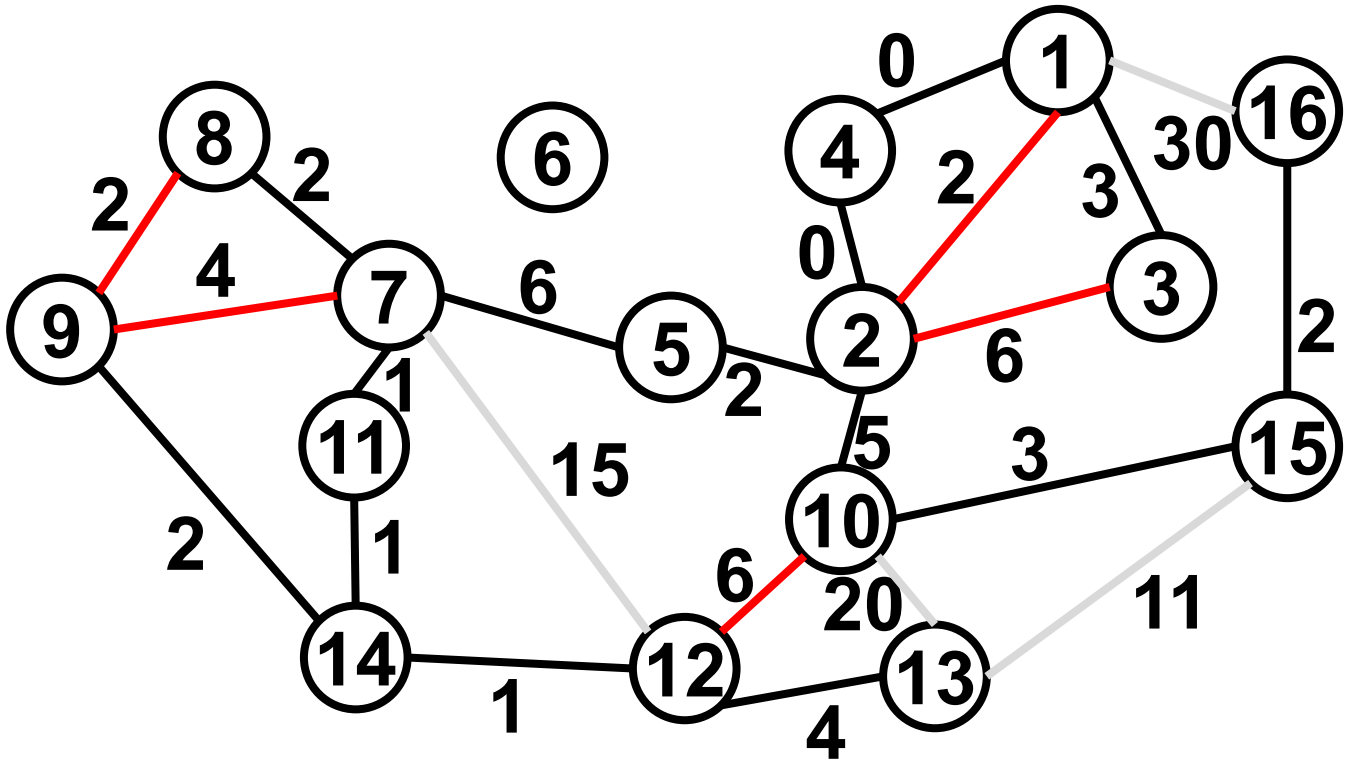

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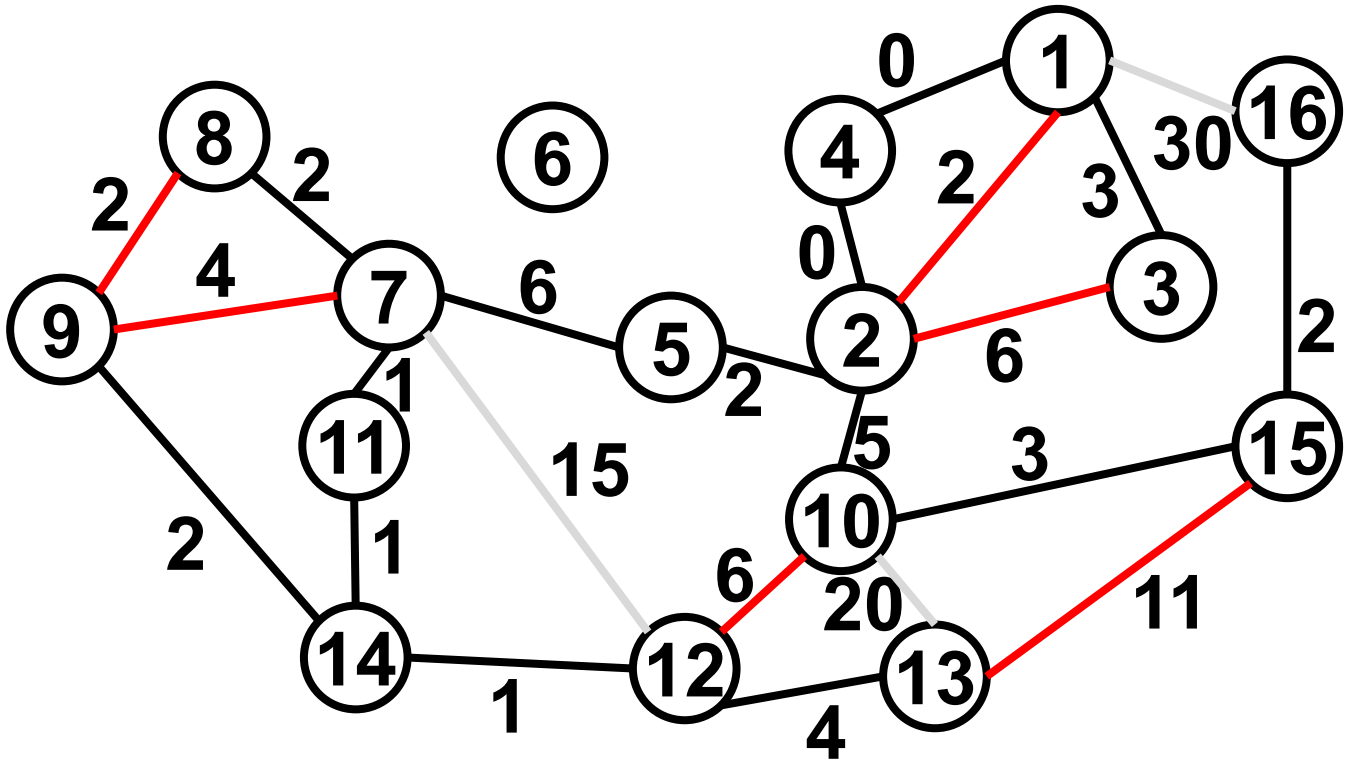

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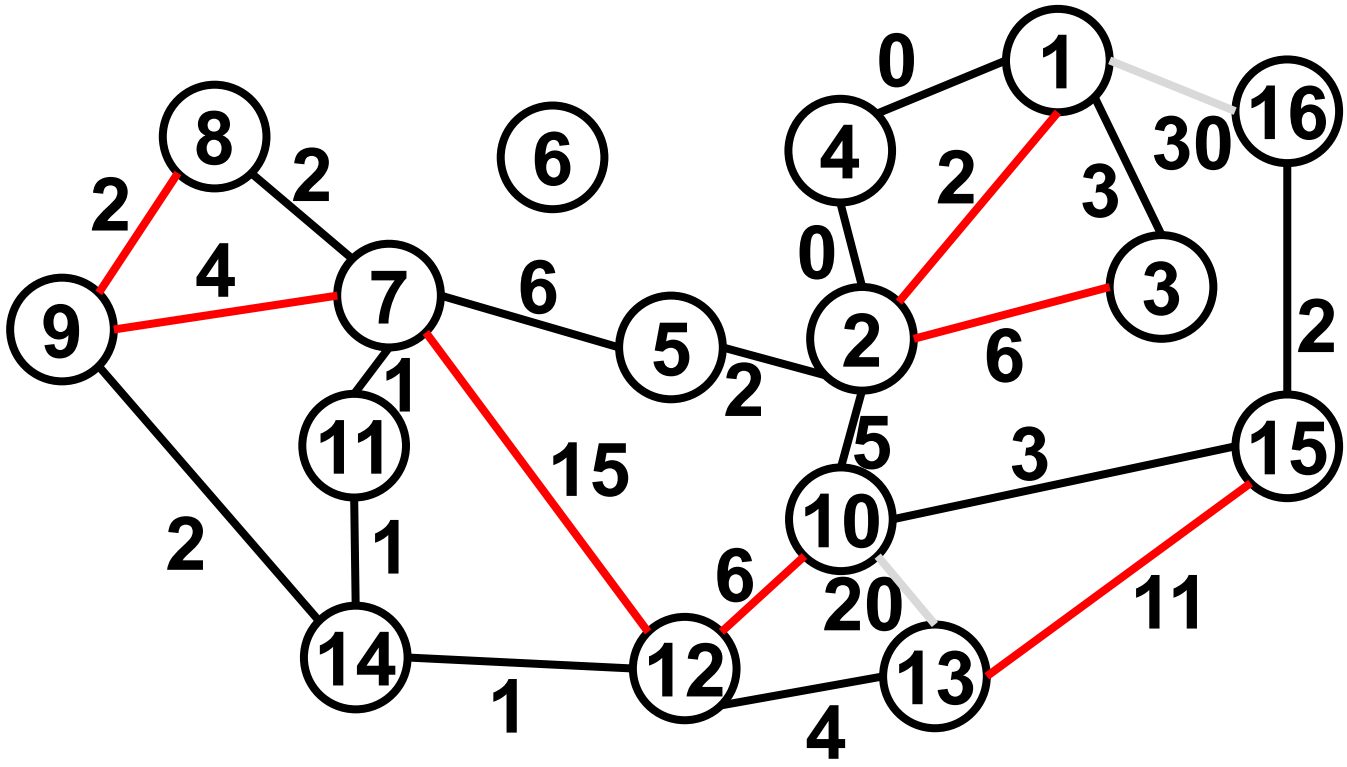

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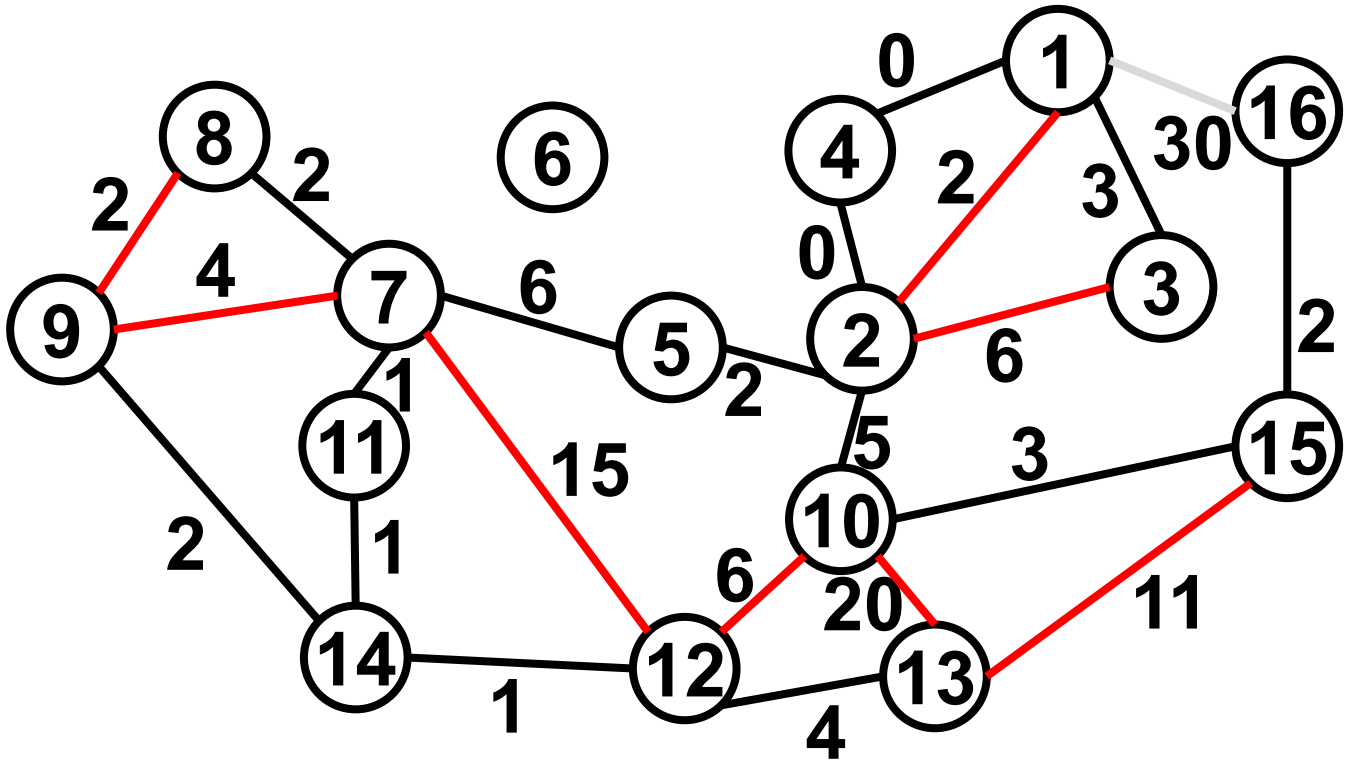

