MOORE-BELLMAN-FORD ALGORITHM

Input: A digraph G, weights $c : E(G) \to \mathbb{R}$, and a vertex $s \in V(G)$.

Output: A negative circuit C in G, or shortest paths from s to all $v \in V(G)$ and their lengths.
More precisely, in the second case we get the outputs $l(v)$ and $p(v)$ for all $v \in V(G) \setminus \{s\}$. $l(v)$ is the length of a shortest s-v-path, which consists of a shortest s-$p(v)$-path together with the edge $(p(v), v)$. If v is not reachable from s, then $l(v) = \infty$ and $p(v)$ is undefined.

① Set $l(s) := 0$ and $l(v) := \infty$ for all $v \in V(G) \setminus \{s\}$. Let $n := |V(G)|$.

② **For** $i := 1$ **to** $n - 1$ **do**:
  For each edge $(v, w) \in E(G)$ **do**:
    If $l(w) > l(v) + c((v, w))$ **then**
      set $l(w) := l(v) + c((v, w))$ and $p(w) := v$.

③ **If** there is an edge $(v, w) \in E(G)$ with $l(w) > l(v) + c((v, w))$ **then** set $x_n := w$, $x_{n-1} := v$, and $x_{n-i-1} := p(x_{n-i})$ for $i = 1, \dots, n - 1$, and output any circuit C in $(V(G), \{(x_{i-1}, x_i) : i = 1, \dots, n\})$.