
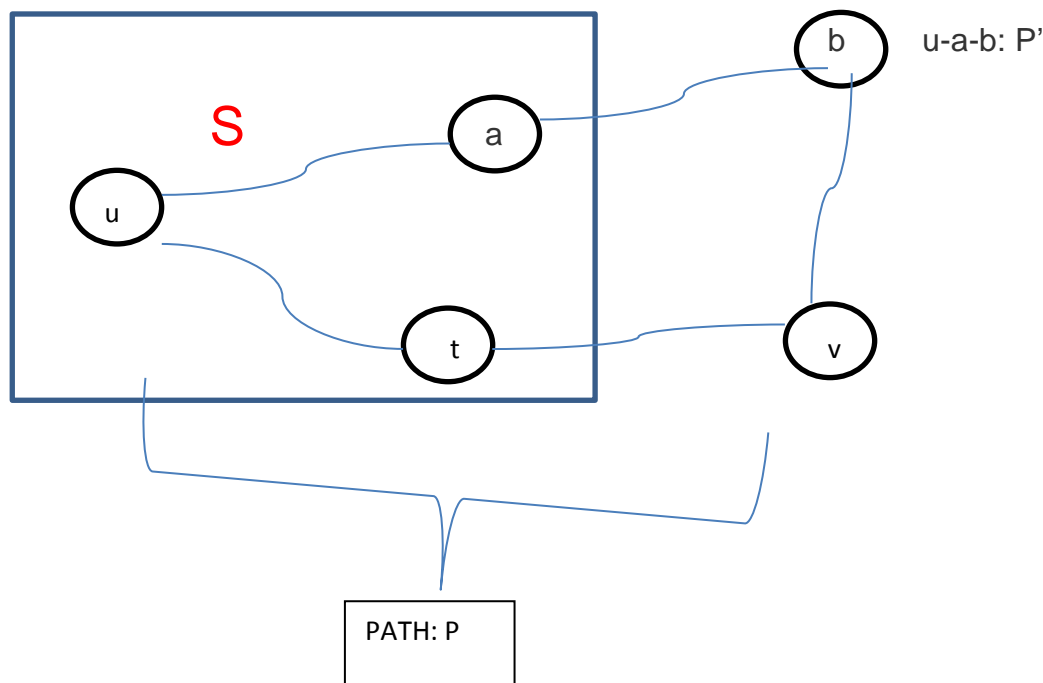


- Let S be the set of all vertices on the shortest path found by [Dijkstra's algorithm](#).
- Prove that the $\text{distances}[u]$ is the minimum length between the vertex u and the target vertex t .

Proof: Base case

- When $|S| = 1$, it is true. 
- Induction case
 - Inductive hypothesis: Assume that it is true for $|S| = k > 1$.
 - For each target vertex t in S , $\text{distances}[u]$ is the shortest path.
 - Given $k > 1$ vertices. Currently $\text{distances}[u]$ is the minimum length between u and t .
 - Let v be the next node added to the S . And let $t-v$ be the chosen edge. Assume there is a shorter path than P ($u-v$). Let P' denote such a path.
 - However P' is already longer (or at least equal if b does not exist because edges have positive weights) than P as soon as it leaves S . Therefore it contradicts the assumption that P' is shorter than P . P and therefore $\text{dist}[u]$ is the shortest.



$$L(P') > L(P) > L(u-t)$$