Project Selection

Project selection problem:

▶ Set P of possible projects. Project v has an associated profit p_v (can be positive or negative).

▶ Some projects have requirements (taking course EA2 requires course EA1).

▶ Dependencies are modelled in a graph. Edge (u, v) means "can't do project u without also doing project v."

▶ A subset A of projects is feasible if the prerequisites of every project in A also belong to A.

Goal: Find a feasible set of projects that maximizes the profit.

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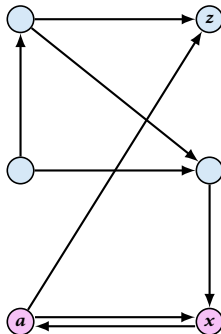
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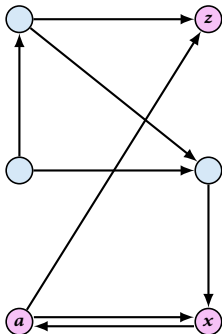
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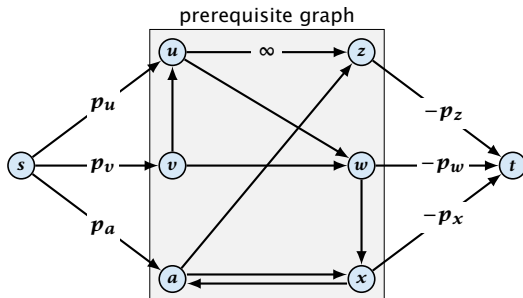
Project Selection

The prerequisite graph:

- ▸ $\{x, a, z\}$ is a feasible subset.
- ▸ $\{x, a\}$ is infeasible.

Project Selection

Mincut formulation:

- ▶ Edges in the prerequisite graph get infinite capacity.
- ▶ Add edge (s, v) with capacity p_v for nodes v with positive profit.
- ▶ Create edge (v, t) with capacity $-p_v$ for nodes v with negative profit.

prerequisite graph

Theorem 2

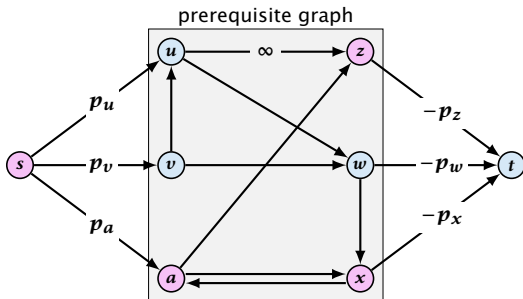*A is a mincut if $A \setminus \{s\}$ is the optimal set of projects.*

Theorem 2

A is a mincut if $A \setminus \{s\}$ is the optimal set of projects.

Proof.

- A is feasible because of capacity infinity edges.

prerequisite graph
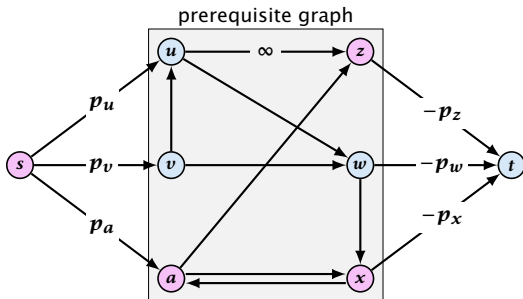
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- ▸ $\text{cap}(A, V \setminus A)$

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- ▸ A is feasible because of capacity infinity edges.
- ▸ $\text{cap}(A, V \setminus A) = \displaystyle\sum_{v \in \bar{A}:p_v > 0} p_v + \sum_{v \in A:p_v < 0} (-p_v)$

prerequisite graph

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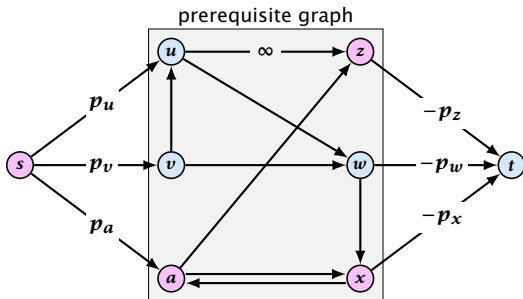- *A* is feasible because of capacity infinity edges.
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  $\displaystyle\sum_{v: p_v > 0} p_v - \sum_{v \in A} p_v$

prerequisite graph