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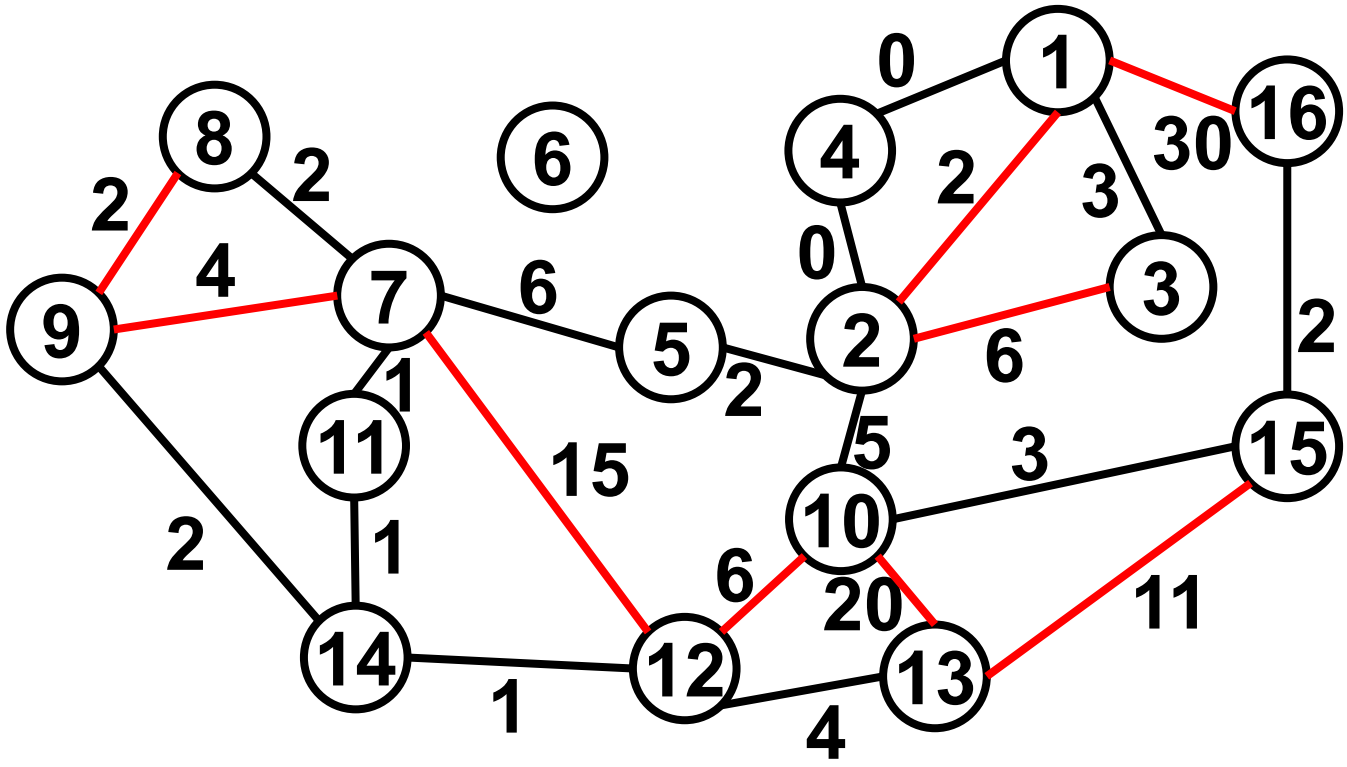

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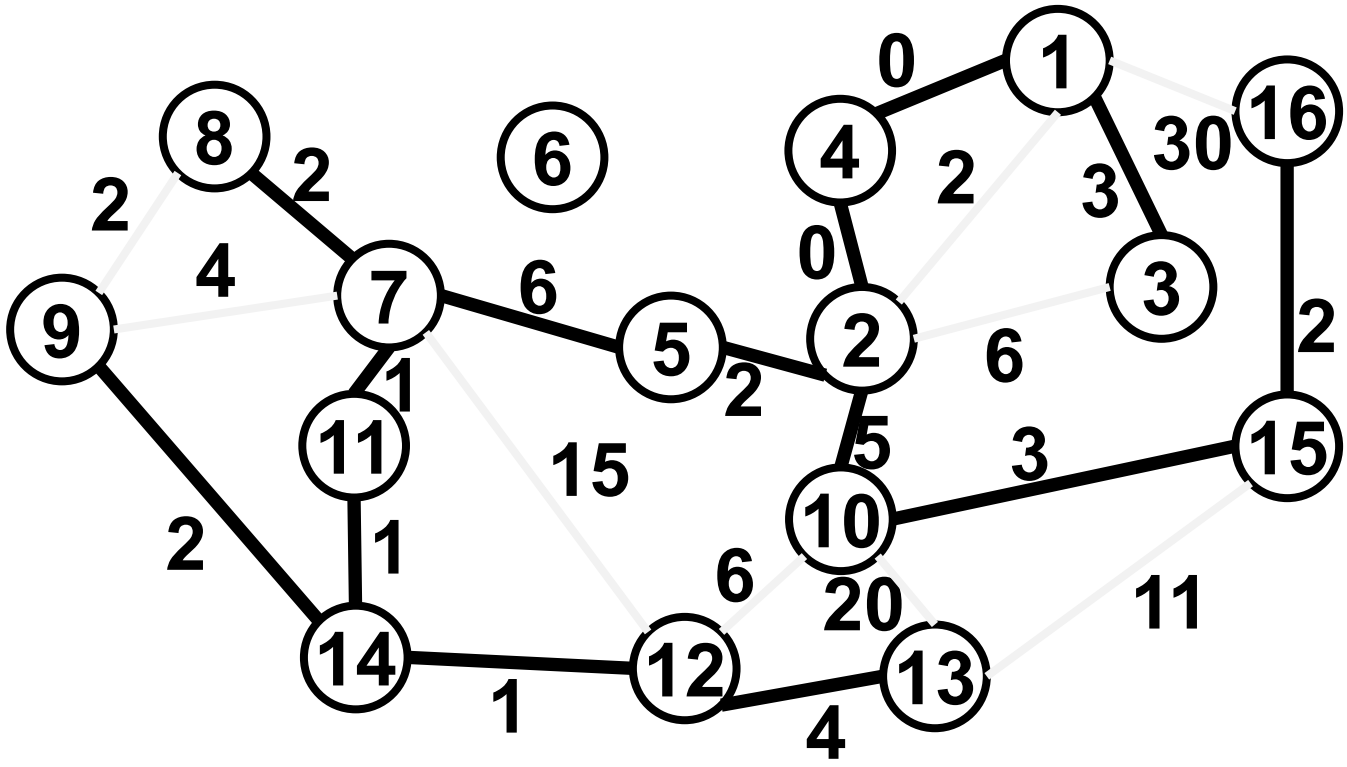

Complexitate?

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            Union(Find_set(u), Find_set(v));
        }
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```

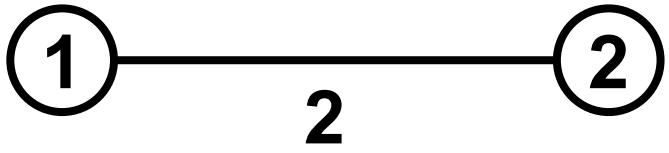
Complexitate?

$$O(Elog(E))$$

Flux maxim

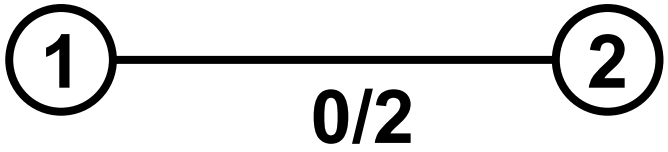
Graf capacitate

- 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.



  - Similar apei/curentului, cu cât capacitatea e mai mare cu atât e mai ușor de parcurs.

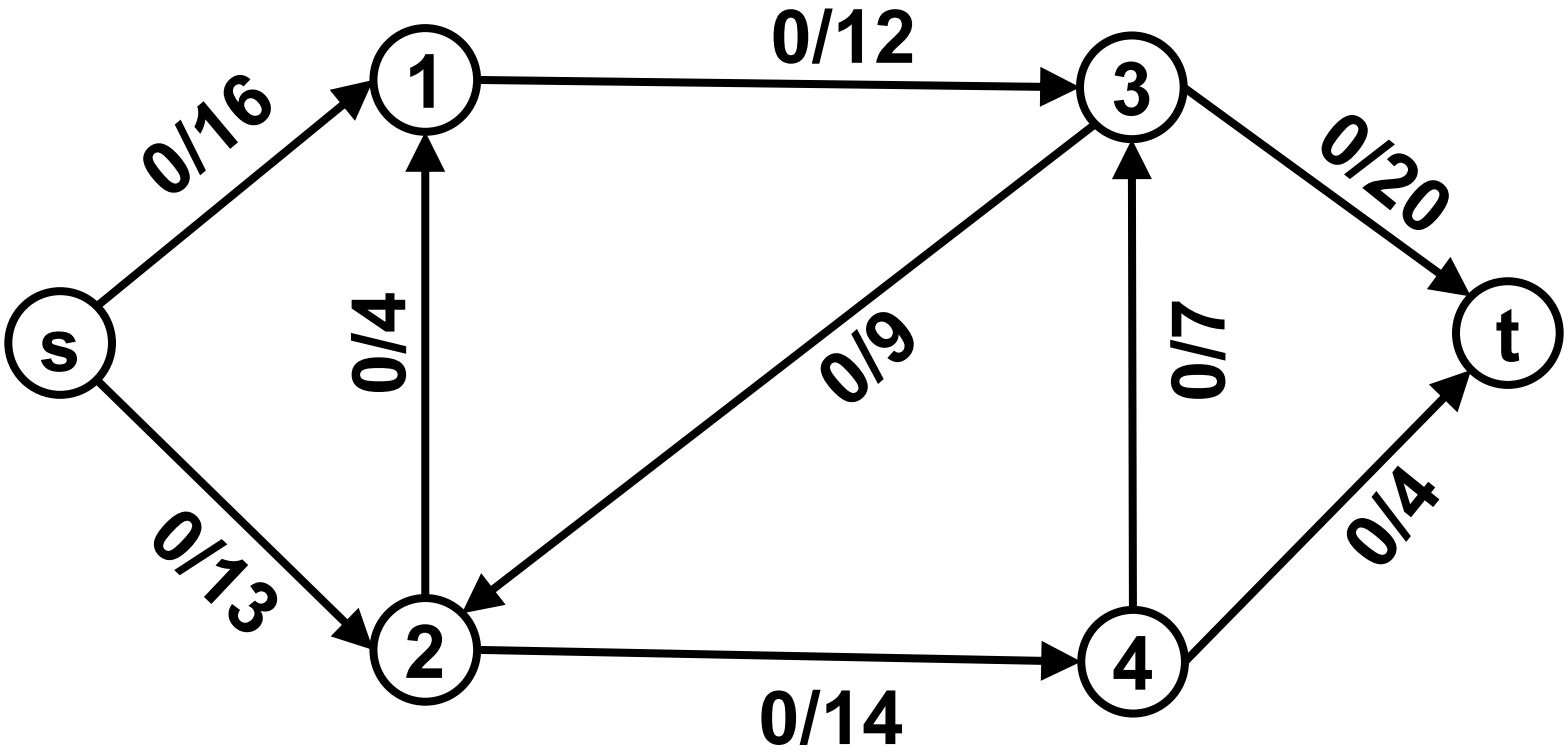
- Șoselele au și distanță și capacitate (număr benzi/viteză max)

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) ∈ 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) 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



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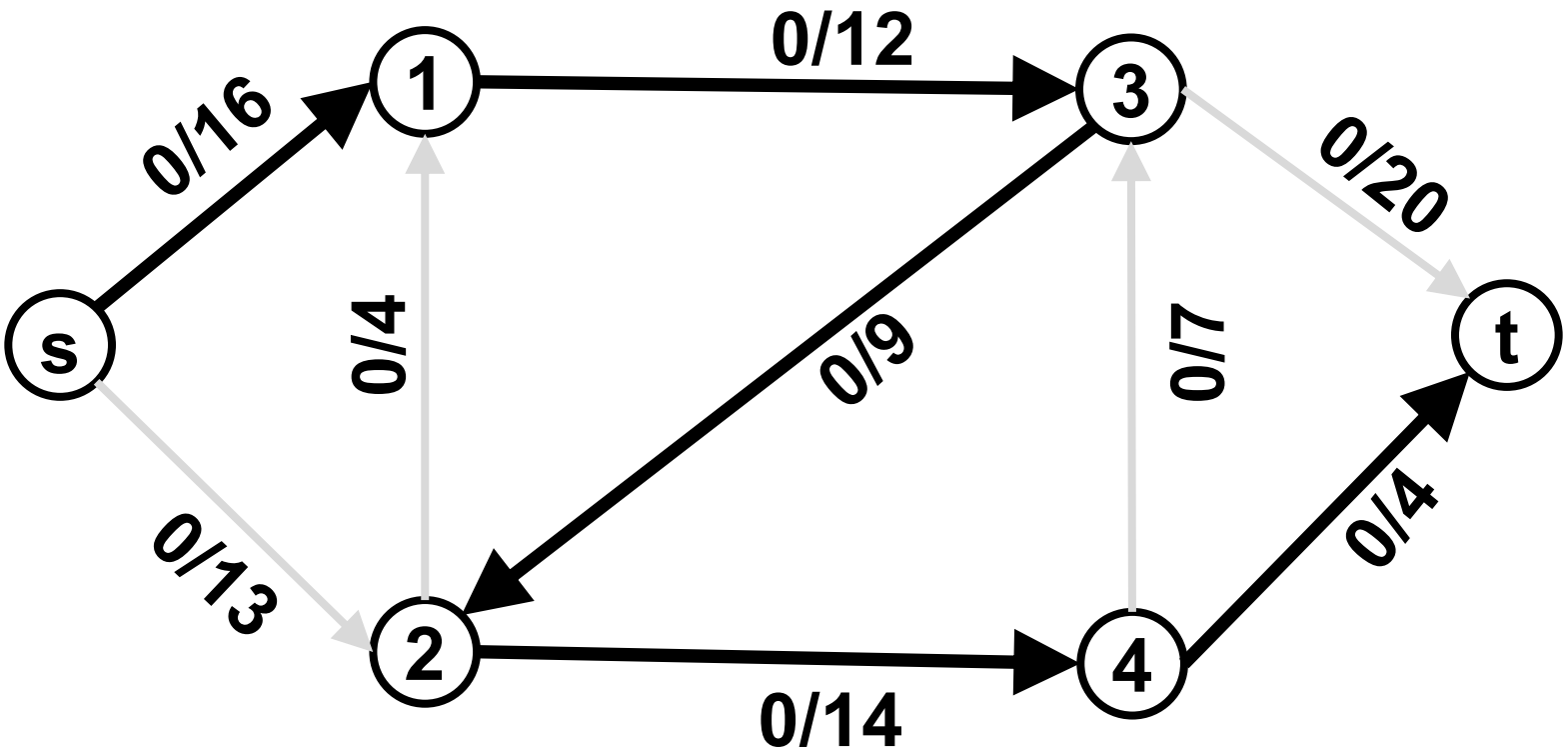

