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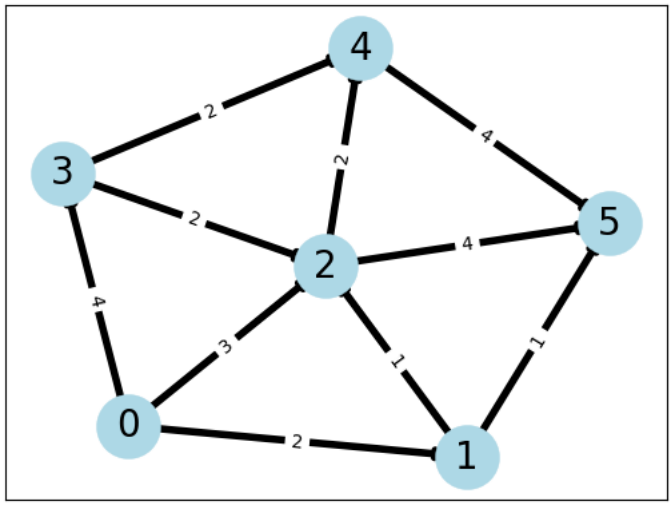
All pictures are taken from my collab code. These are the best case output that the program gives. Reproducing such outcome may or may not be possible as the graph and the graph flow is generated at random each time.

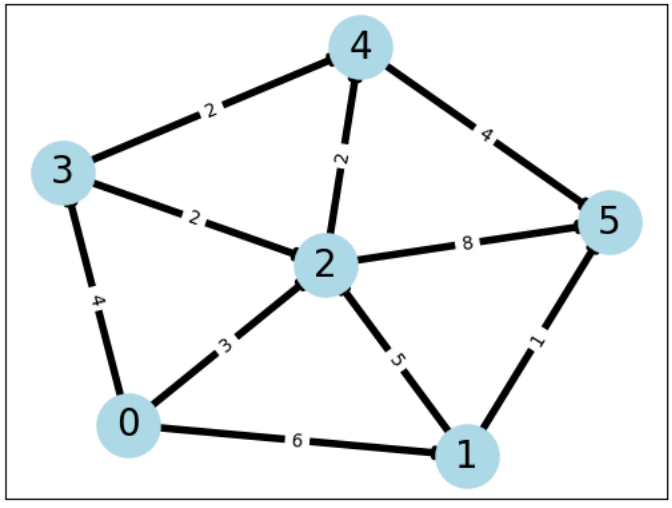
Requirement 1

This part of the program will optimize the static graph that was provide to us in the assignment. As from the result in the collab file. The algorithm performs as expected and does exactly as illustrated in the trace.

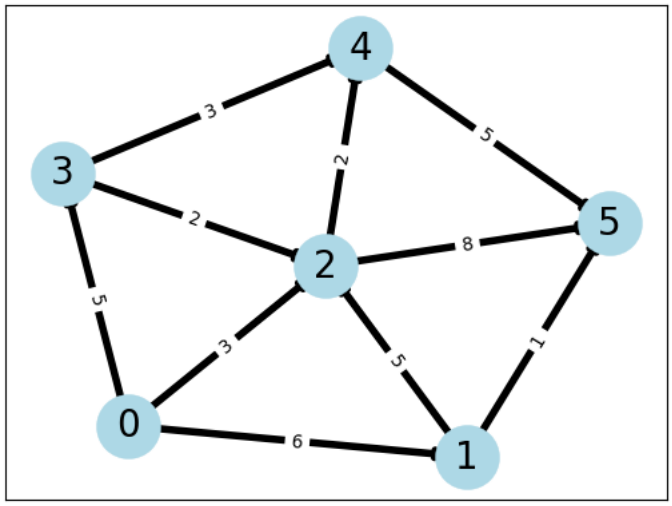
This is the initial graph



This is the graph after the first optimization.



This is the graph after the second and the final optimization.



Requirement 2

The values of Hill climbing flow (tf) and Edmond Karp flow (tf_net) are as:

Tf_net(OPTIMAL FLOW) : 19
Tf(optimized flow) : 18

```
OPTIMAL FLOW 19
Done optimizing
optimised flow 18
```

This is the most realist and expected outcome I could find after running the code a multiple time. Where EK flow is greater than our HC flow. My code normally overfits and the HC flow is much greater than the EK flow.

Requirement 3a

The values of Hill climbing flow (tf) and Edmond Karp flow (tf_net) are as:

Tf_net(OPTIMAL FLOW) : 15.2
Tf(optimized flow) : 23.86

```
Average EK flow = 15.2
Average HC flow = 23.866666666666667
```

Requirement 3b

The values of Hill climbing flow (tf) and Edmond Karp flow (tf_net) are as:

Tf_net(OPTIMAL FLOW) : 9.16
Tf(optimized flow) : 13.6

```
    Average EK flow = 9.166666666666666
    Average HC flow = 13.6
```

Requirement 3c

Yes, there is a significant difference between these flows. This is mainly because as the connectivity decreases the number of edges between any two nodes decreases from 3 to 2. Our code also removes all back flows so if node 3 had a flow to node 2 then such flow gets removed. I used the back flow code provided to us my Professor Pears and this is how it behaves.
As a result the edges between nodes decreases which reduces the overall flow in the system and the sink node has a lower flow as compared the flow when connectivity was 3.