

Missing Roads

Problem

- **Given**: undirected graph G and an integer k
- **Find**: set of k cities $\{v_1, v_2, \dots, v_k\}$ and edges $\{e_1, e_2, \dots, e_k\}$ such that
 - a) each city v_i is **adjacent** to the edge e_i
 - b) the sum

$$\sum_{i=1}^k \text{cost}(e_i)$$

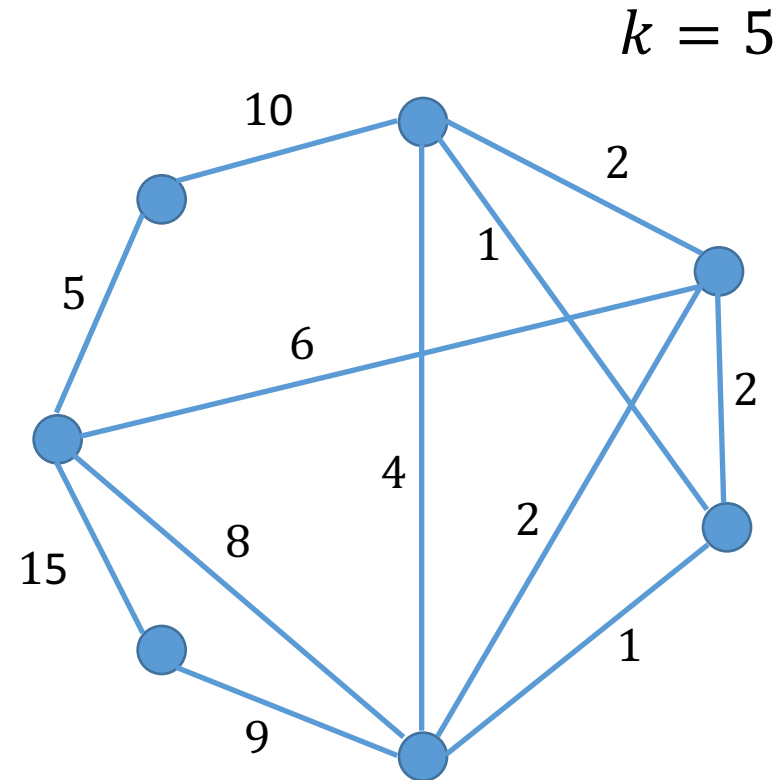
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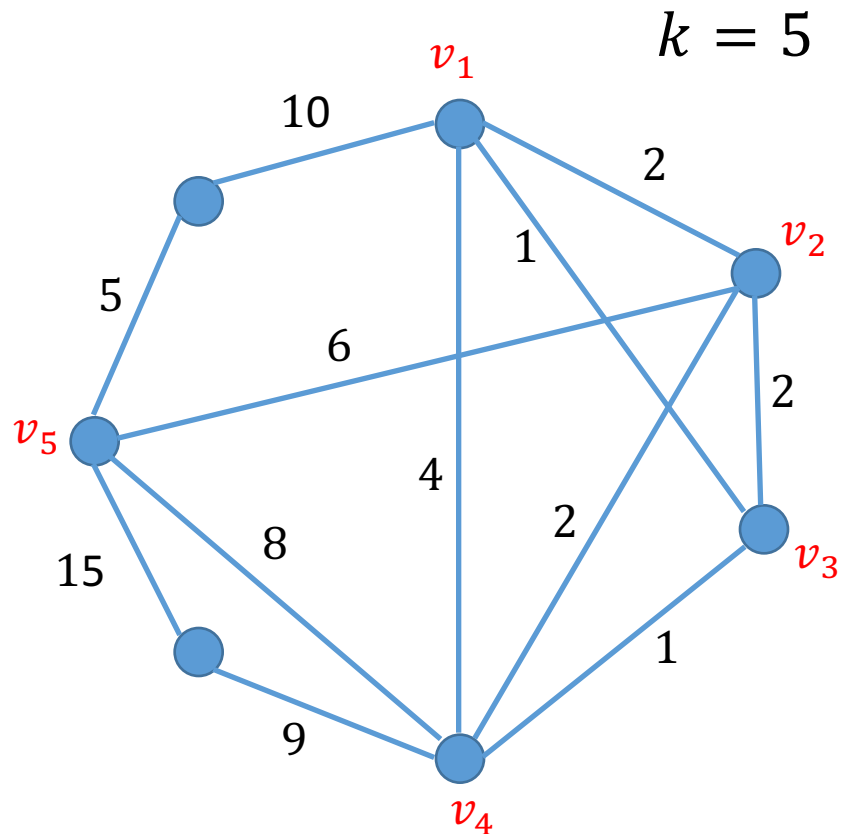


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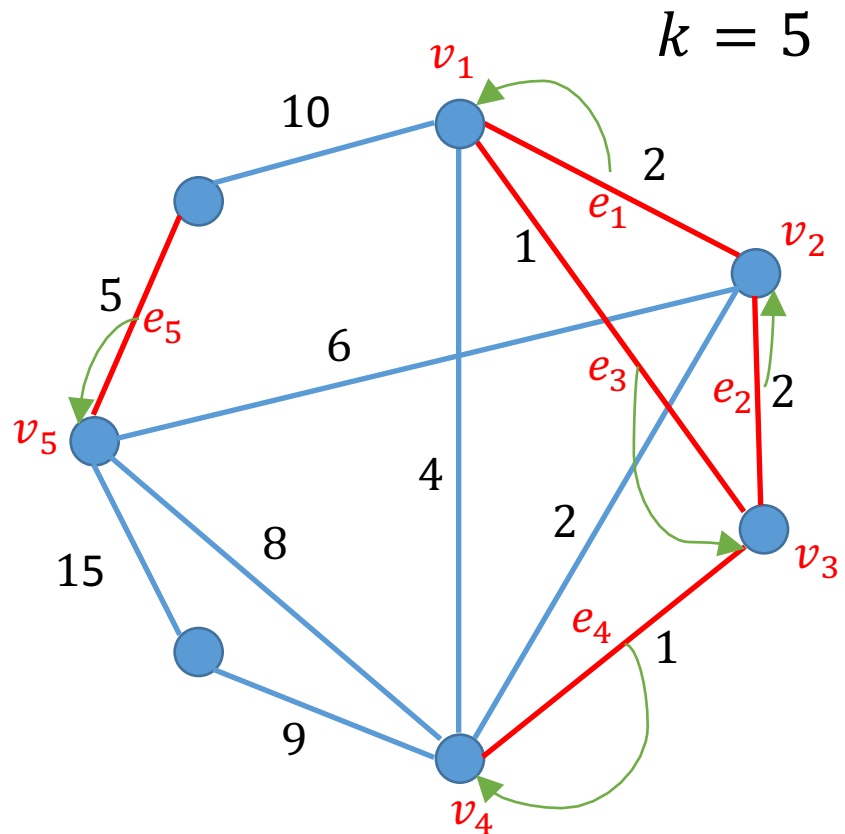


