ALG22 PA3 Report
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DATA STRUCTURE being used: Disjoint set, Vector, Adjacent List and I consider that MST is one of the data structure.

Notice that **KruskalMST** is in reverse order to get the maximum spanning tree, because we want the weights sum of removed edges to be as small as possible.

```
struct Edge {
    int u, v, w;
    bool merged;
};

bool operator<(const Edge &e1, const Edge &e2){
    return e1.w > e2.w;
}

class MST{
public:
    MST();
    void INIT(FILE*, FILE*);
    void END(FILE*, FILE*);
    void check(char, FILE*, FILE*);

private:
    void kruskal();
    int find(const int &);
    int V;
    int E;
    int *disjoint_set;
    Edge *edge;
};
```

I also define a struct Edge to store the information of edges' start point, end point, weight, and if it's merged.

For case I, II, I use the class **MST** to solve these two problem. However, for case III, I define another class **Acyclic** to solve it. If we meet a positive one, we add it as long as it's acyclic.

In the **Acyclic**, we need to run the DFS, also I define friend class in order to let the class **MST** could use the Acyclic's function (in **check** we'll need it).

```
struct A_Edge{
    int i, j, w;
    bool deleted;
};

bool operator<(const A_Edge &e1, const A_Edge &e2);

class Acyclic {
public:
    Acyclic();
    void process(FILE *, FILE *);
    void dfs(const vector<vector<int>>&, char *, const int&, bool &);
    void dfs_has_cycle(const vector<vector<int>>&, bool &);

    bool is_connected(const vector<vector<int>>&);
    int find(const int &);

private:
    int V, E;
    int *disjoint_set;

friend class MST;
};
```

FIND IN THE PA

First of all, I found that this PA is more harder to implement(code), and it indeed took me a lot of time to do this PA.

Through this PA, I got a more deeper insight go the data structure taught in the class, like disjoint set and DFS, in the class, we only think about it, however, in this PA, we have to implement them in our code. This really improve my knowledge and militarily about these stuffs(data structure). Except the data structure experience, I learned the unsigned int and the struct that I use in the PA, and these are taught by my dear classmates, I think they are really kind to share these cool tools to me since this PA is somewhat a competition between us EE students. I think this PA also let me know the teamwork's importance (I mean teaching, not Plagiarizing lol).

Also, I have learned that how to get a suboptimal solution of a NPC problem, which is really important o us.