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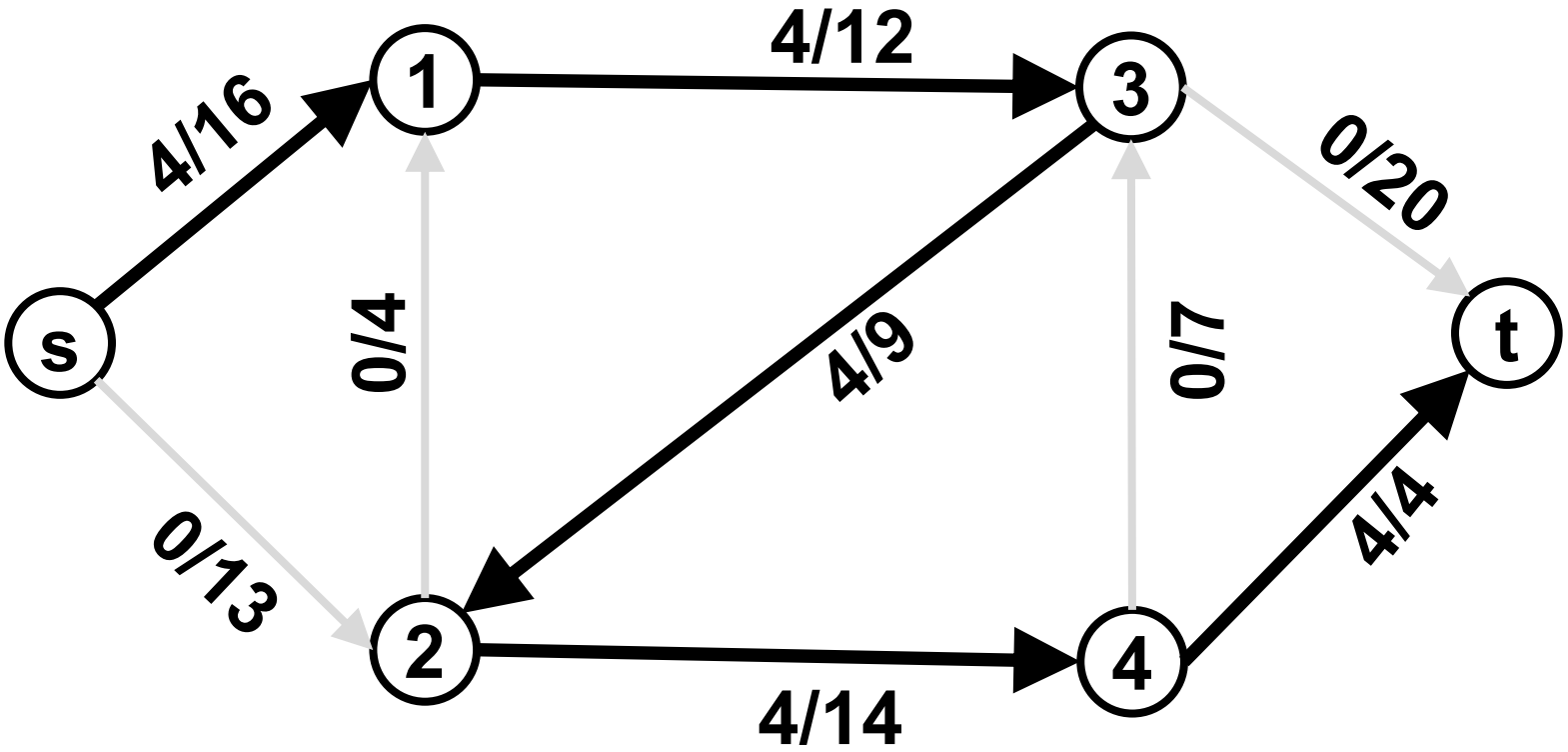

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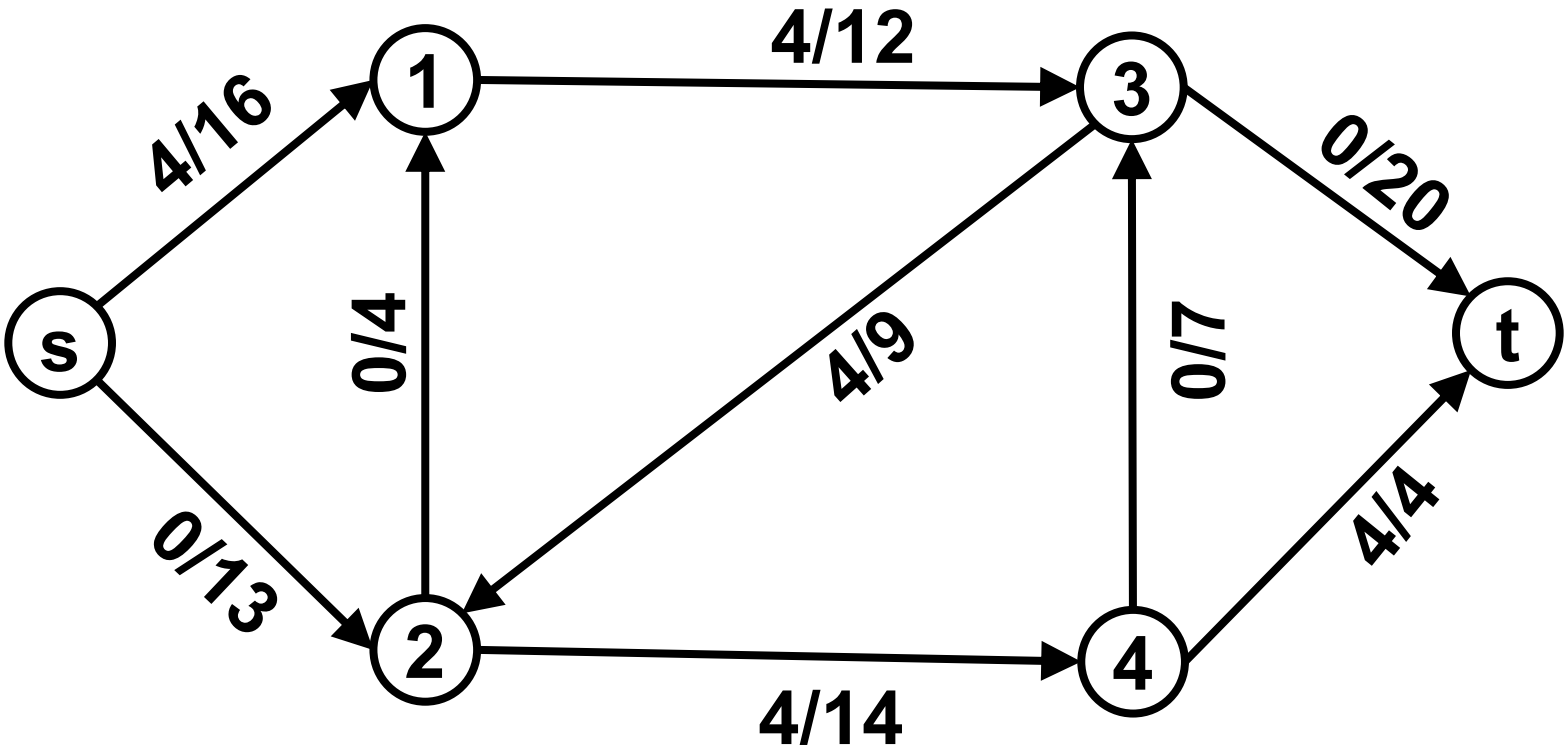

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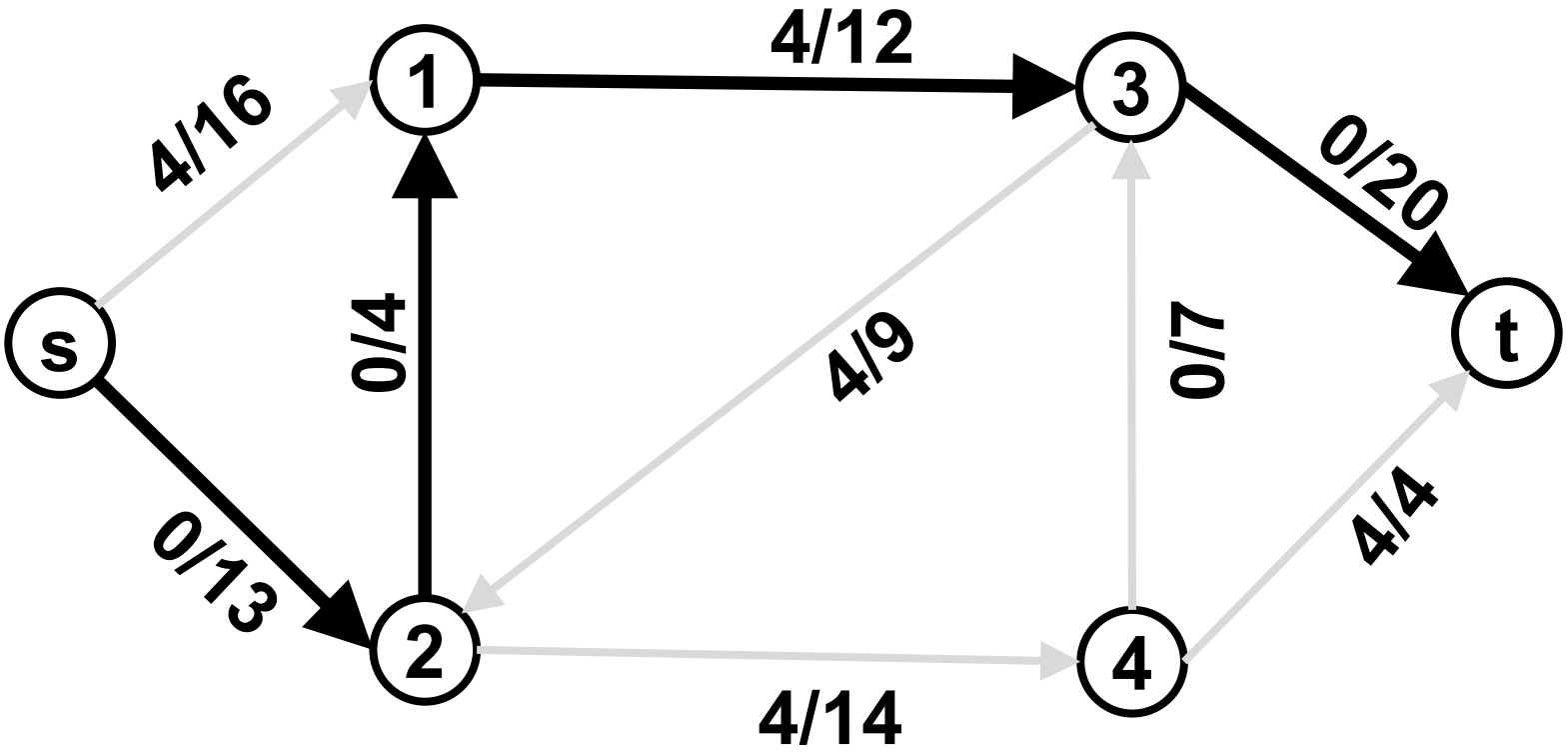

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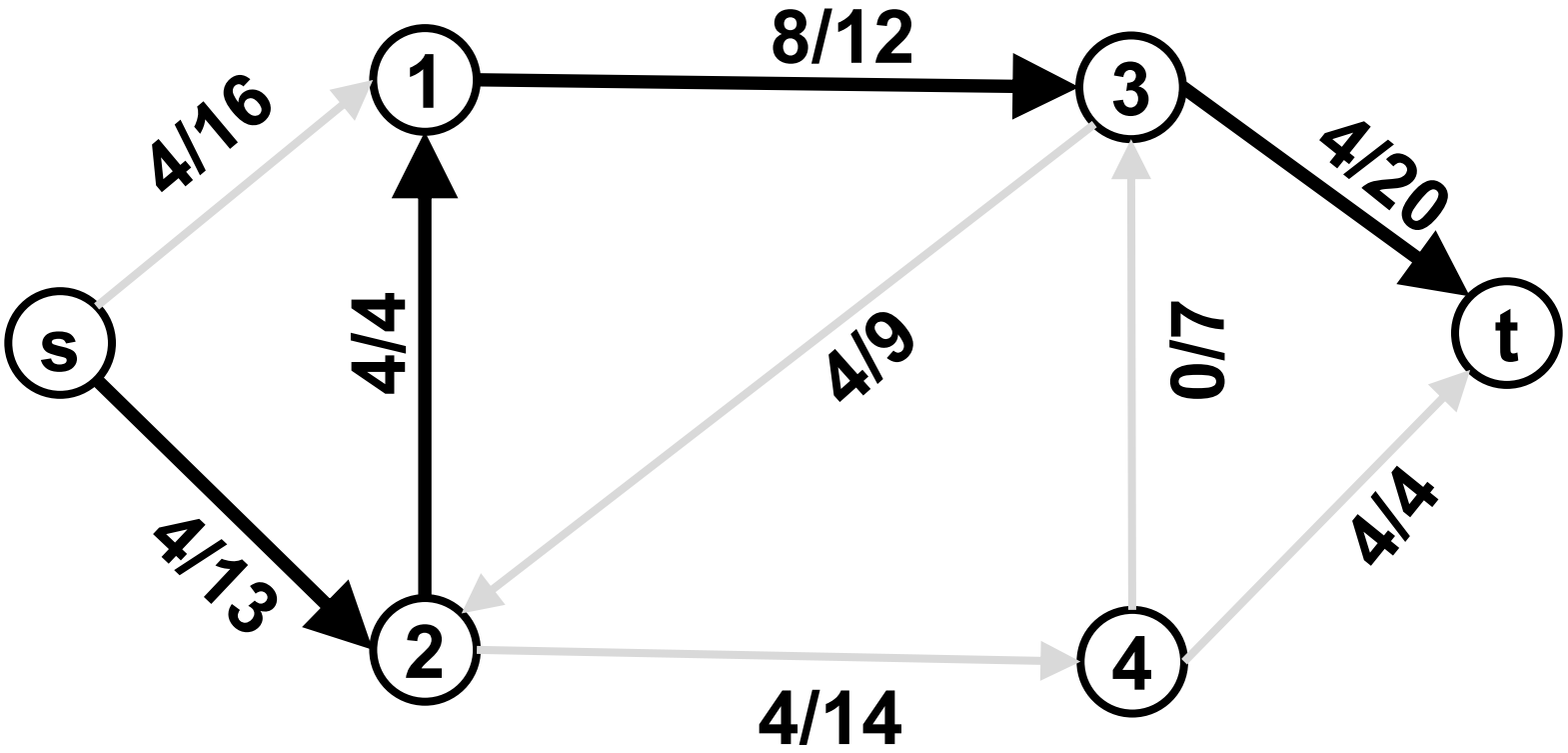