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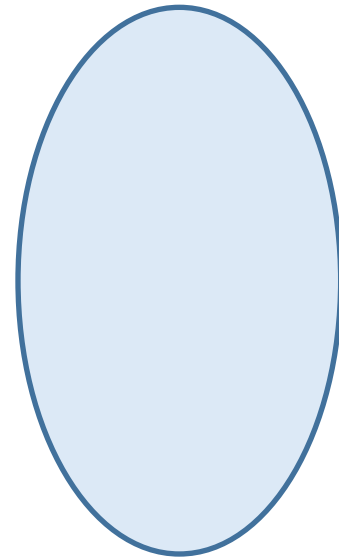
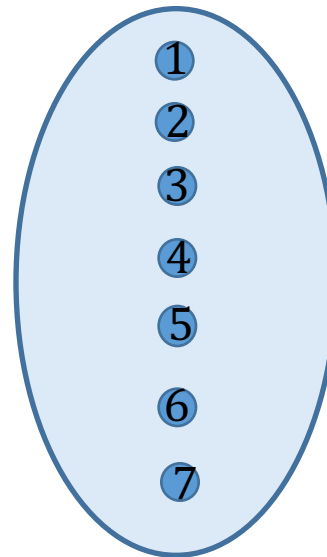
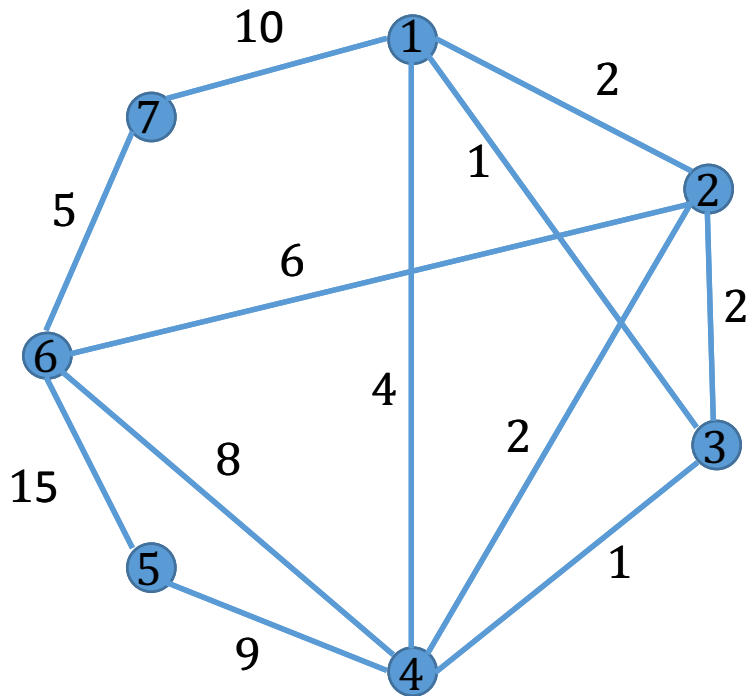


Solution

- Create auxiliary **bipartite** graph B :
 - one side – vertices of G
