VE281 Writing Assignment Five

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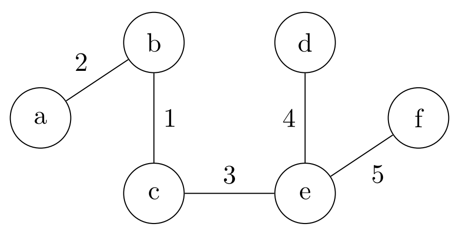
Ex. 1

In Kruskal's algorithm, we take the shortest edge and connect two nodes if it doesn't form a cycle.

1. Connect b and c
2. Connect a and b
3. Connect c and e
4. Connect e and f
5. Connect e and d

The minimum spanning tree is



Ex. 2

Input:
  A directed acyclic graph $G = (V, E)$ with real-valued edge weights
  Two distinct nodes s and d
Output:
  A longest weighted path from s to d if exists

```
L ← G sorted in topological order
Remove nodes located before s or after d from L
Remove node s from L
s.distance ← 0
s.predecessor ← NULL
for node v in L do
    v.distance ← −∞
    v.predecessor ← NULL
    for edge (u, v) in edges with end node v do
        if u.distance + (u, v).weight > v.distance then
            v.distance ← u.distance + (u, v).weight
            v.predecessor ← u
        end if
    end for
end for
if d.predecessor == NULL then
    print "No path exists"
else
    print d.predecessor recursively in reverse order
end if
```

The time complexity is $O(V + E)$.

Ex. 3

Input:
A directed graph $G = (V, E)$ with real-valued edge reliability in the range $[0, 1]$
Two distinct nodes s and d
Output:
A most reliable path from s to d if exists

```
for node u in G do
    u.reached ← false
    u.probability ← 0
    u.predecessor ← NULL
end for
s.probability ← 1
push node s into set S
while Set S is not empty do
    u ← pop the node with largest reliability in S
    u.reached ← true
    for edge (u, v) in edges with start node u do
        if not v.reached and u.probability * (u, v).reliability > v.probability then
            v.probability ← u.probability * (u, v).reliability
            v.predecessor ← u
        end if
    end for
end while
if d.predecessor == NULL then
    print "No path exists"
else
    print d.predecessor recursively in reverse order
end if
```

Ex. 4

Input:
A connected, undirected graph $G = (V, E)$
Output:
A path that traverses edge in E exactly once in each direction.

```
for node u in G do
    u.reached ← false
    u.depth ← 0
end for
s ← an arbitrary node in G
DFS(s)

function DFS(node u)
    u.reached ← true
    for edge (u, v) in edges adjacent to u do
        if not v.reached then
            v.depth ← u.depth + 1
            traverse u → v
            DFS(v)
            traverse v → u
        else if v.depth > u.depth then
            traverse u → v
            traverse v → u
        end if
    end for
end function
```

Ex. 5