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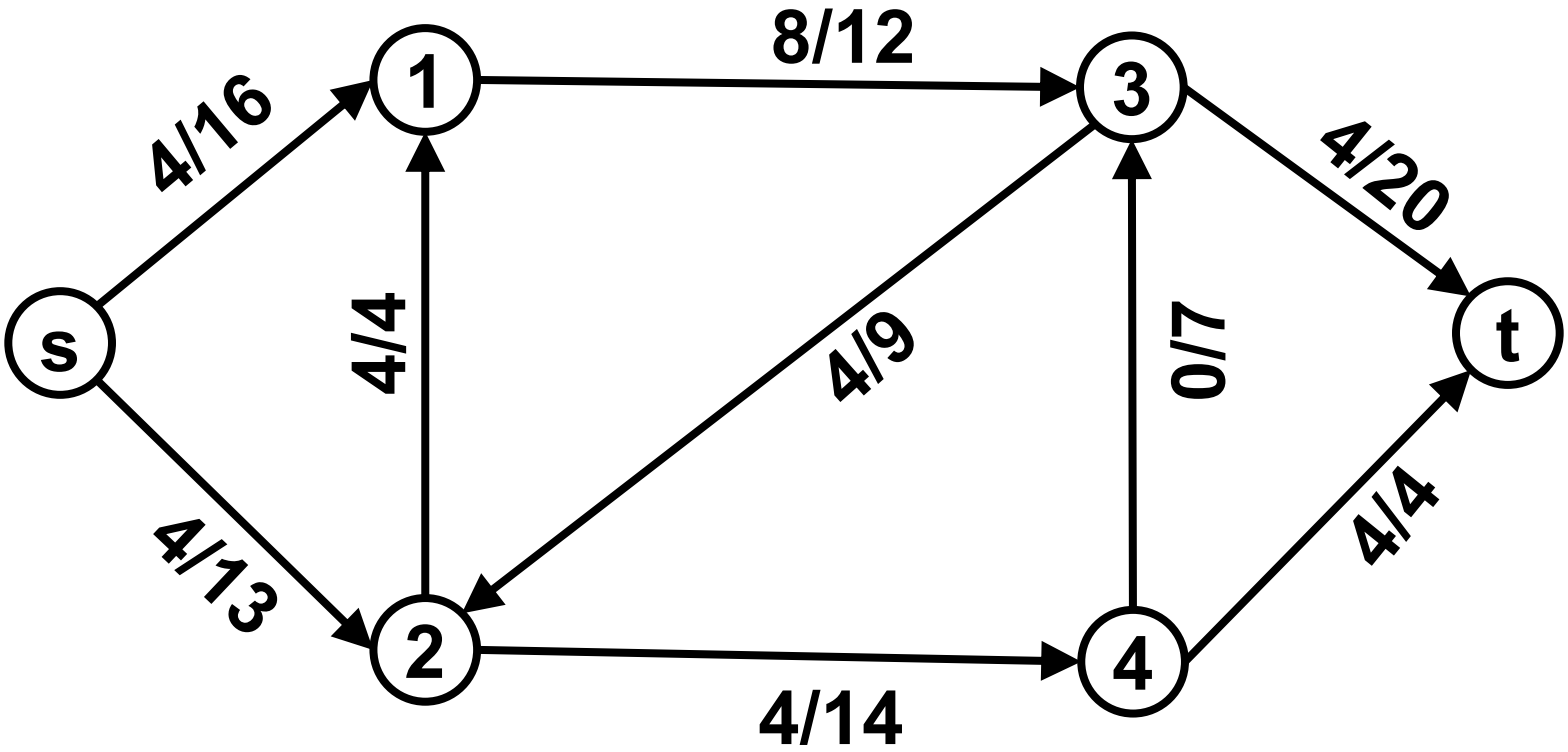

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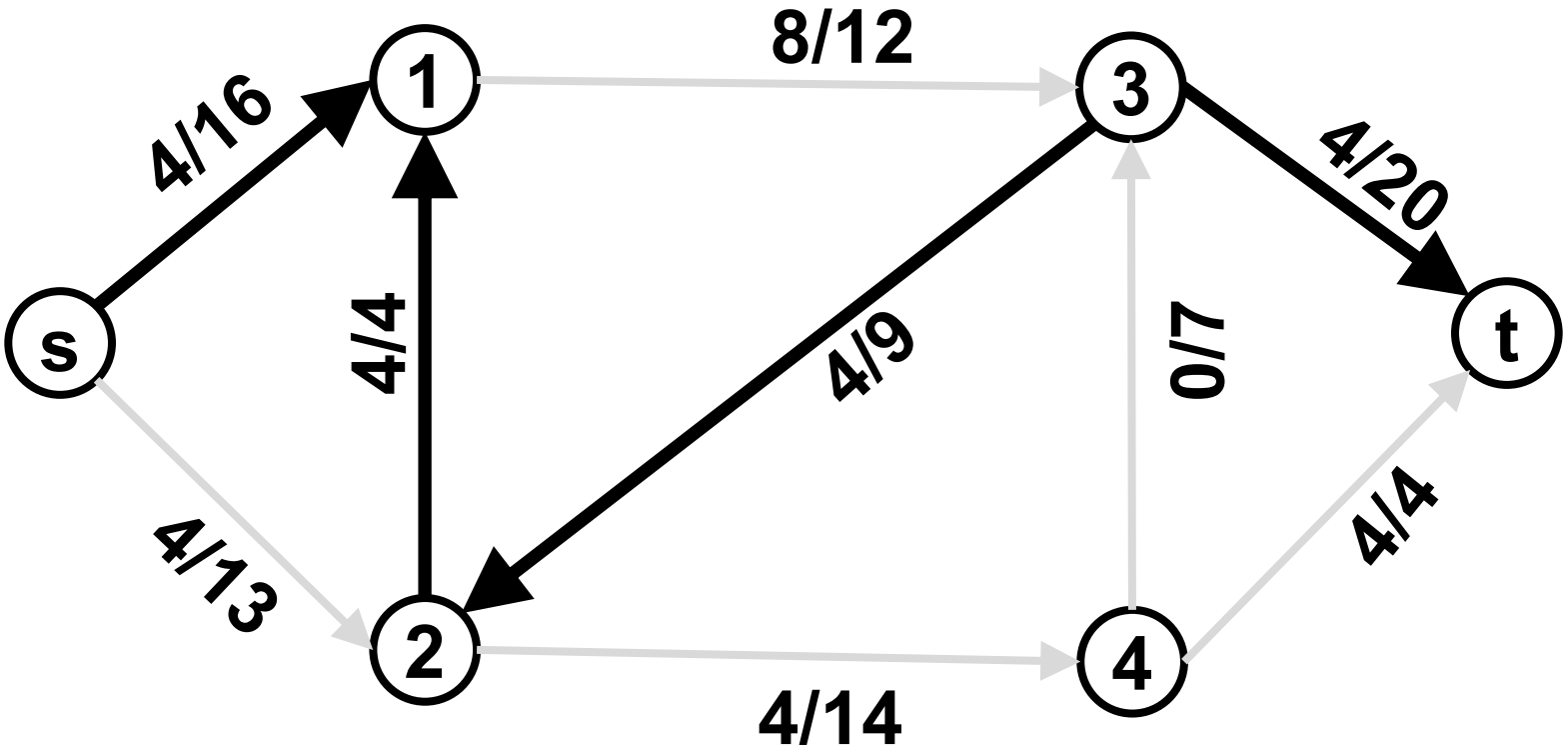

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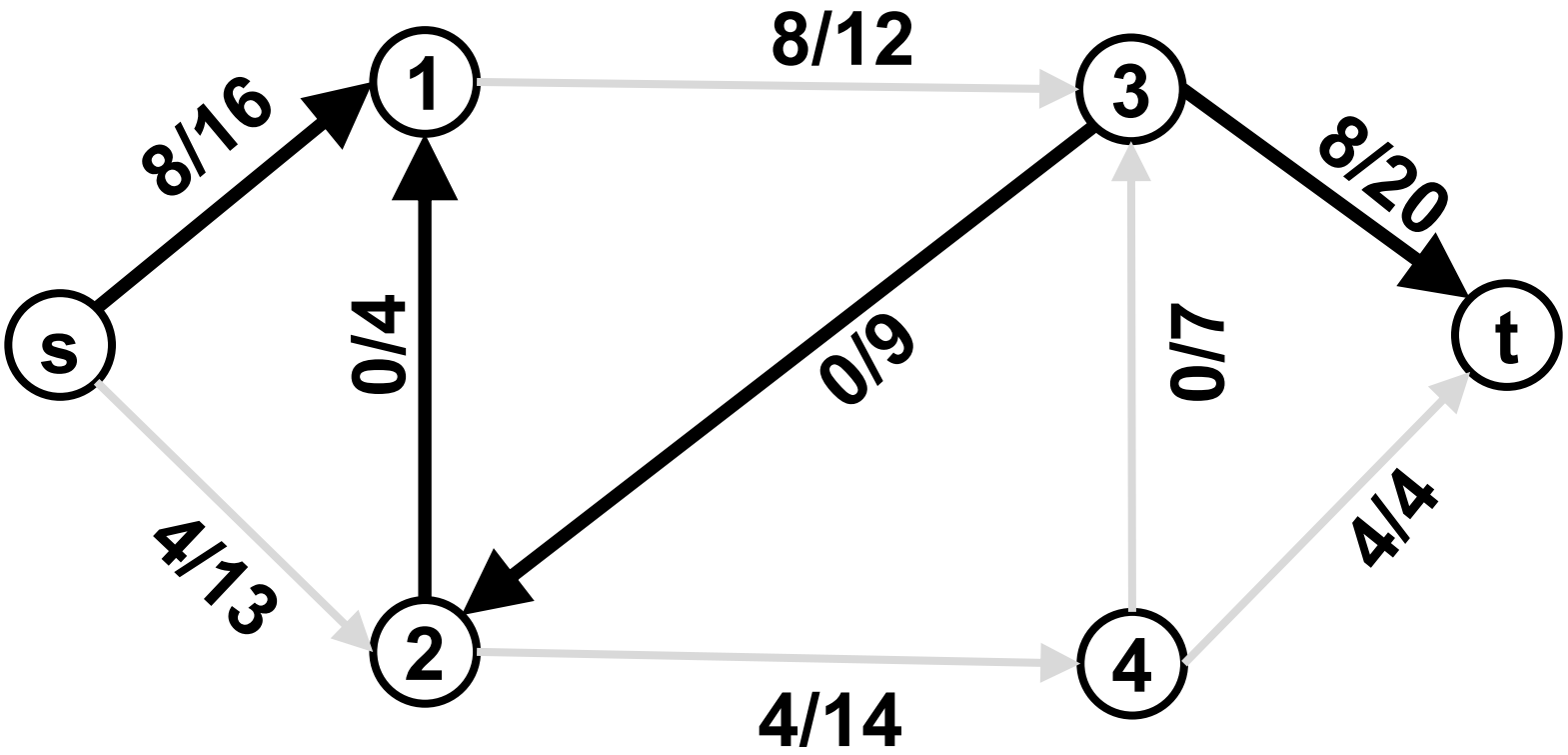

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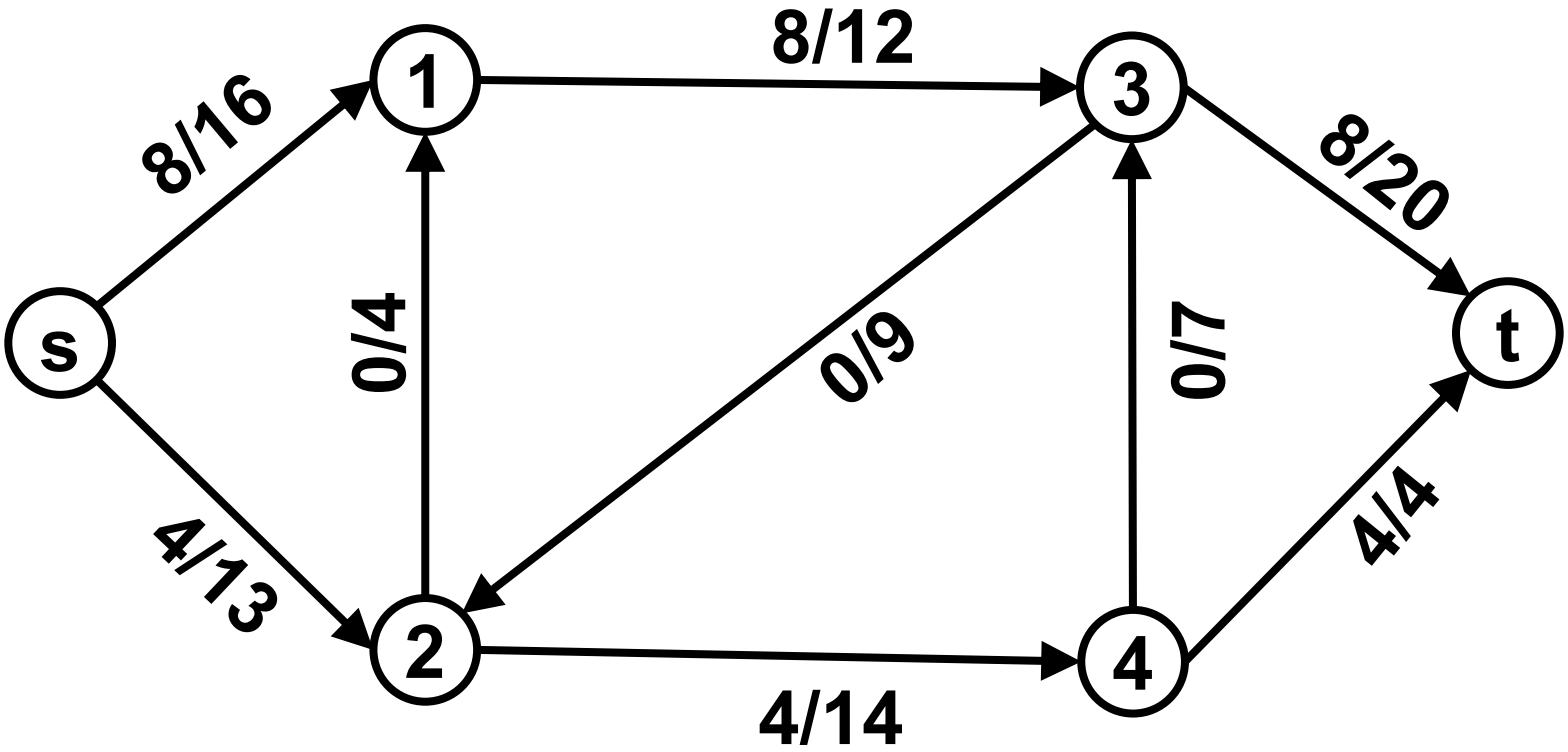