 - the other side – edges of G (now as vertices in B)
 - edge between vertex v and an edge e if they are adjacent in G

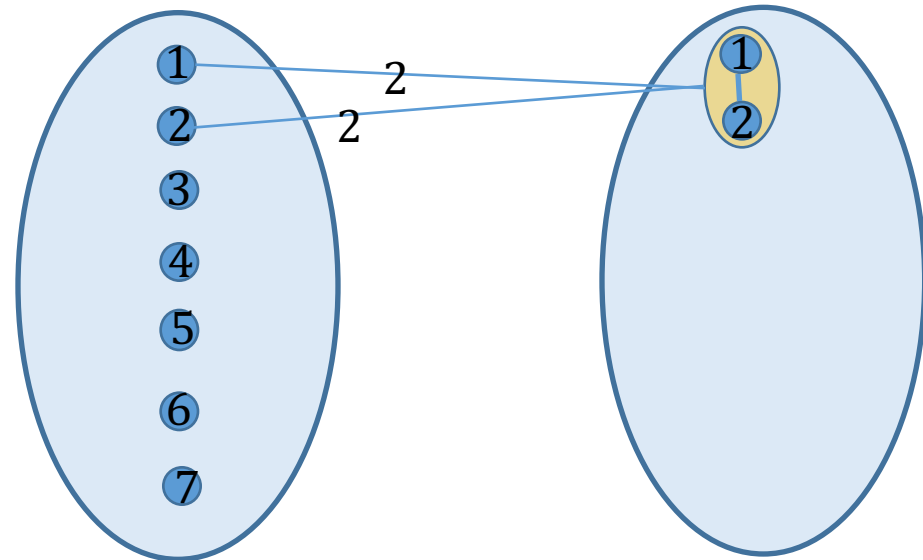
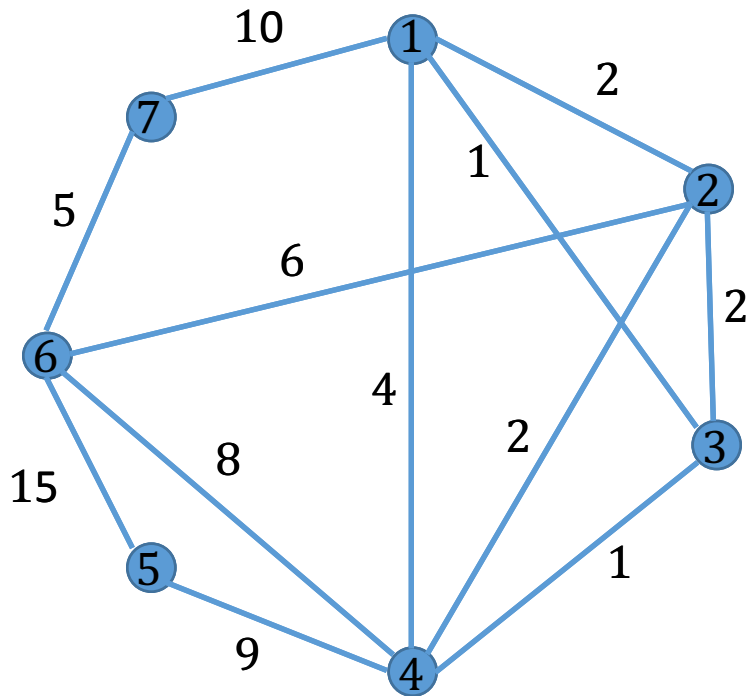
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