Set S is all vertices to which we have found shortest paths.

$$\min_{\substack{u \in S \\ \{u,v\} \text{ an edge}}} d[u] + c_{u,v} = d[v]$$

If $v \notin S$, $d[v]$ is our best guess of shortest path.

Pick v min $d[v]$ over all vertices not in S.

- Add to S.
- Update dist

Recurse

Correctness By induction

At any point of running ALG, For all $u \in S$, $d[u]$ is the shortest path from $s \to u$.

Base Case: $|S| = 1$. $S = \{s\}$ $d[s] = 0$. ✓

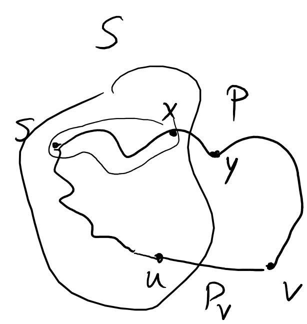
IH: Suppose claim holds when $|S| = k$.

IS. Goal show holds when we go to $|S| = k+1$.

Suppose we added v.

$$v = \min_{w \notin S} \underbrace{d[w]}_{\min_{\substack{u \in S \\ \{u,\}}} d[u] + c_{u,w}}$$

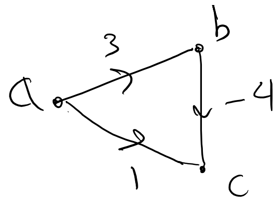
$d[v] = d[u] + c_{u,v}$ for $u \in S$



Goal: P_v is shortest path to v.

Show $len(P) \geq len(P_v)$.

$$len(P) \geq len(s \to x \text{ part}) + c_{xy} \underbrace{\geq}_{\text{by IH}} d[x] + c_{xy} \geq d[y] \geq d[v] = len(P_v).$$


3
b
a
-4
1
c