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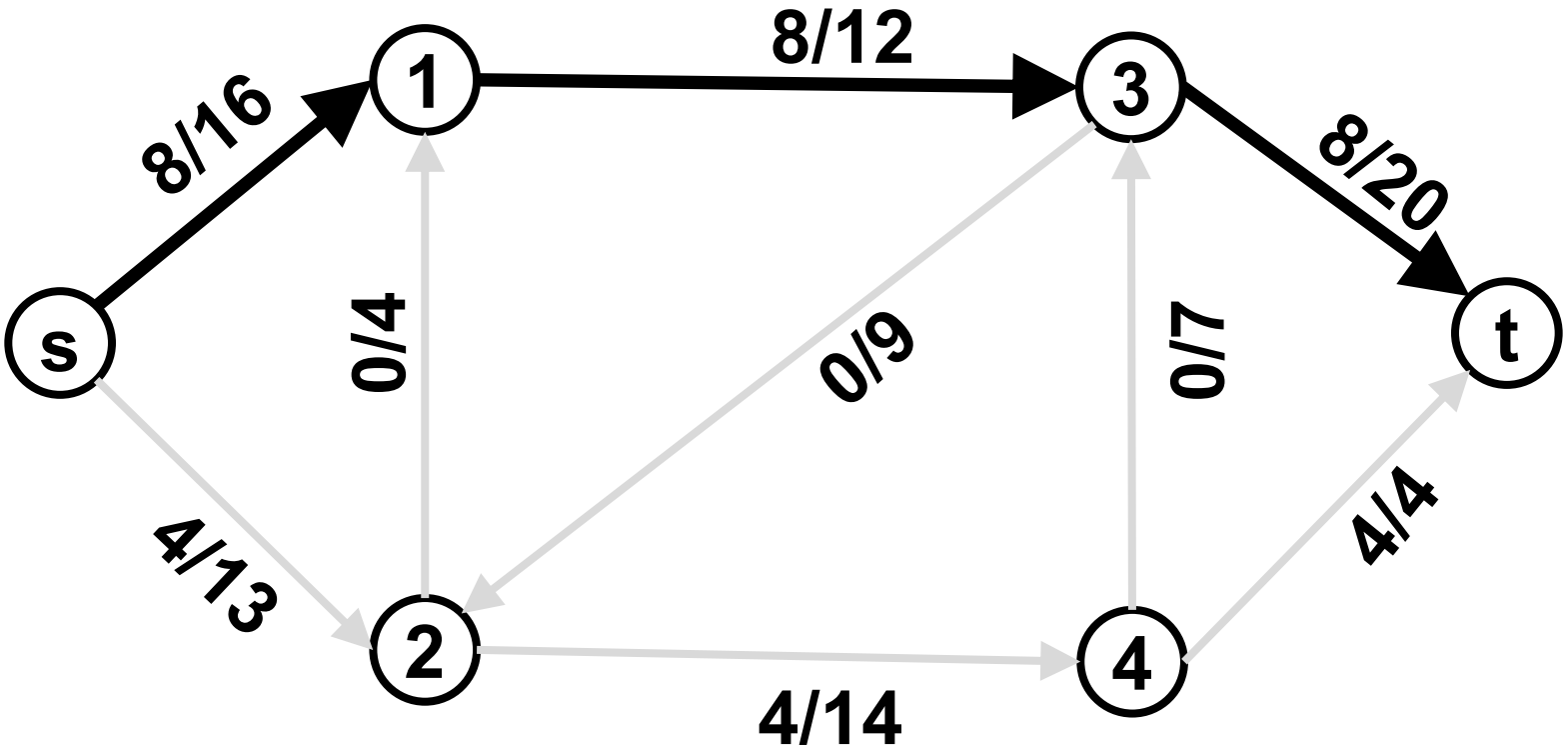

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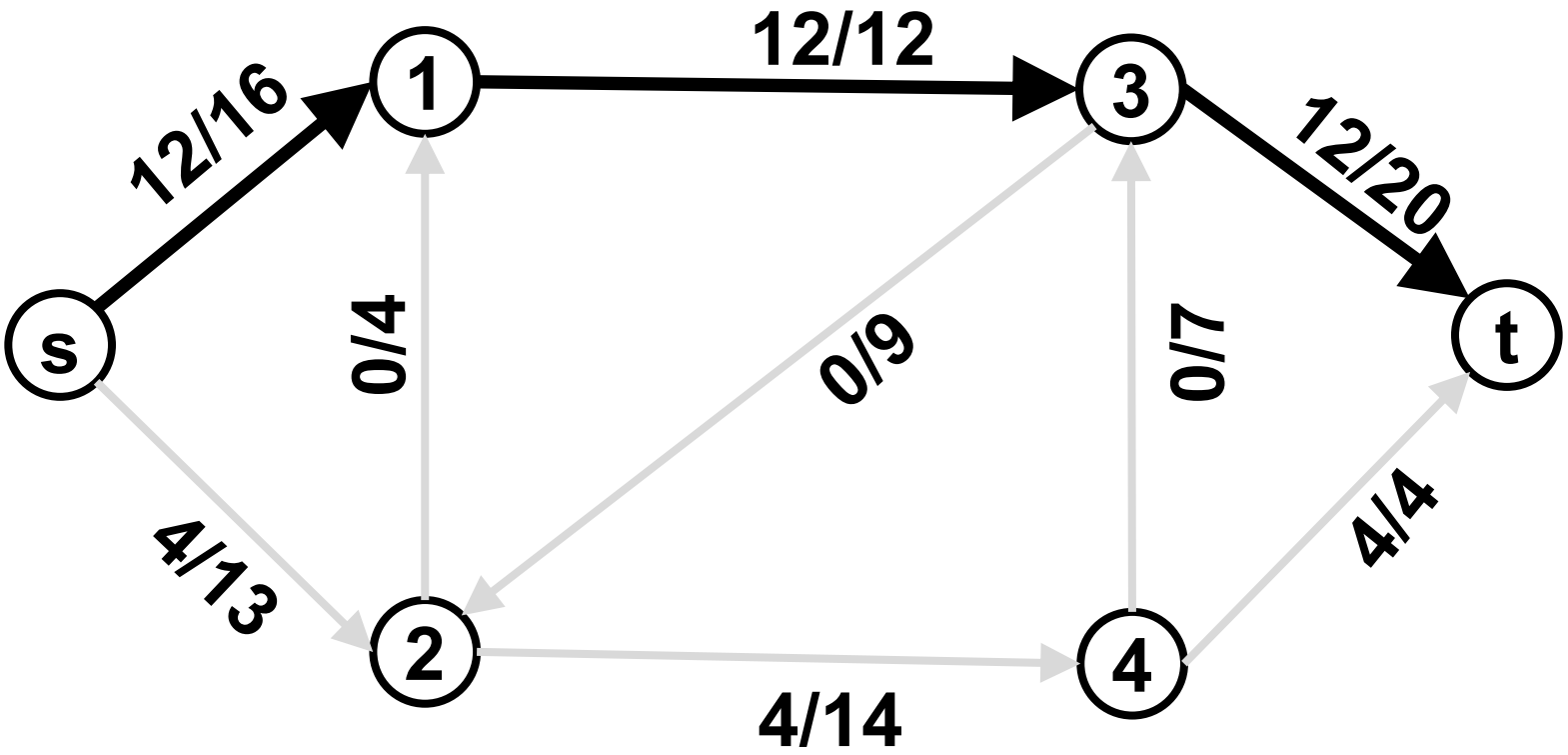

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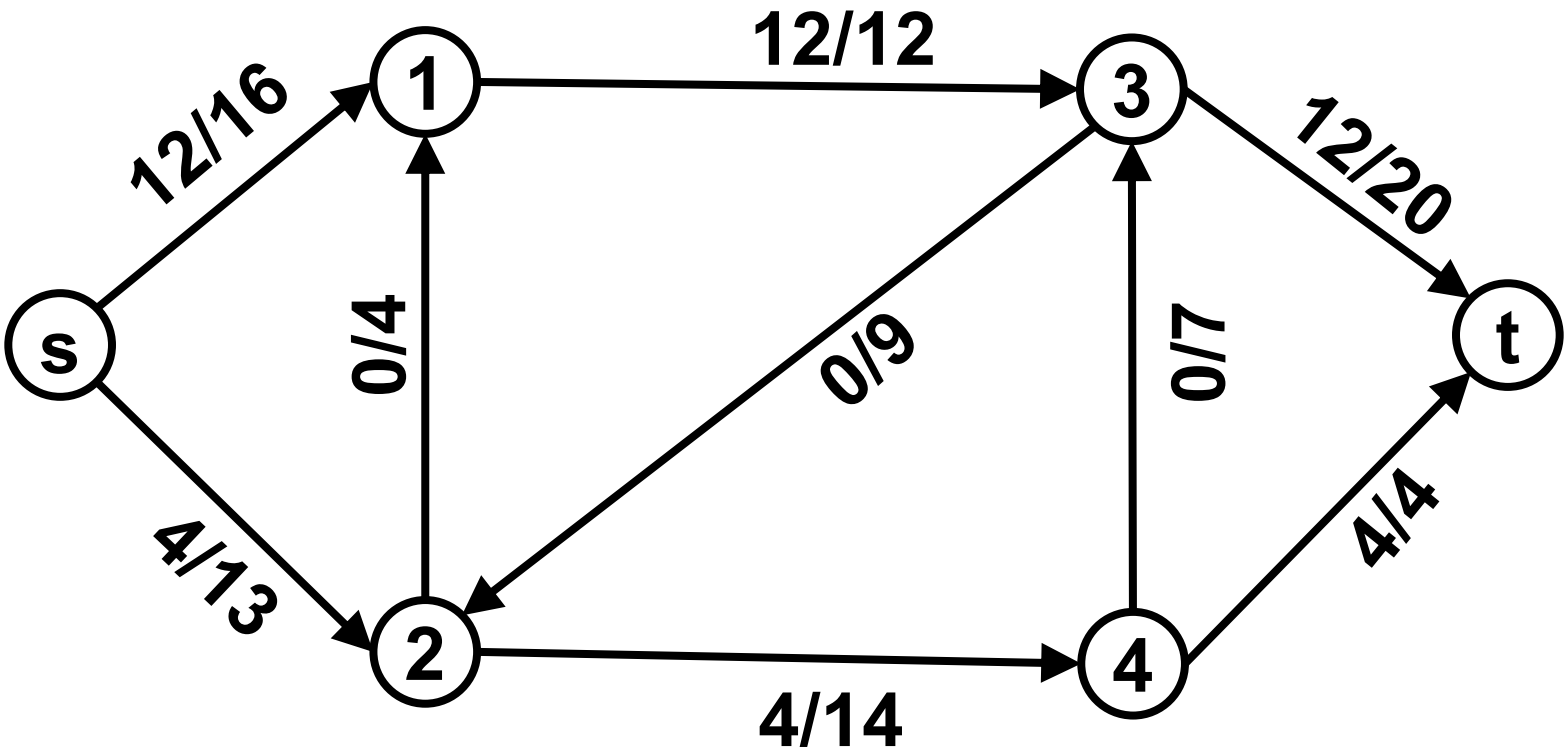

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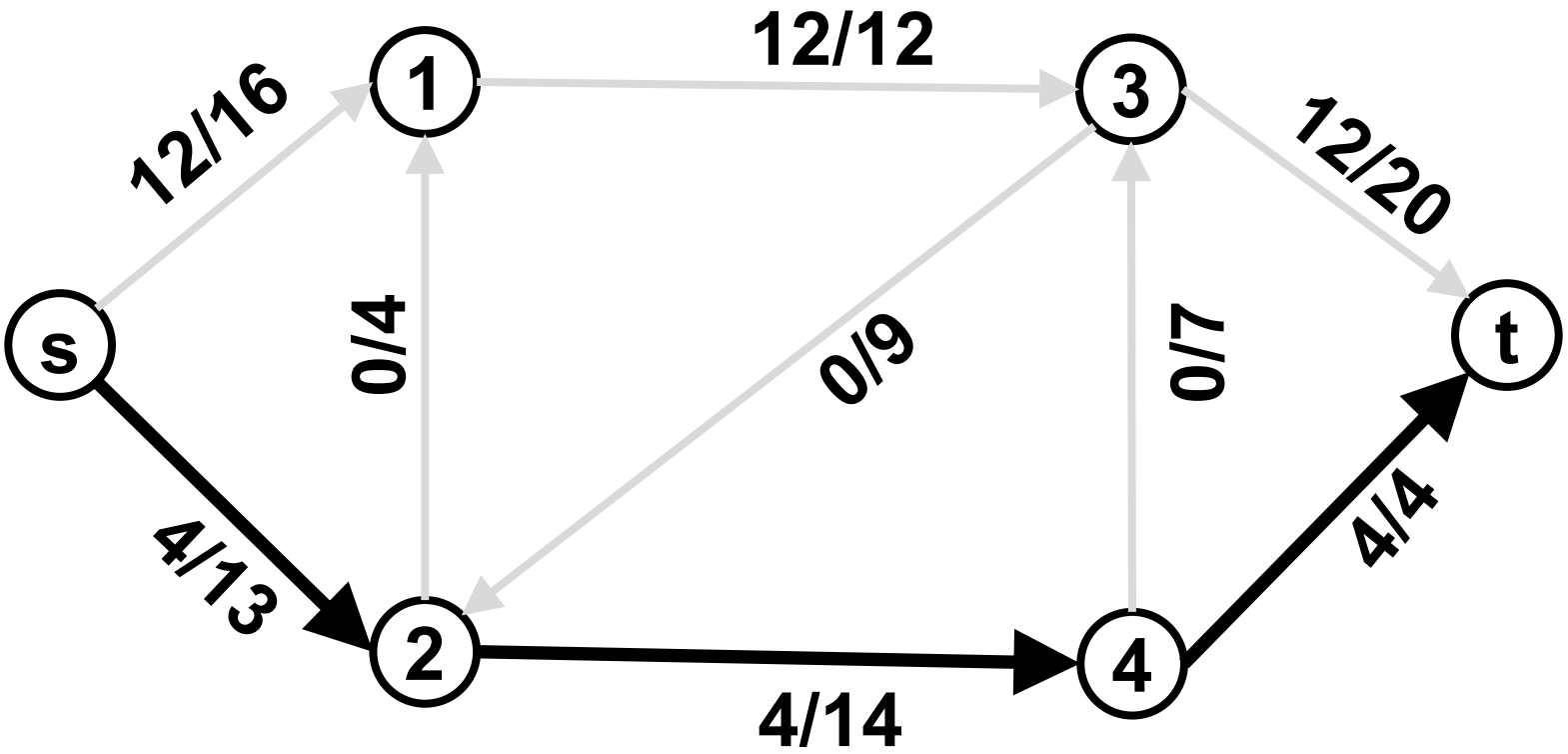