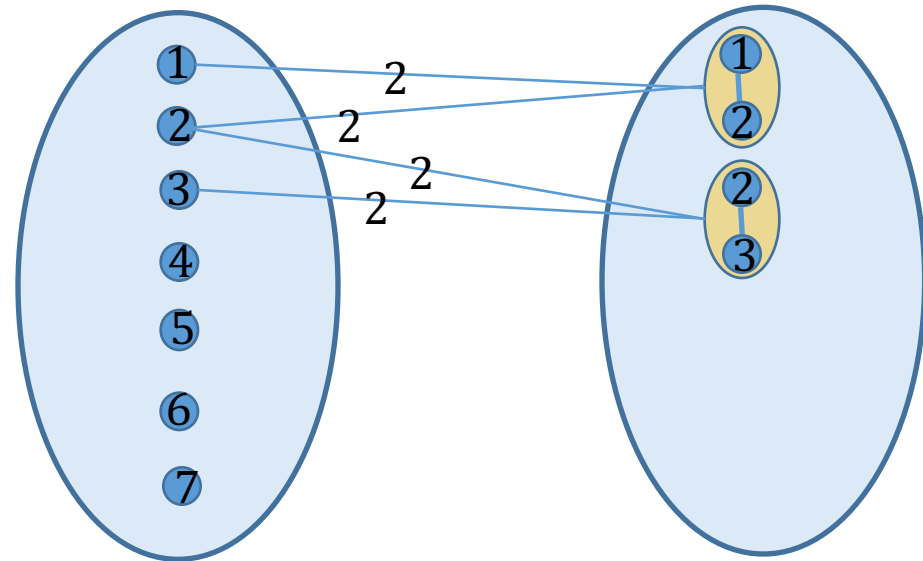
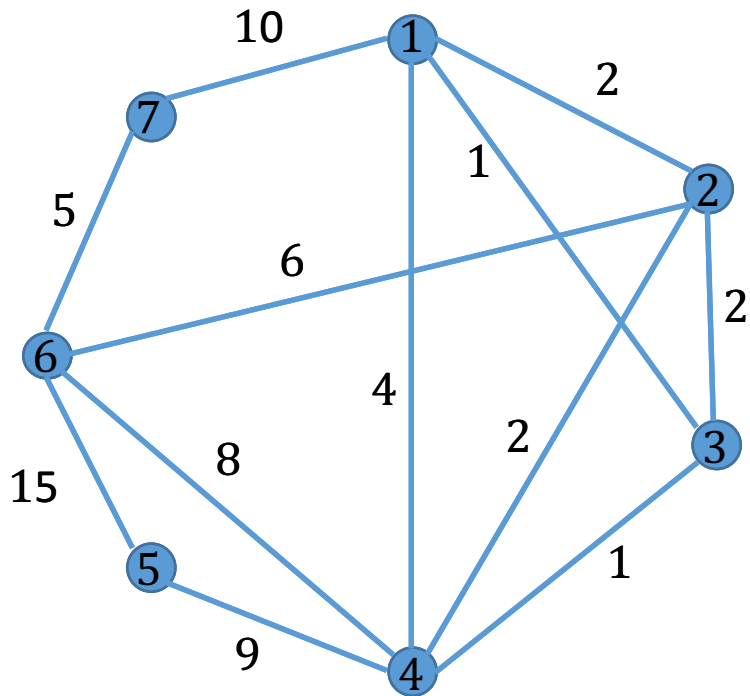
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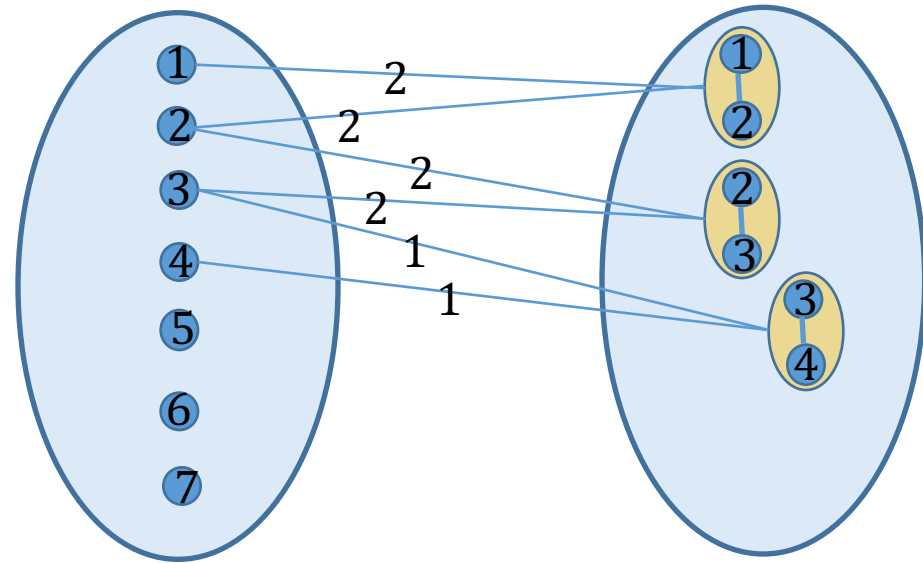
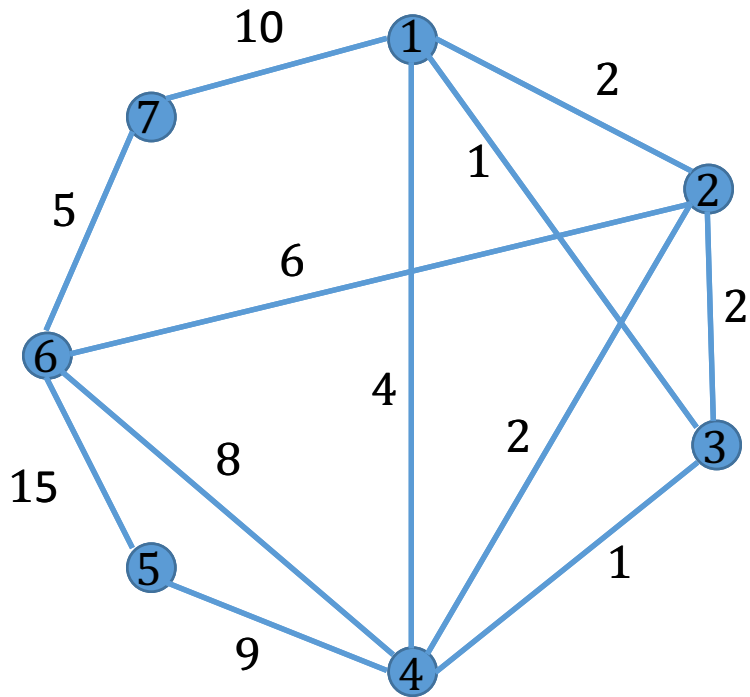
