Algorithm 1 - General
- works in case with no negative loop!!

1. \( \forall u : d(u) = \begin{cases} 0 & \text{if } u = v \\ \infty & \text{otherwise} \end{cases} \)

2. Repeat (improvement step)
   - pick \( u \in V \)
   - let \( d(u) = BF(u) \)

Repeat until nothing can change

* Theorem & Proof

- No negative loops -

1. \( \forall u \), throughout the algorithm,
   \( \tilde{d}(u) \geq d(u) \)
   \( \tilde{d}(u) = BF(u) \)

   \( \tilde{d}(r_1) + w_1 \leq \tilde{d}(r_2) + w_2 \)

   We know \( d(r_1) \leq \tilde{d}(r_1) \) by induction hypothesis

   \( d(w) \leq w(r_i,u) + d(r_1) \) triangular inequality

   \( d(w) \leq w(r_i,u) + \tilde{d}(r_1) \) first step of improvement

2. The algorithm halts.
   a) There is a SPT, \( v \rightarrow u \) has no loops
   b) Shortest path with out loop.