Algoritmi 1: TRACEBACK-PATH(x, π, π_{REV})

```
1  u = x
2  p = ⟨⟩
3  while u is not nil do
4  |   p = ⟨u⟩ ∘ p
5  |   u = π(u)
   Kaksisuuntainen haku?
6  if π_REV is not nil then
7  |   u = π_REV(x)
8  |   while u is not nil do
9  |   |   p = p ∘ ⟨u⟩
10 |   |   u = π_REV(u)
11 return p
```

Algoritmi 2: BREADTH-FIRST-SEARCH(G, s, t)

```
1  Q = ⟨s⟩
2  π(s) = nil
3  while |Q| > 0 do
4  |   u = DEQUEUE(Q)
5  |   if u is t then
6  |   |   return TRACEBACK-PATH(u, π, nil)
7  |   for (u, v) ∈ G.A do
8  |   |   if v is not yet mapped in π then
9  |   |   |   π(v) = u
10 |   |   |   ENQUEUE(Q, u)
11 |   return ⟨⟩
```

Algoritmi 3: BIDIRECTIONAL-BREADTH-FIRST-SEARCH(G, s, t)

```
1  Q, π, d = (⟨s⟩, (s, nil), (s, 0))
2  Q_REV, π_REV, d_REV = (⟨t⟩, (t, nil), (t, 0))
3  τ, μ = (nil, ∞)
4  while |Q||Q_REV| > 0 do
5      if τ is not nil and d(HEAD(Q)) + d_REV(HEAD(Q_REV)) ≥ μ then
6          return TRACEBACK-PATH(τ, π, π_REV)
7      u = DEQUEUE(Q)
8      if u is mapped in π_REV and μ > d(u) + d_REV(u) then
9          μ = d(u) + d_REV(u)
10         τ = u
11     for (u, v) ∈ G.A do
12         if v is not yet mapped in π then
13             π(v) = u
14             ENQUEUE(Q, v)
15             d(v) = d(u) + 1
16     u = DEQUEUE(Q_REV)
17     if u is mapped in π and μ > d(u) + d_REV(u) then
18         μ = d(u) + d_REV(u)
19         τ = u
20     for (v, u) ∈ G.A do
21         if v is not yet mapped in π_REV then
22             π_REV(v) = u
23             ENQUEUE(Q_REV, v)
24             d_REV(v) = d_REV(u) + 1
25 return ⟨⟩
```

Algoritmi 4: DIJKSTRA-SHORTEST-PATH(G, s, t, w)

```
1  OPEN, CLOSED, g, π = ({s}, ∅, {(s, 0)}, {(s, nil)})
2  while |OPEN| > 0 do
3      u = arg min_{x∈OPEN} g(x)
4      if u is t then
5          return TRACEBACK-PATH(u, π, nil)
6      OPEN = OPEN − {u}
7      CLOSED = CLOSED ∪ {u}
8      for (u, x) ∈ G.A do
9          if x ∈ CLOSED then
10             continue
11         g′ = g(u) + w(u, x)
12         if x ∉ OPEN then
13             OPEN = OPEN ∪ {x}
14             g(x) = g′
15             π(x) = u
16         else if g(x) > g′ then
17             g(x) = g′
18             π(x) = u
19 return ⟨⟩
```