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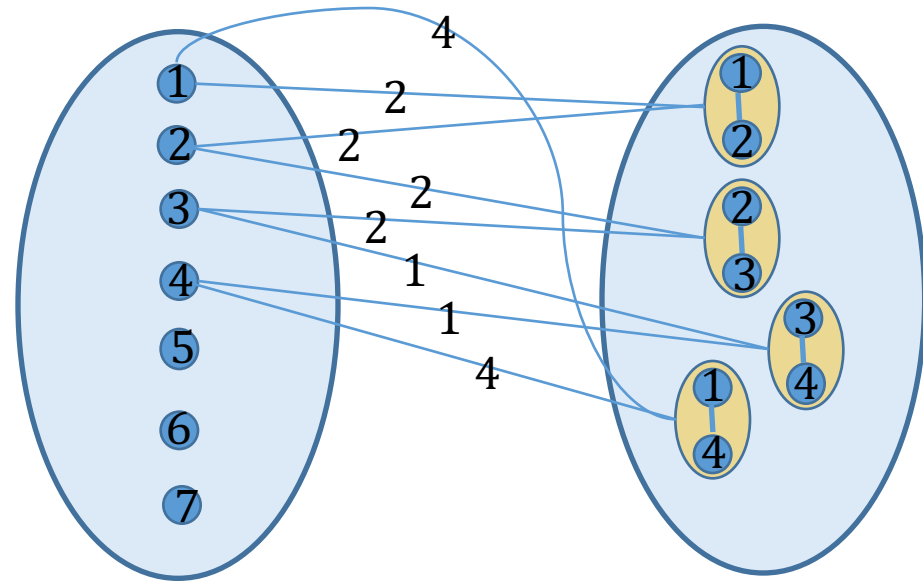
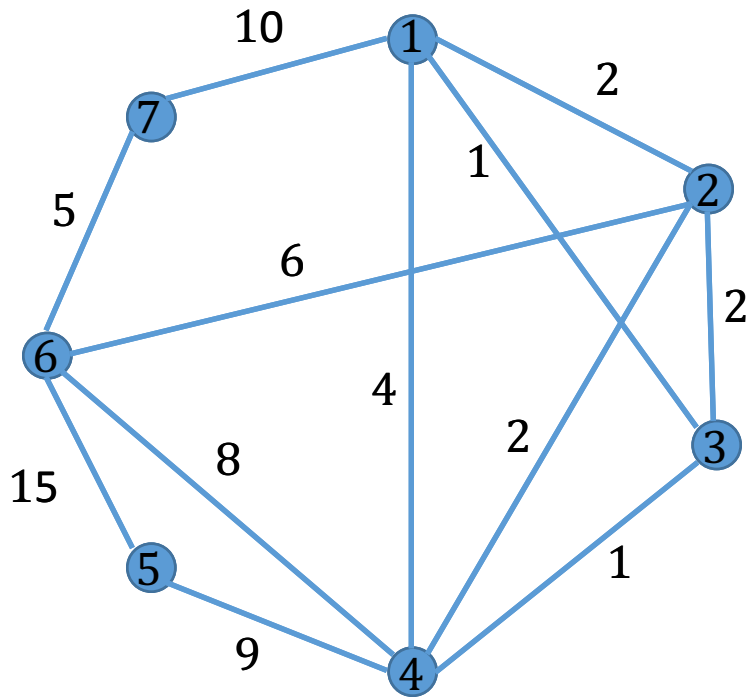
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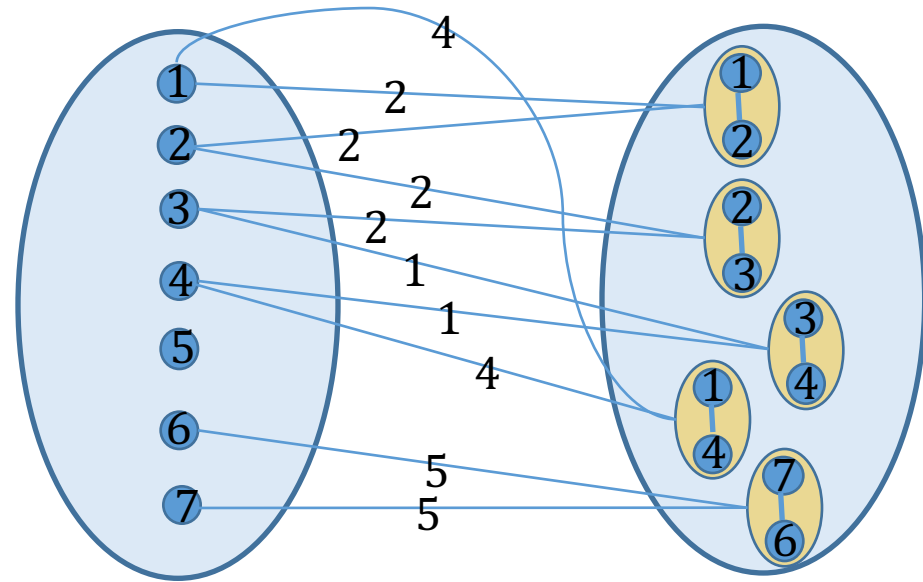
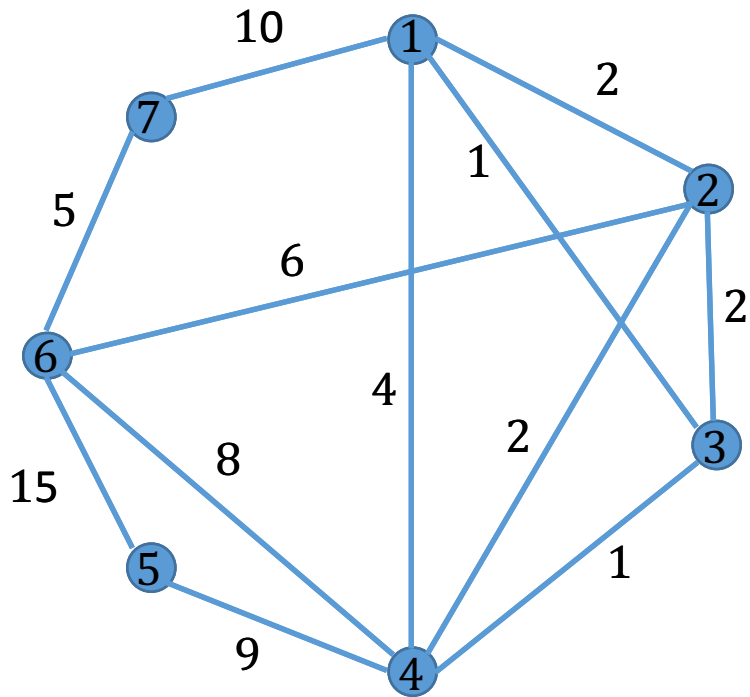