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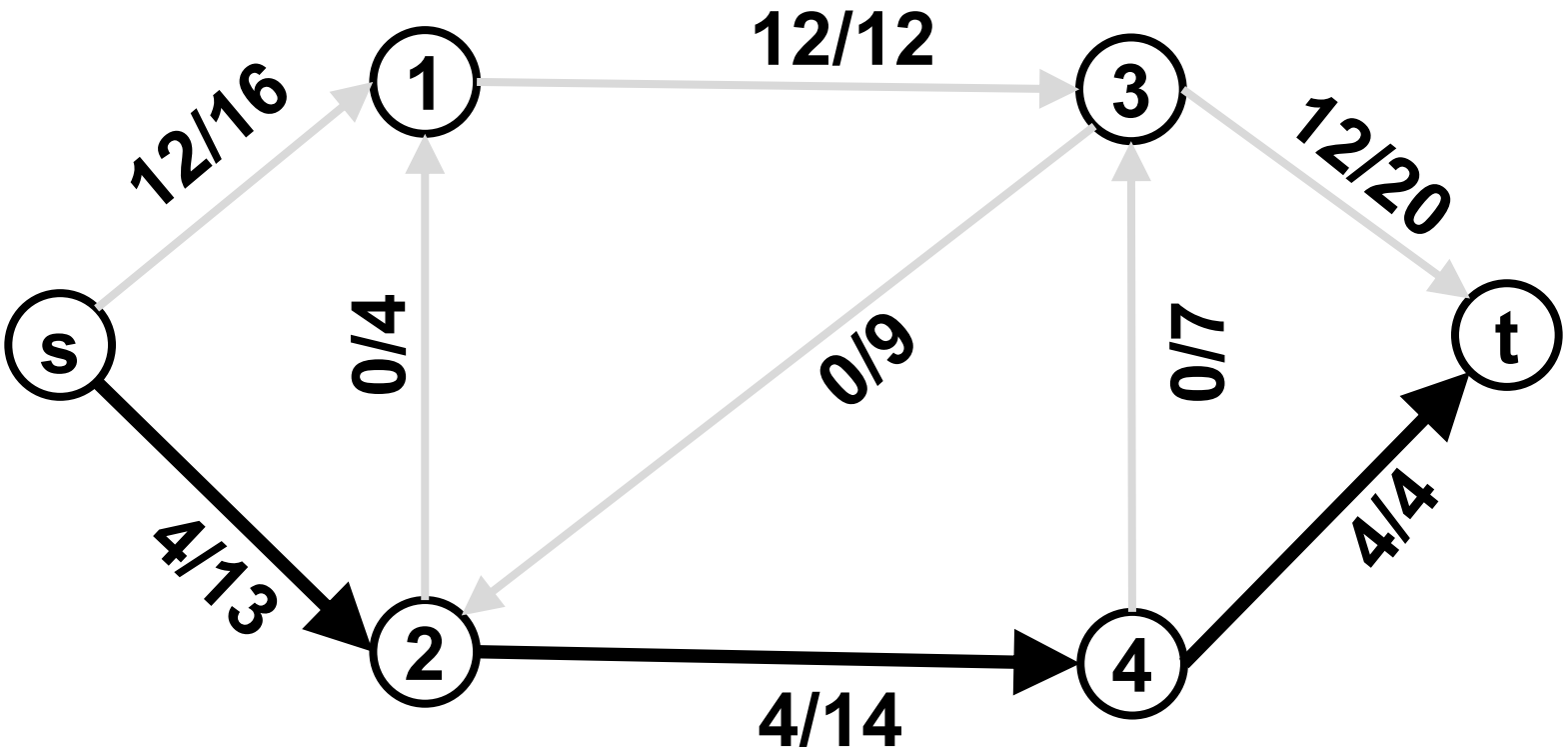
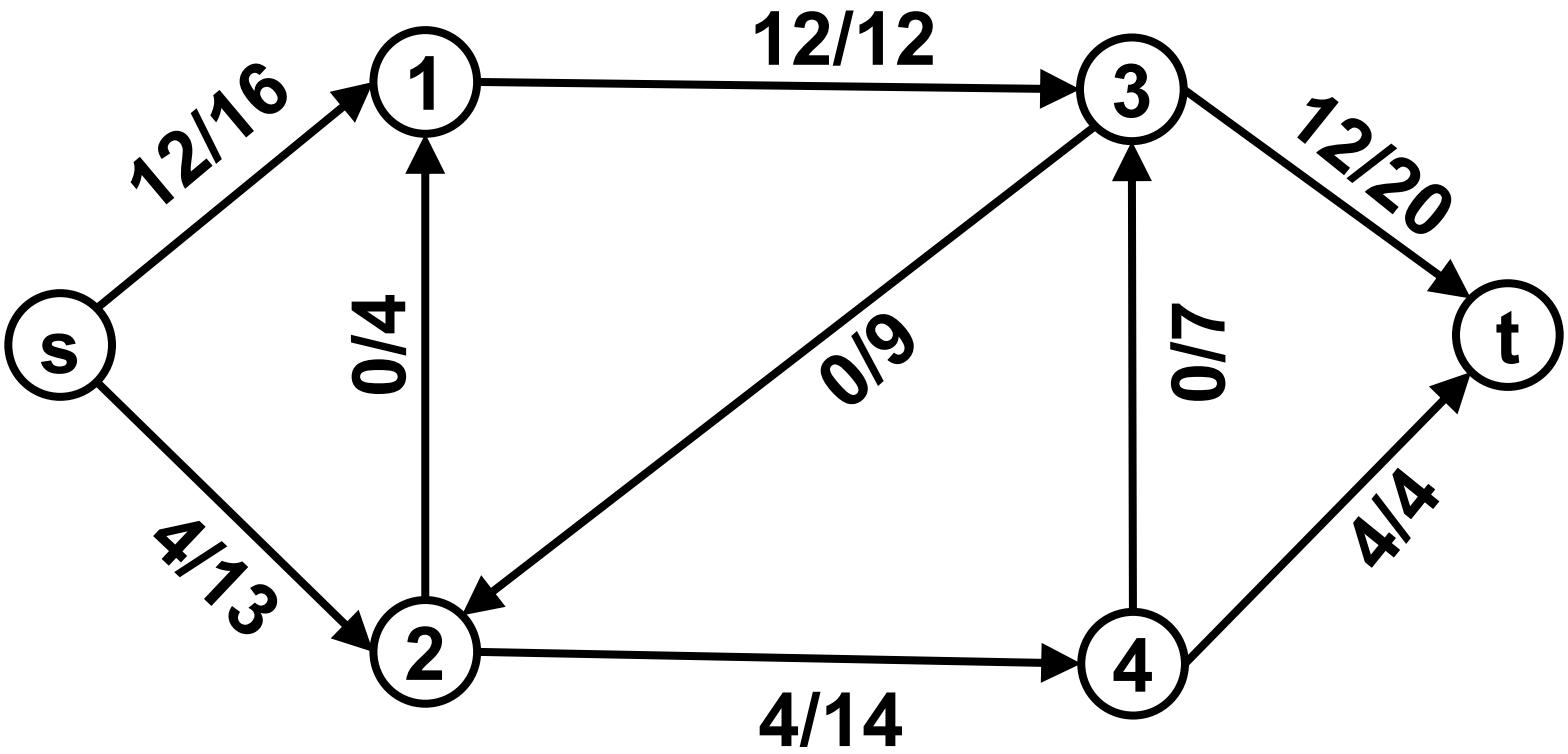


Algoritmul Ford-Fulkerson



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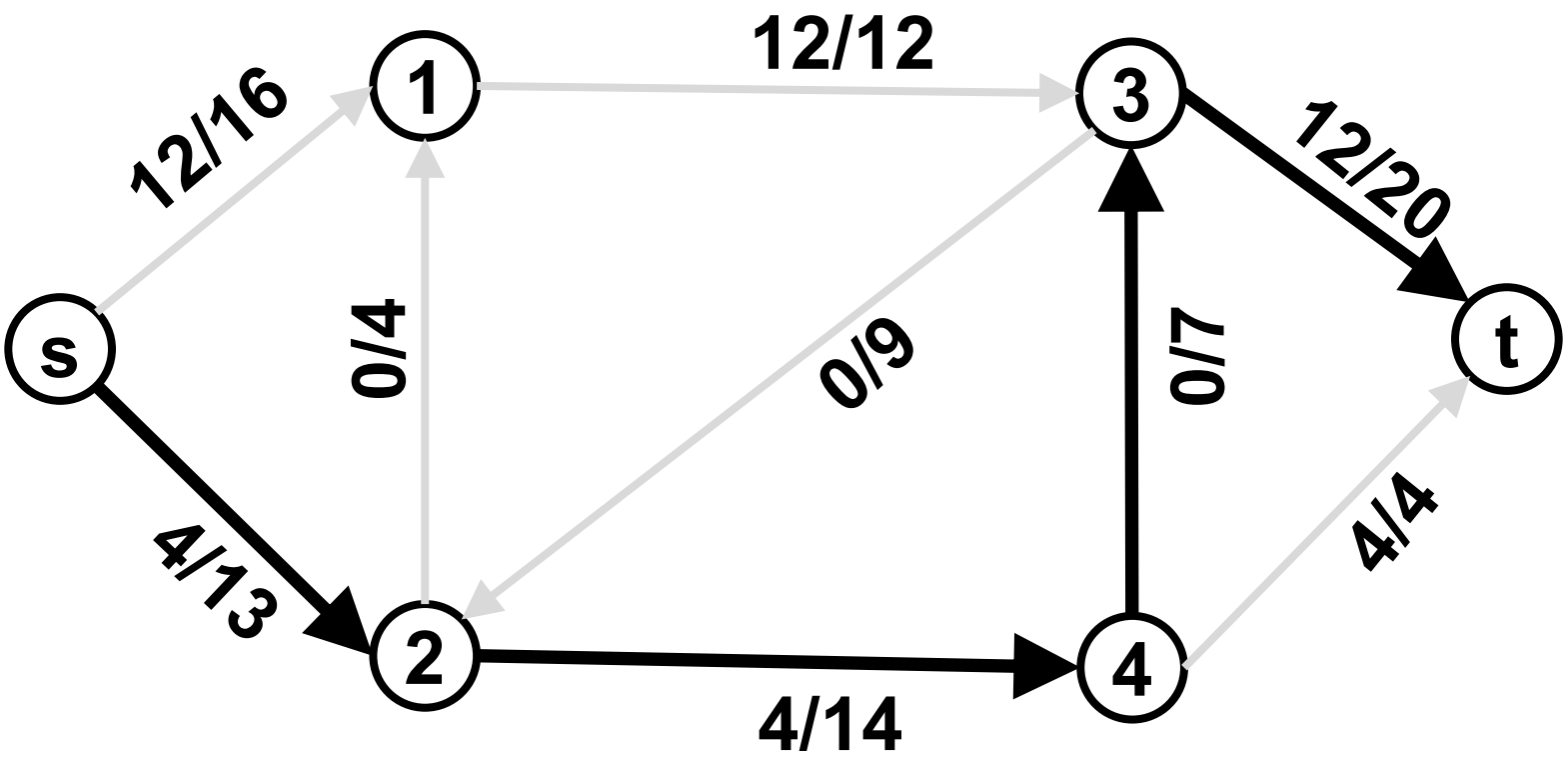

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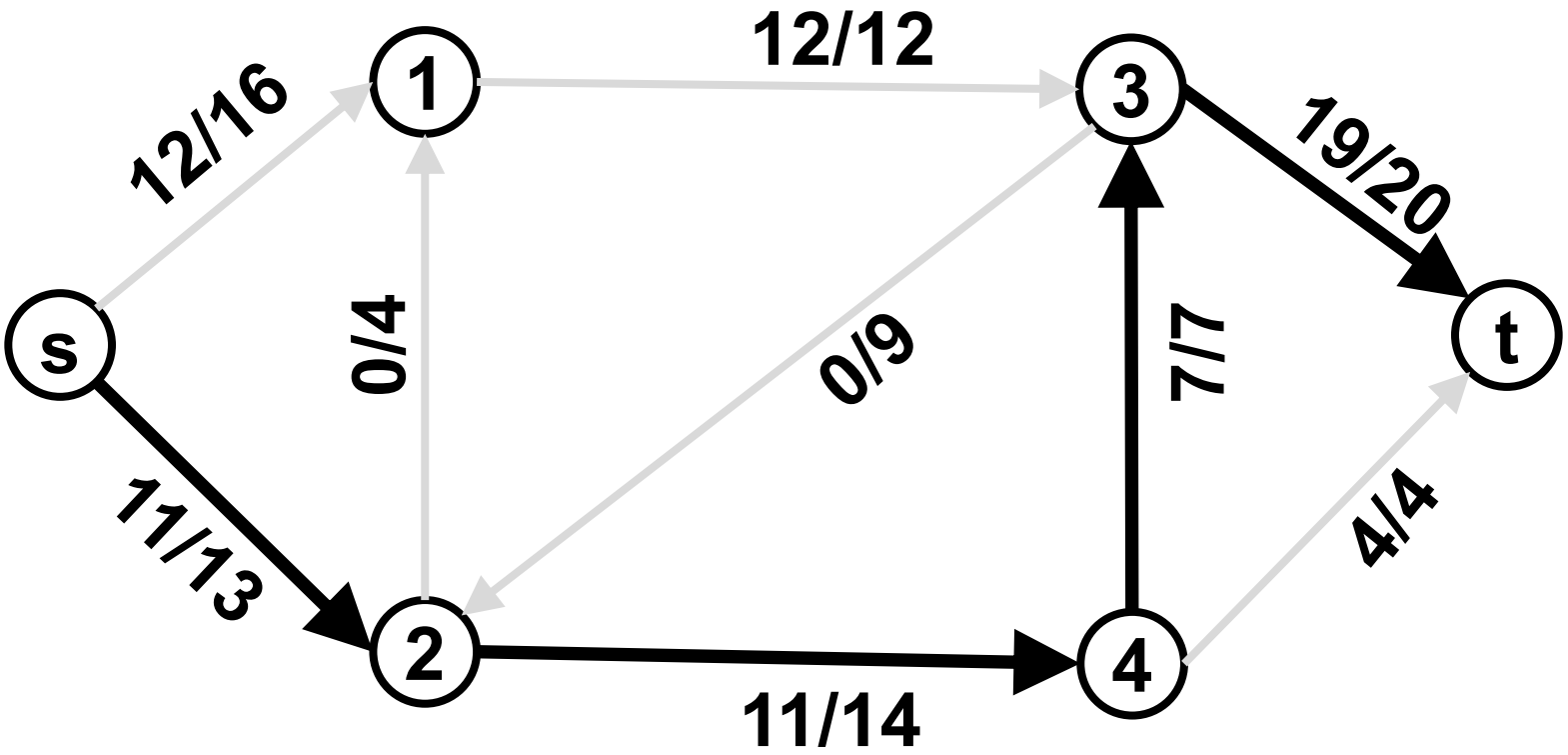

