CAA PRESENTATION

Network

ELECTRICITY GRID PROBLEM

Flows

Presented by Arun Kushwaha

Paths

Min Cut

AGENDA

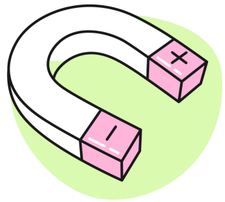
INTRODUCTION

Problem Discussion

APPROCH

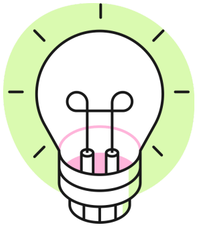
Elaborate disscssion on solving process

ALGORITHM



Discussion on algorithm

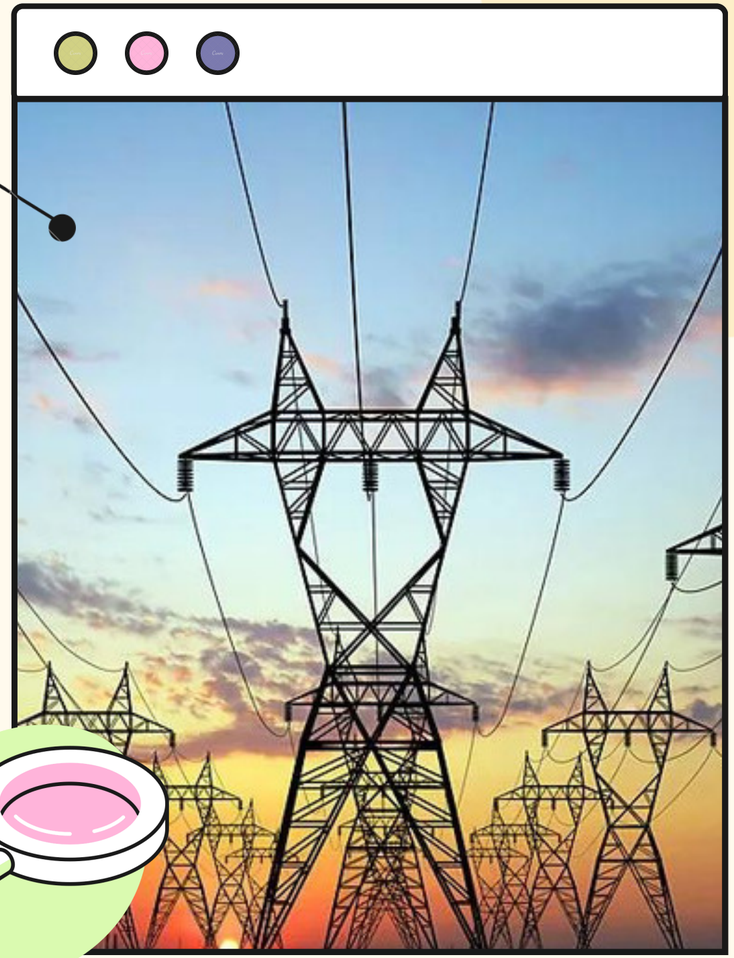
CONCLUSION



Learning and understanding

INTRODUCTION

There are two town in a country 's' and 't'. Town 's' is very close to water resouces, and thus produces abundant electric power. Whereas town 't' has shortage of electricity. Town 's' has been given responsiblity of providing power to town 't'. These town are connected by various electric poles and wire. Use Network Flow to maximise the electric power that can be provided to town 't' by town 's'



INTRODUCTION

INPUT

Given a list of eletric pole connecting two towns. You are also provided by load of each wire between two poles. A overloaded wire can cause fire in nearby area, so try to avoid it.