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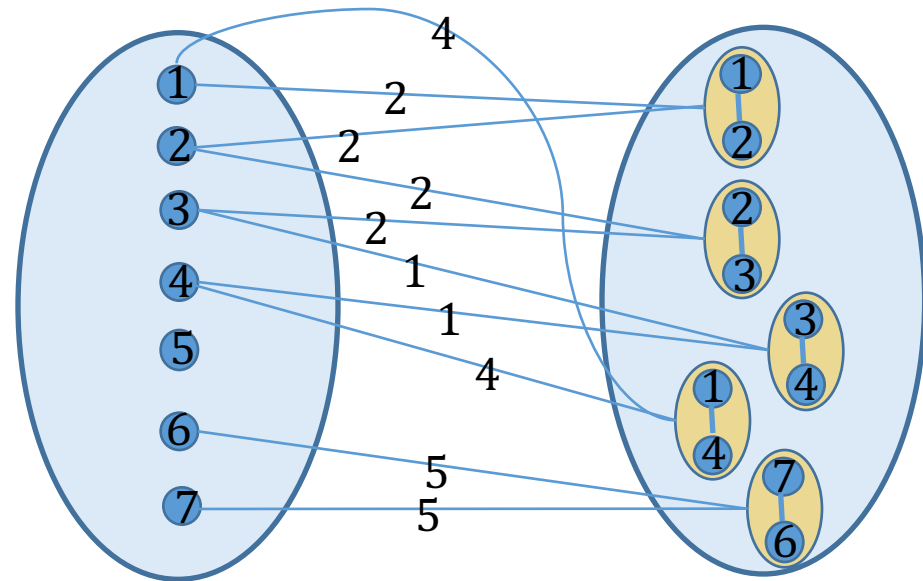
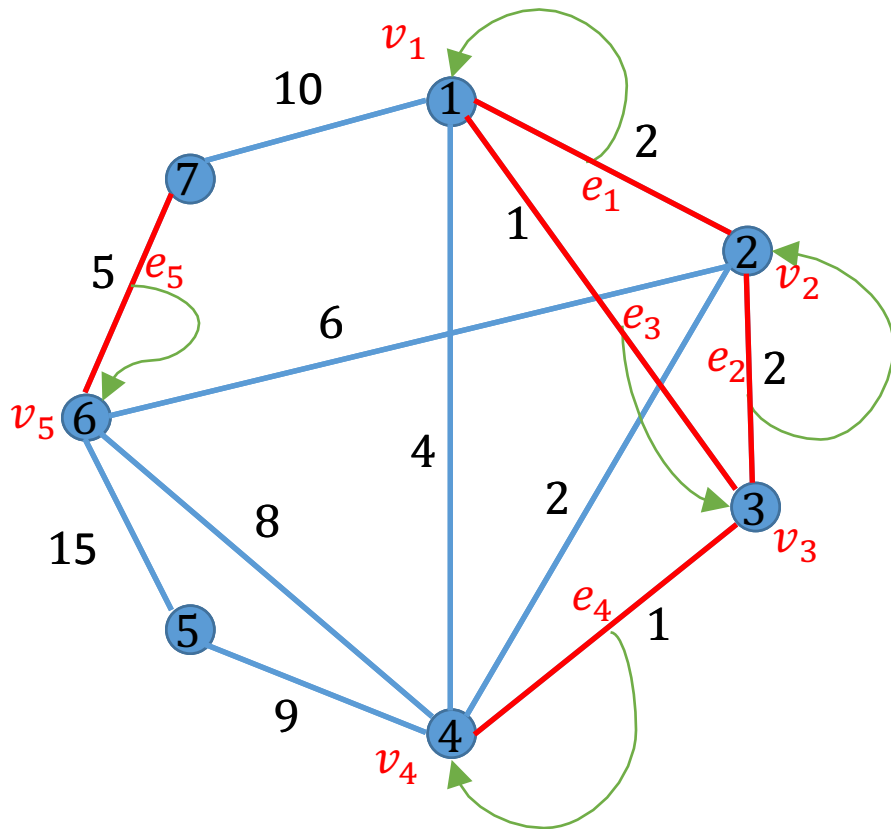
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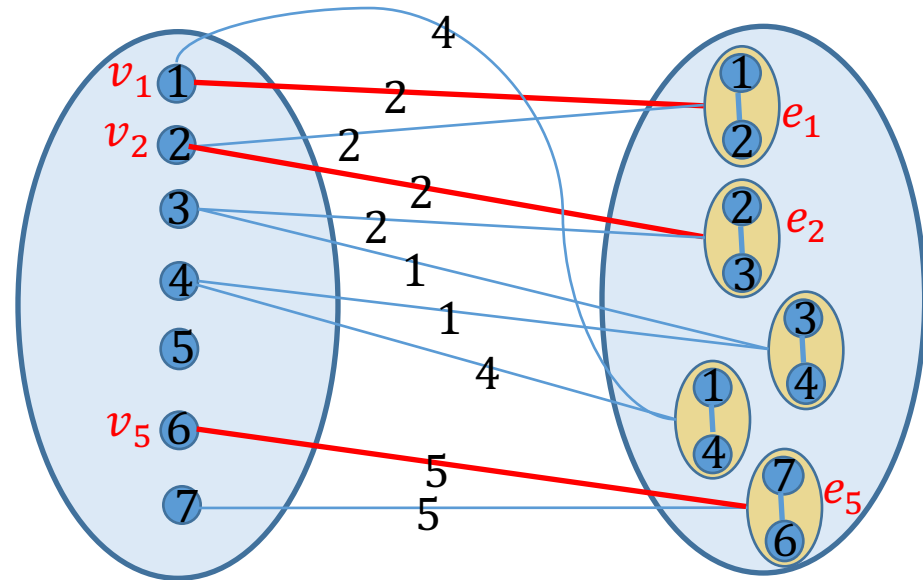
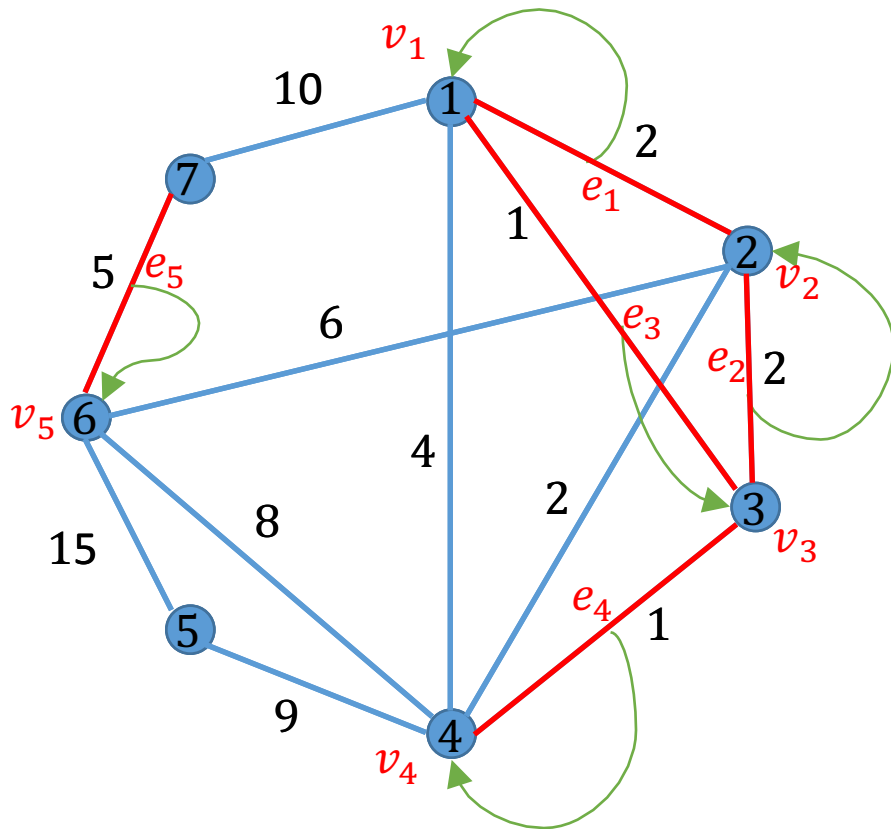
