1 Minimal Spanning Tree Algorithm

1.1 Introduction

This project mainly contains

- Prim Algorithm
- Kruskal Algorithm

1.2 Prim Algorithm

1.2.1 Pseudo code

Algorithm 1 Prim algorithm

```
function PRIM($V, E$)    ▷ $V$ denotes vertices, $E$ denotes edges
Require: A weighted, connected map which vertices set as $V$ and edges set as $E$.
Ensure: Using sets $V_{new}$ and $E_{new}$ which describe the minimal spanning tree.
    $V_{new} \leftarrow \{x\}$    ▷ $x \in V$, $x$ as the start vertex
    $E_{new} \leftarrow \{\}$    ▷ set $E_{new}$ as empty set
    while $V_{new} \neq V$ do
        Find the minimal edge $\langle u, v \rangle$ from $E$ , s.t. $u \in V_{new}, v \notin V_{new}, v \in V$    ▷ If there were multi answers, choose one randomly
        Push $v$ in $V_{new}$ and push $\langle u, v \rangle$ in $E_{new}$
    end while
end function
```

1.2.2 Flowchart

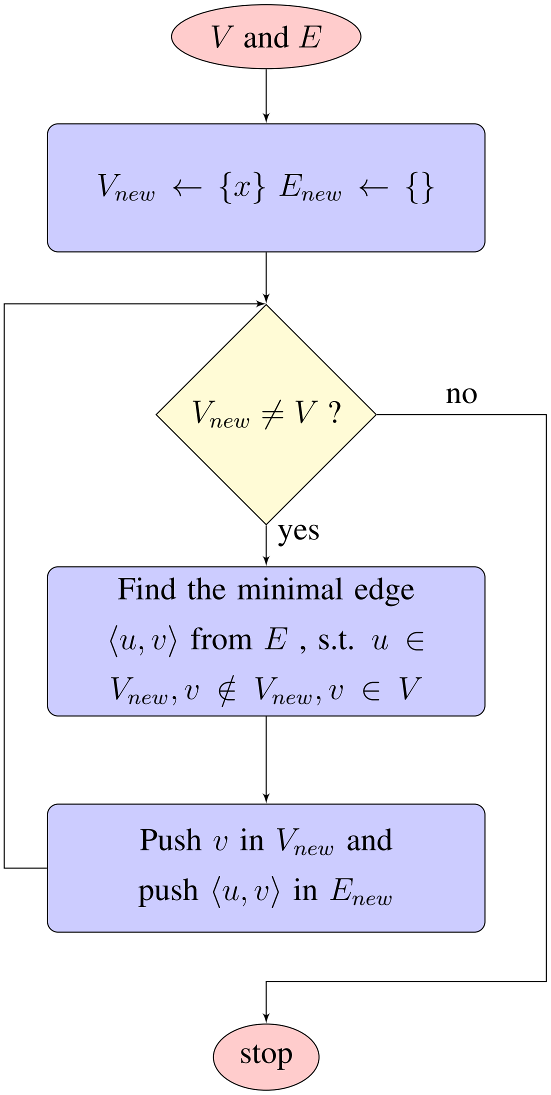
V and E
$V_{new} \leftarrow \{x\}$ $E_{new} \leftarrow \{\}$
$V_{new} \neq V$?
no
yes
Find the minimal edge $\langle u, v\rangle$ from E , s.t. $u \in V_{new}, v \notin V_{new}, v \in V$
Push v in V_{new} and push $\langle u, v\rangle$ in E_{new}
stop

图 1: Prim algorithm flowchart

1.2.3 Analysis

Let v denotes the sum of vertices and e denotes the sum of edges, then, this algorithm's time complexity is:

- Adjacent matrix: $O\left(v^2\right)$
- Adjacent table: $O\left(e \log_2 v\right)$

1.3 Kruskal Algorithm

1.3.1 Pseudo Code

Code here

1.3.2 Flowchart

Flow chart here