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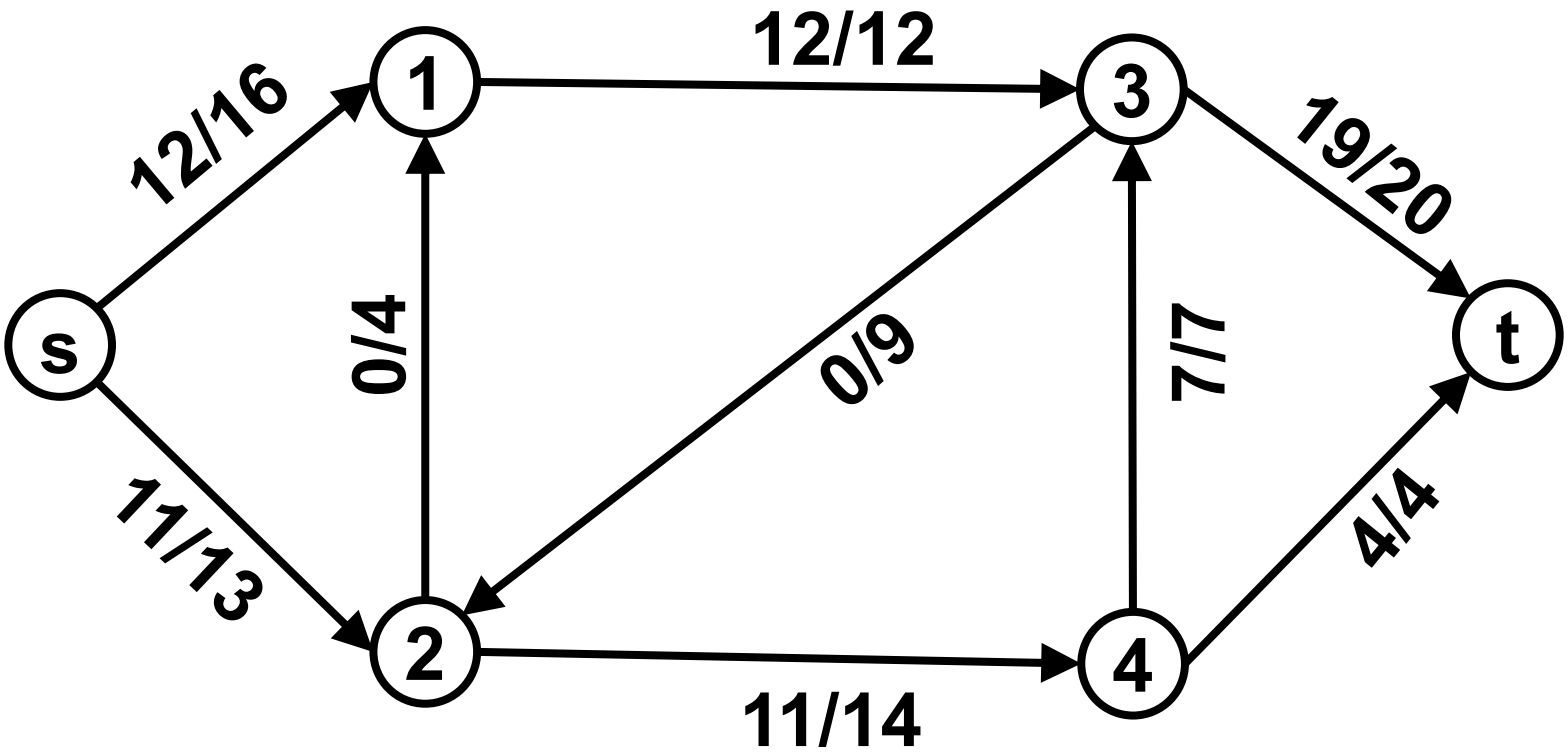


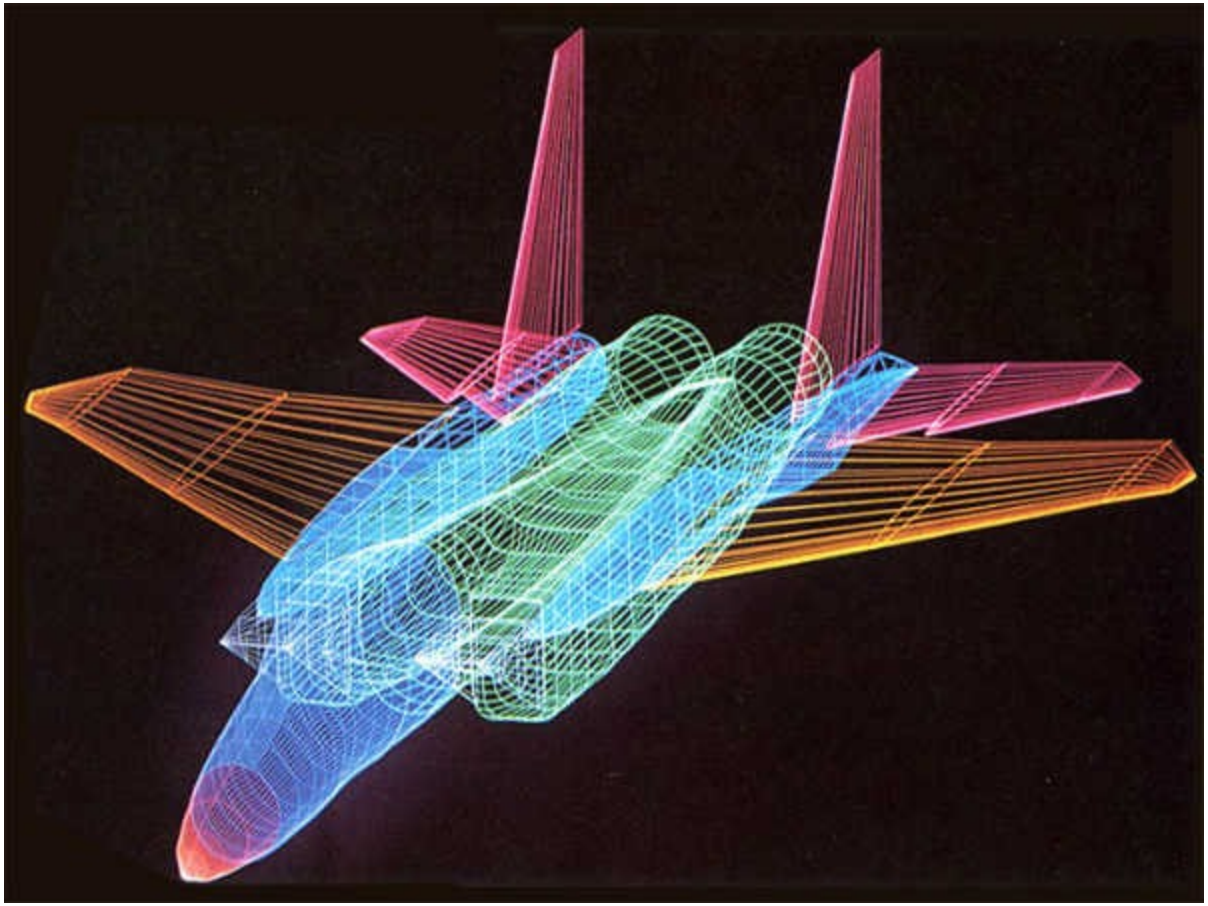
Alte considerente grafuri

- Se pot schimba în timp.

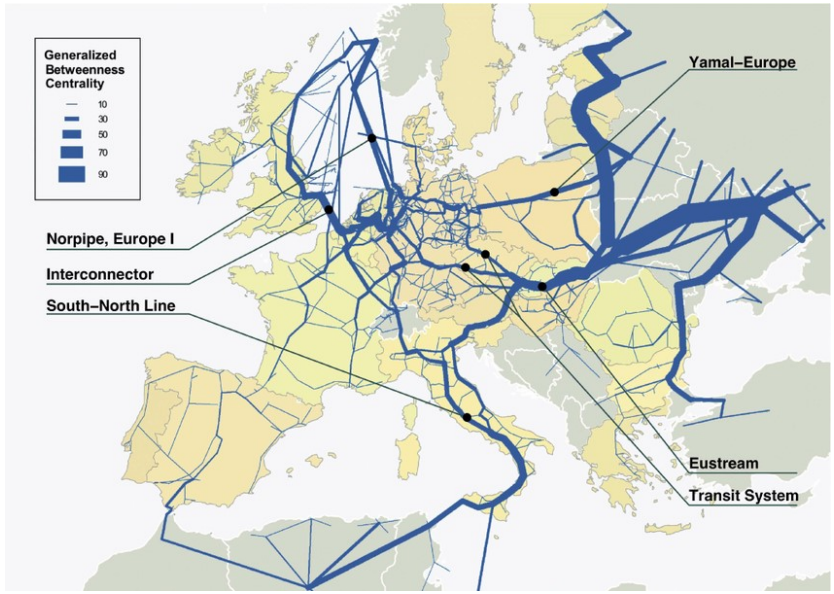
- LineGraph – Pentru un graf non-direcțional muchiile devin noduri și nodurile muchii.