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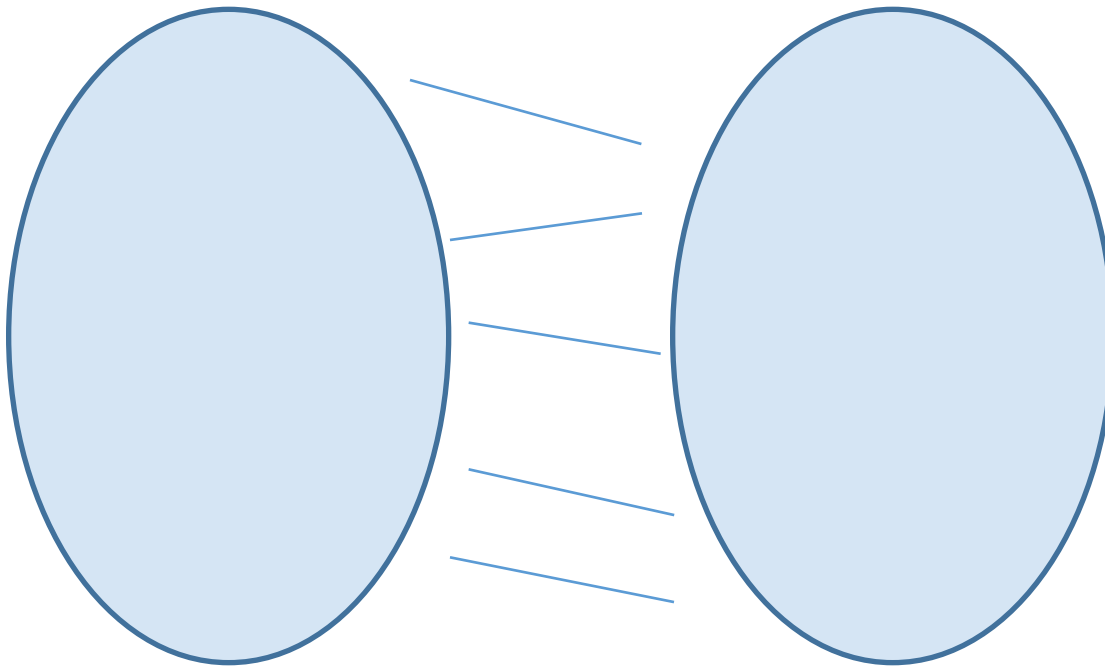
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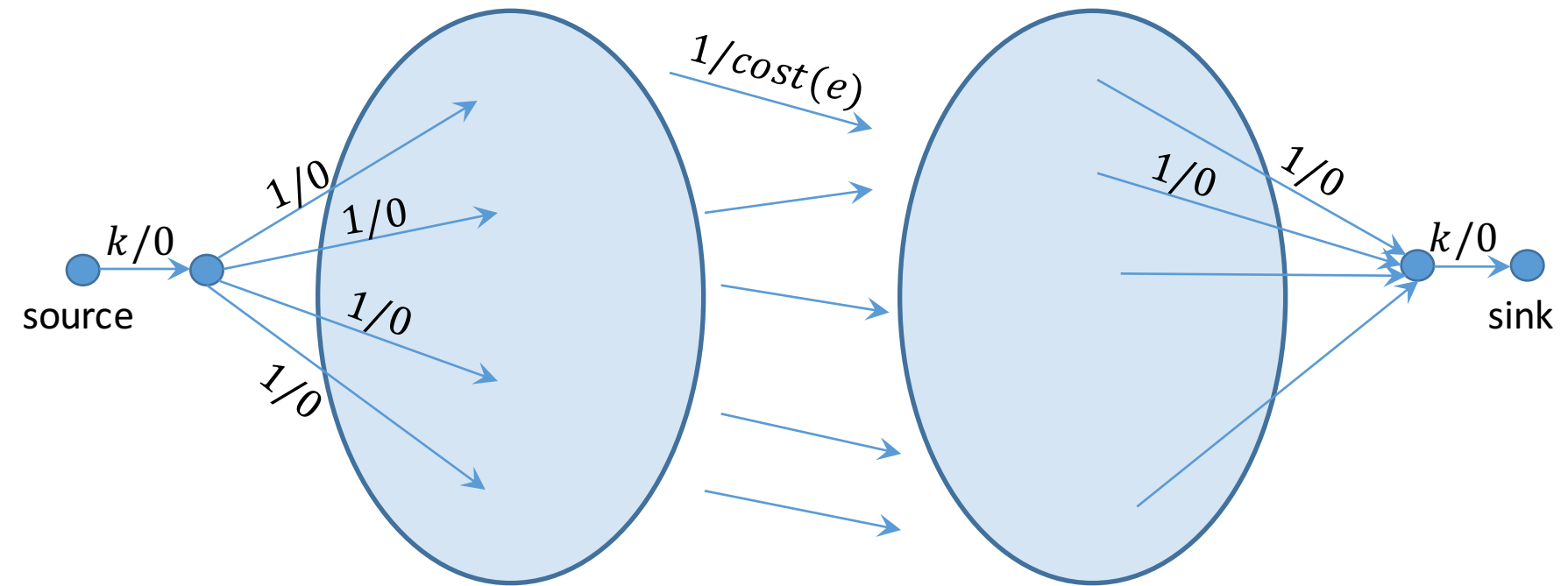
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capacity/cost