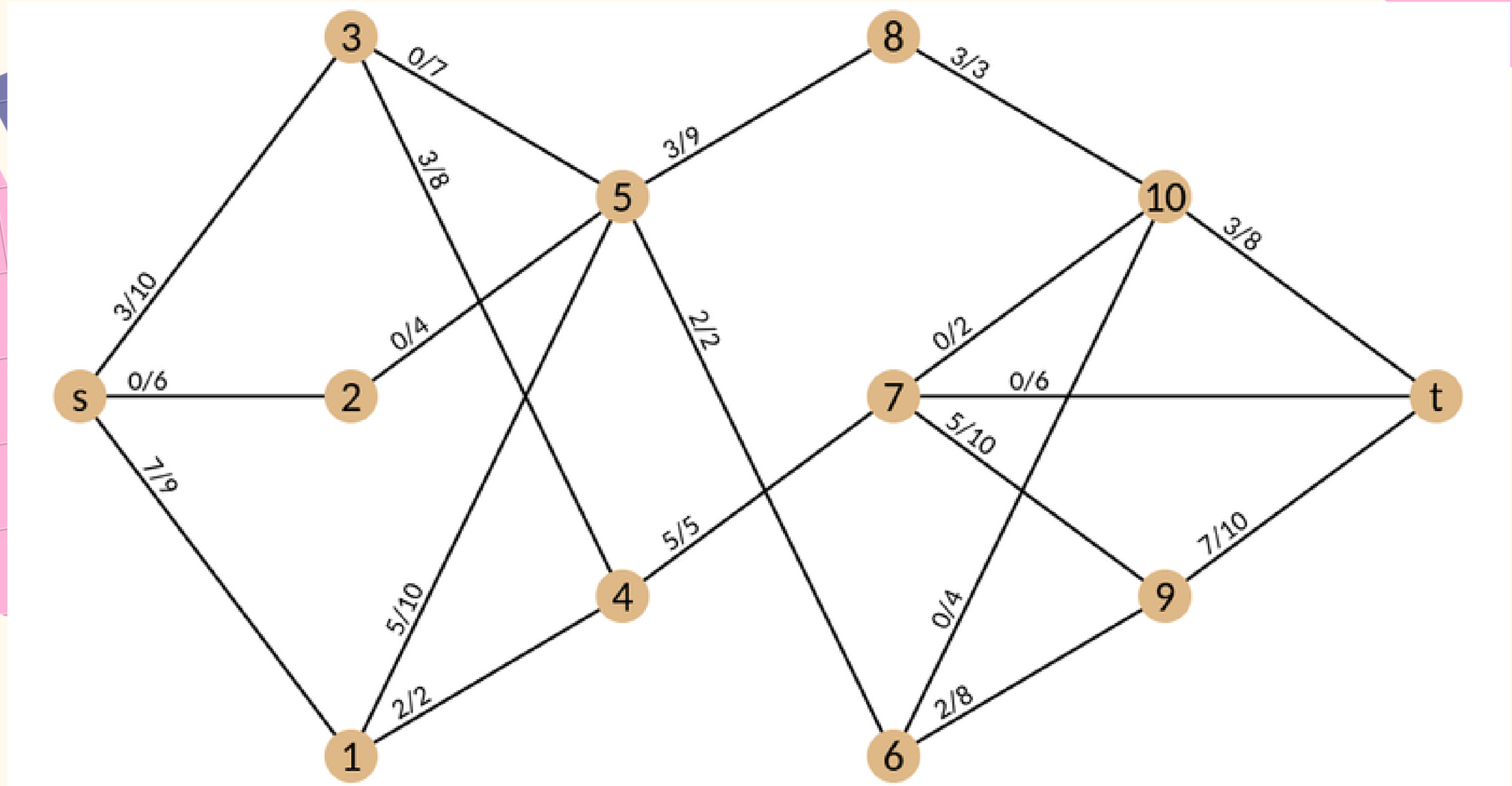
PROBLEM

Find a optimal arrangment of load on wires such that no wire is overload and the electric power shared is maximum.

OUTPUT

Output the maximum electric power that can be shared between two town, and also count the number of unique agumented path required for this transfer.

GRID NETWORK



APPROCH & ALGORITHM

1 UNDERSTANDING

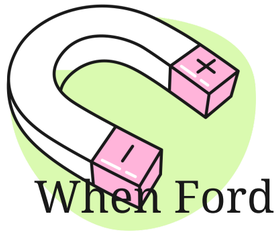
In optimization theory, maximum flow problems involve finding a feasible flow through a flow network that obtains the maximum possible flow rate.
The maximum flow problem can be seen as a special case of more complex network flow problems, such as the circulation problem. The maximum value of an s-t flow (i.e., flow from source s to sink t) is equal to the minimum capacity of an s-t cut (i.e., cut severing s from t) in the network, as stated in the max-flow min-cut theorem.

2 ALGORITHM USED

The Ford–Fulkerson method or Ford–Fulkerson algorithm (FFA) is a greedy algorithm that computes the maximum flow in a flow network. It is sometimes called a "method" instead of an "algorithm" as the approach to finding augmenting paths in a residual graph is not fully specified or it is specified in several implementations with different running times. It was published in 1956 by L. R. Ford Jr. and D. R. Fulkerson