Use case grafuri – Granițe

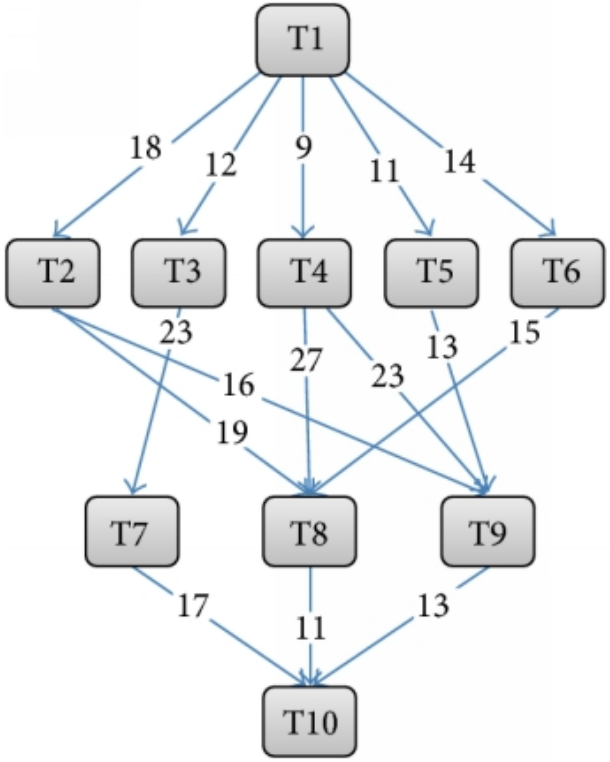
Use case grafuri – Grafică calculator



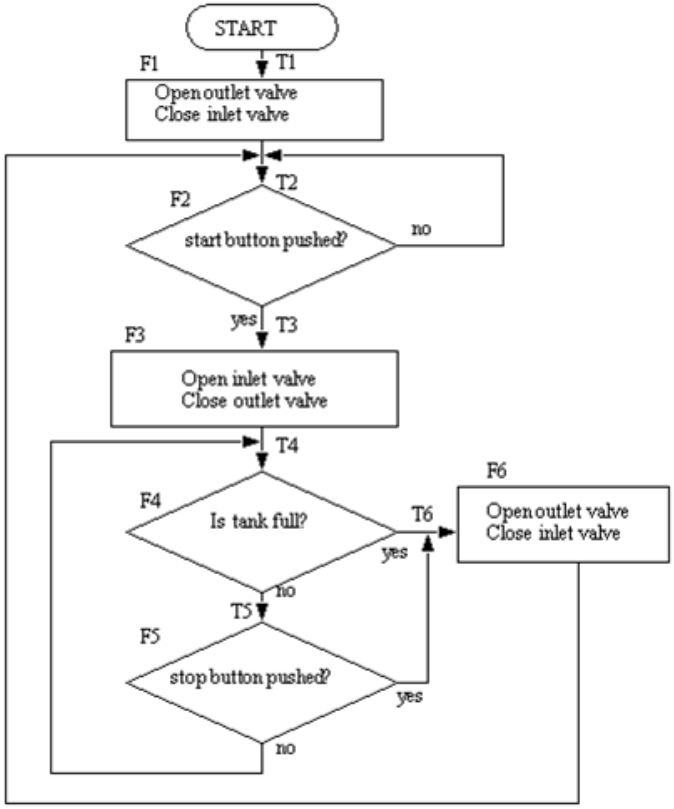
Use caser grafuri – utilități



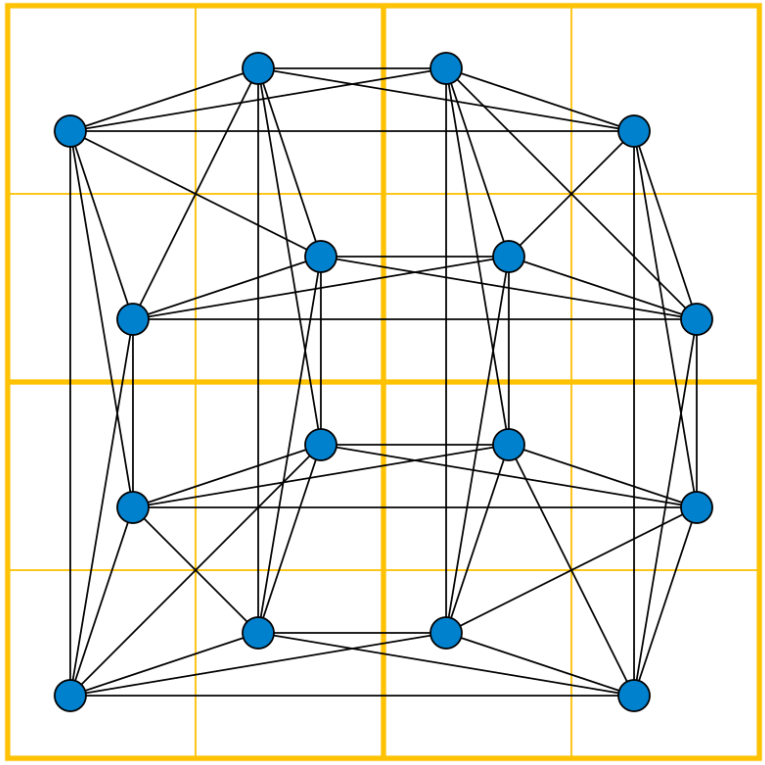
Use case grafuri – Code

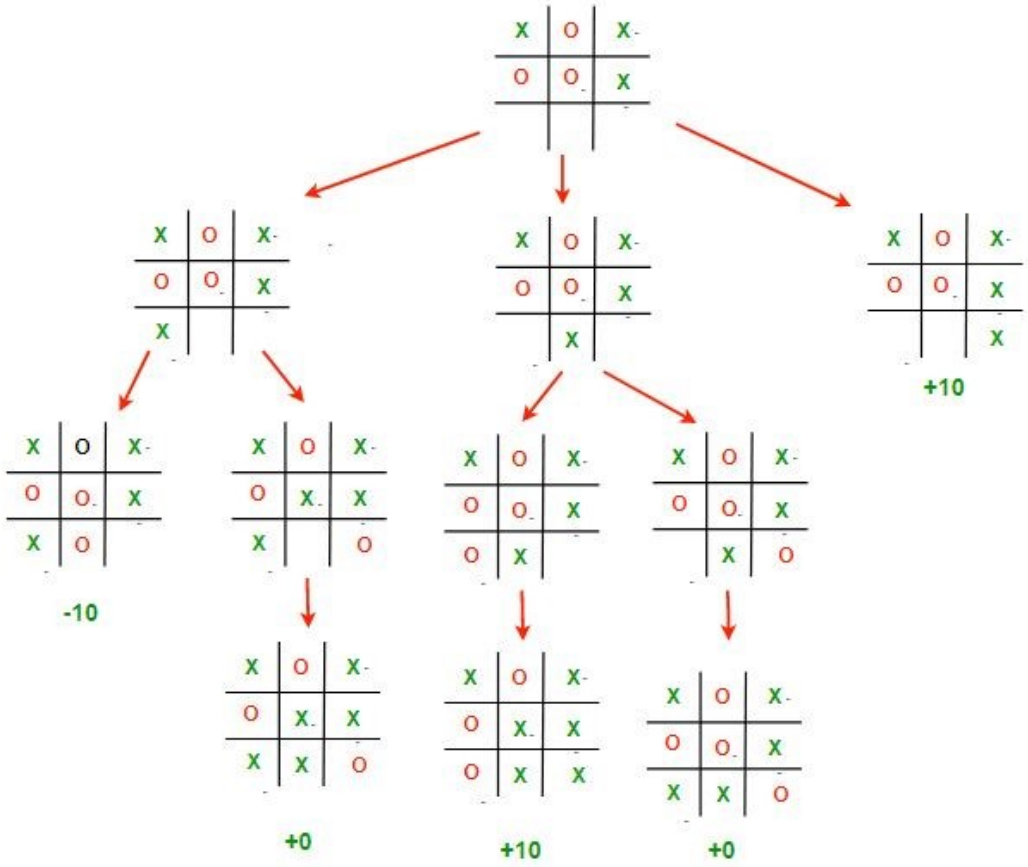


Task	P_1	P_2	P_3
T1	14	16	9
T2	13	19	18
T3	11	13	19
T4	13	8	7
T5	12	13	10
T6	13	16	9
T7	7	15	11
T8	5	11	14
T9	18	12	20
T10	21	7	16

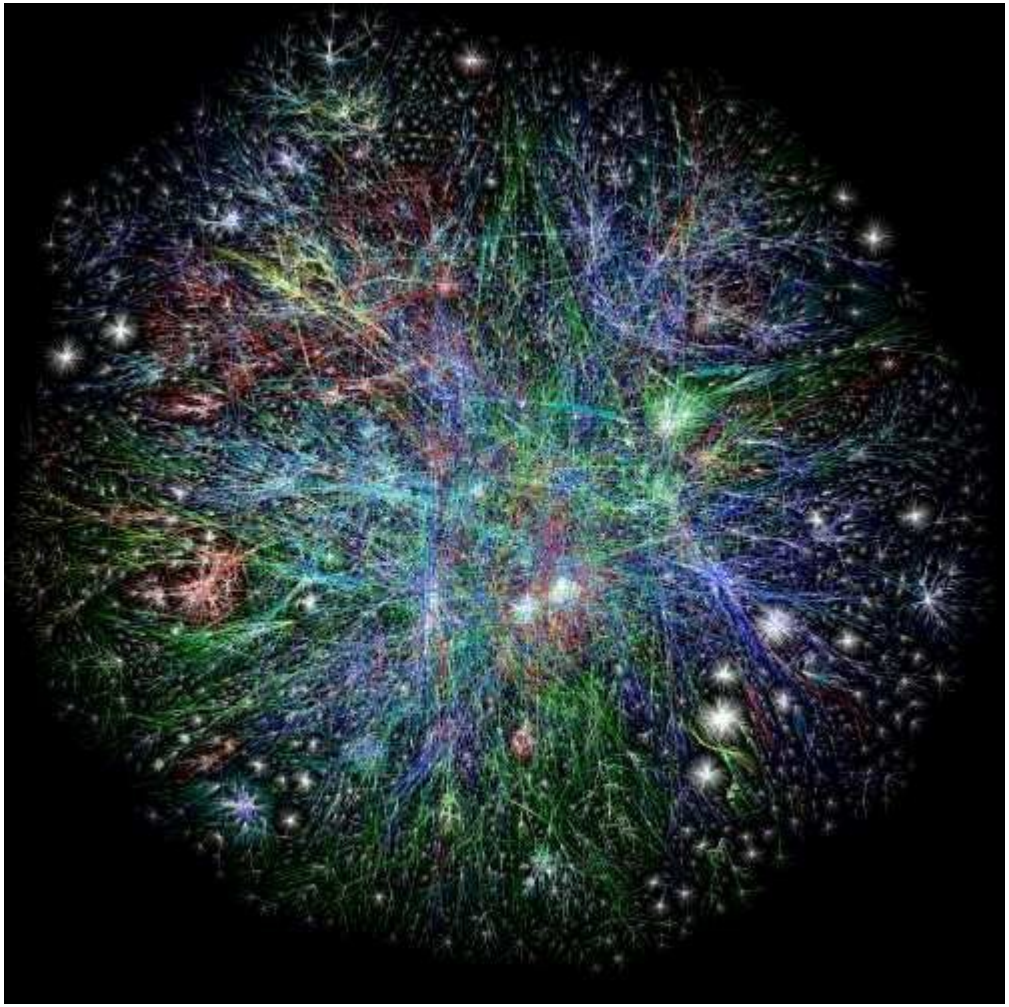


Use case grafuri – Reprezentare Jocuri

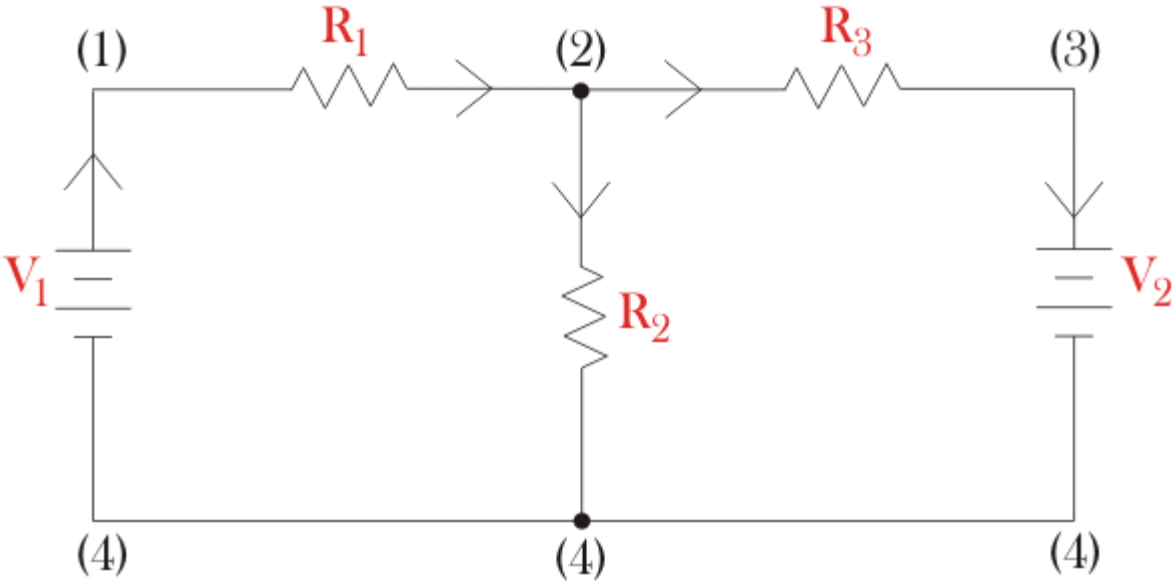




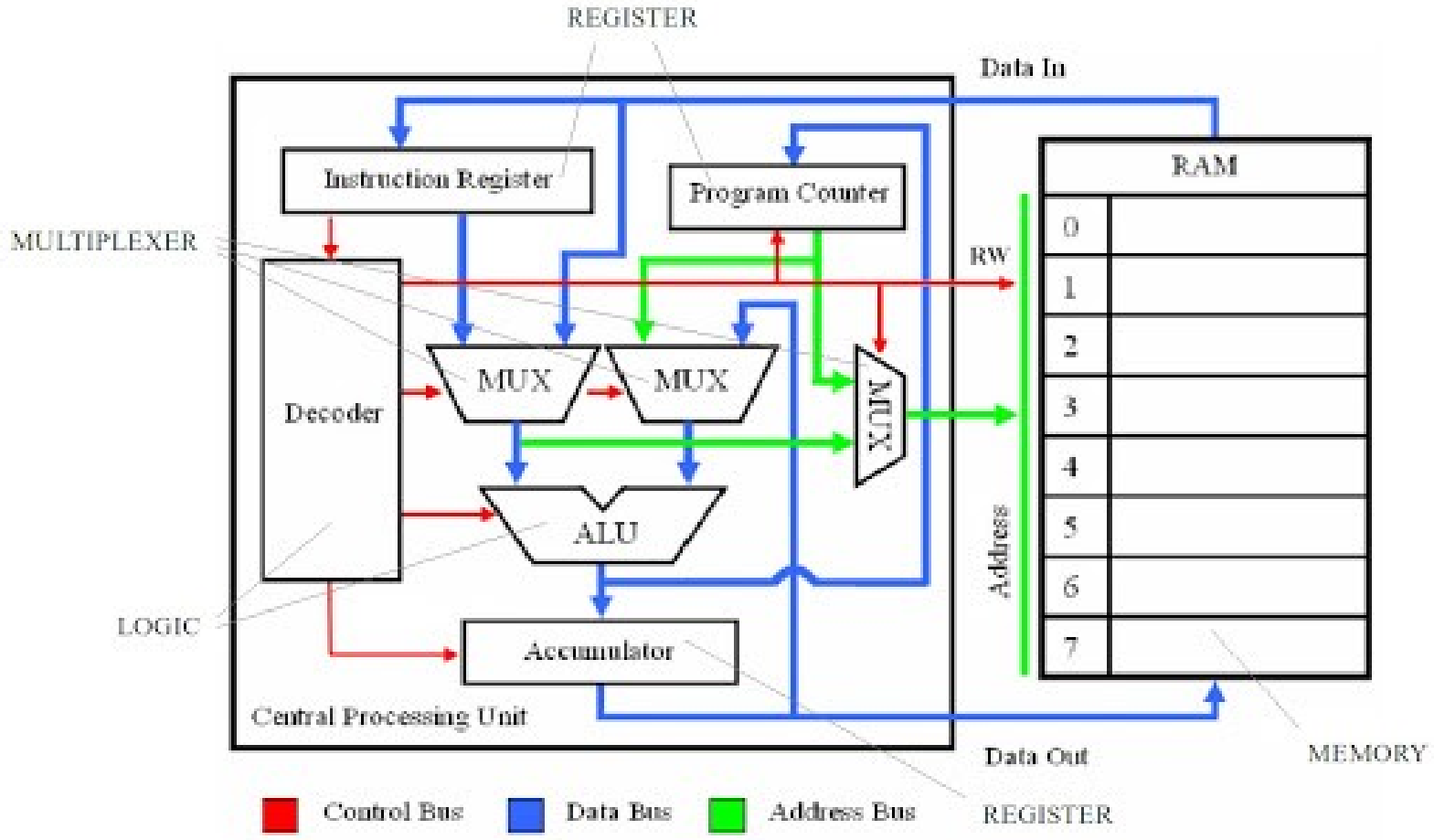
Use case grafuri - Internet



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 ...

e: CEO of Google and Alphabet

rn: Pichai Sundararajan; June 10, 1972 (age ...

chnology · Metallurgy

er

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
ai began his career as a materials
ed Google as a management
4. Wikipedia

Use case-uri – Organigrame