3 TIME COMPLEXITY ANALYSIS

$$O(E^2U)$$



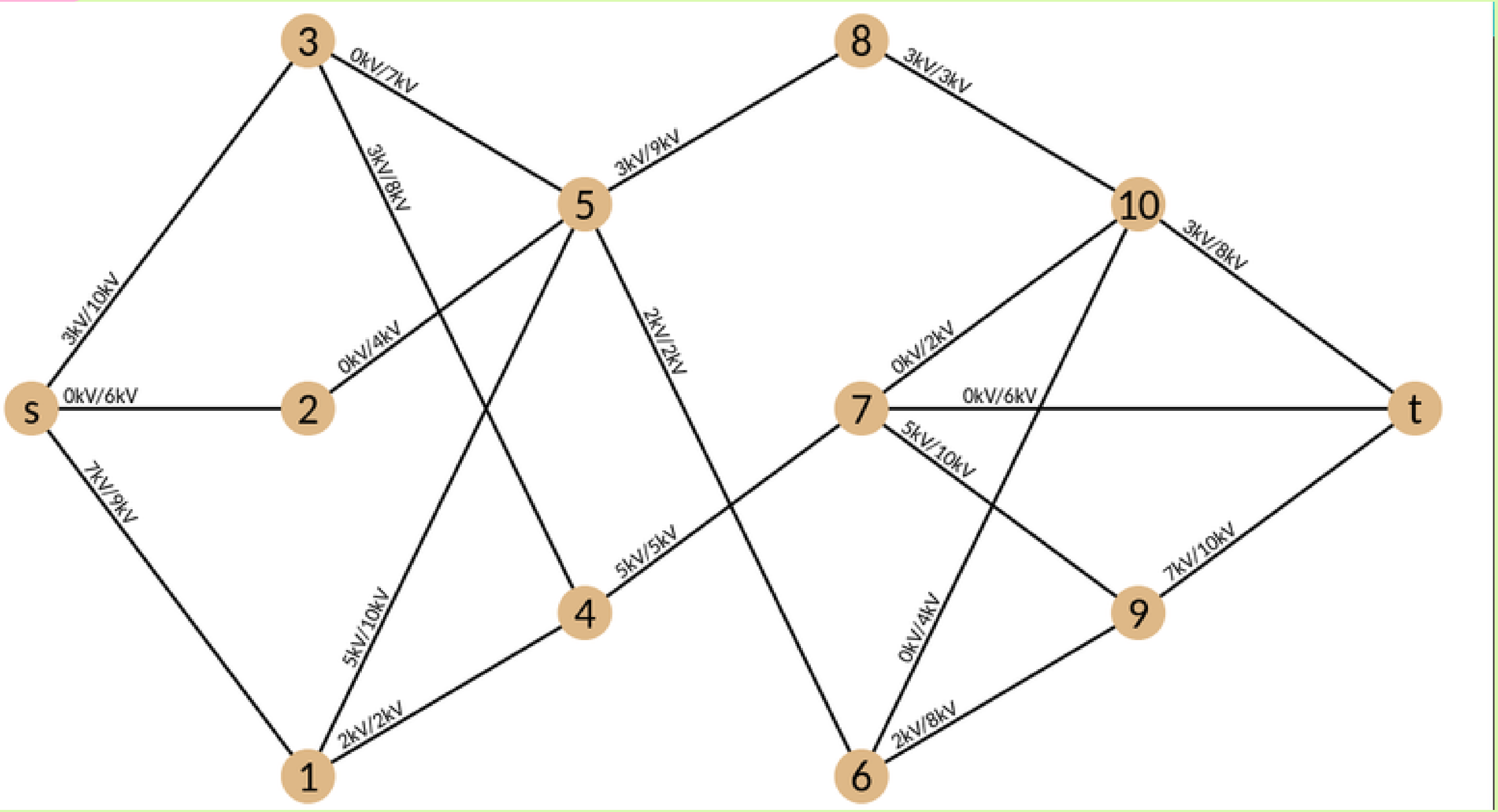
SOLUTION

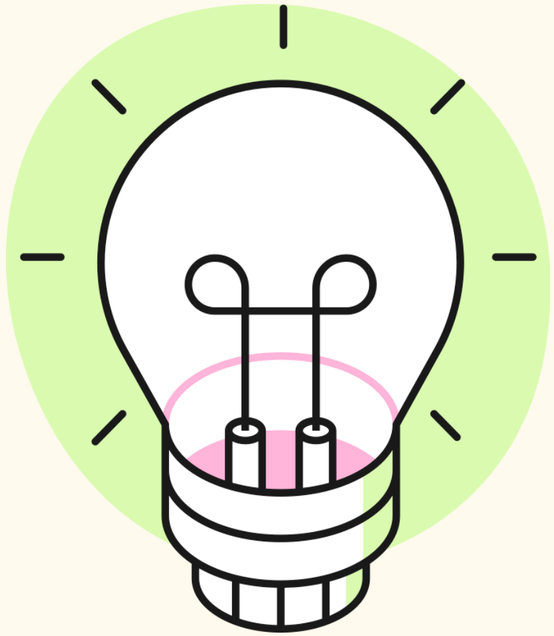
When Ford Fulkerson was used to solve the problem, the max electric power that can be shared came out be 10, which was achieved using 4 agumented paths.

Source-Code : Github
Hosted-Link : Weburl

```
s->3->4->7->9->t
Updating path
Increased flow for node 9 by 3
Increased flow for node 7 by 3
Increased flow for node 4 by 3
Increased flow for node 3 by 3
Increased flow for node s by 3
-----------------------------
Found a argumented path
s->3->4->7->10->t
Invalid path reverting back!
-----------------------------
Found a argumented path
s->3->4->7->t
Invalid path reverting back!
-----------------------------
Finished Ford Fullkerson (DFS) method
-----------------------------
Max Flow : 10
Agumented Path Found: 4
```

OPTIMAL FLOW OF POWER





LEARNING

- Basic Understanding of flow problems
- Use of greedy approch to optimise solution
- Working of Ford Fulkerson Algorithm
- Creating animation using canvas and Javascript

THANK YOU

A presentation by Arun Kushwaha 2020IMT016