KING ABDULAZIZ UNIVERSITY
FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY
CPCS324 - Algorithms and Data Structures (II)
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CPCS324 Project - Phase three

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Group #5

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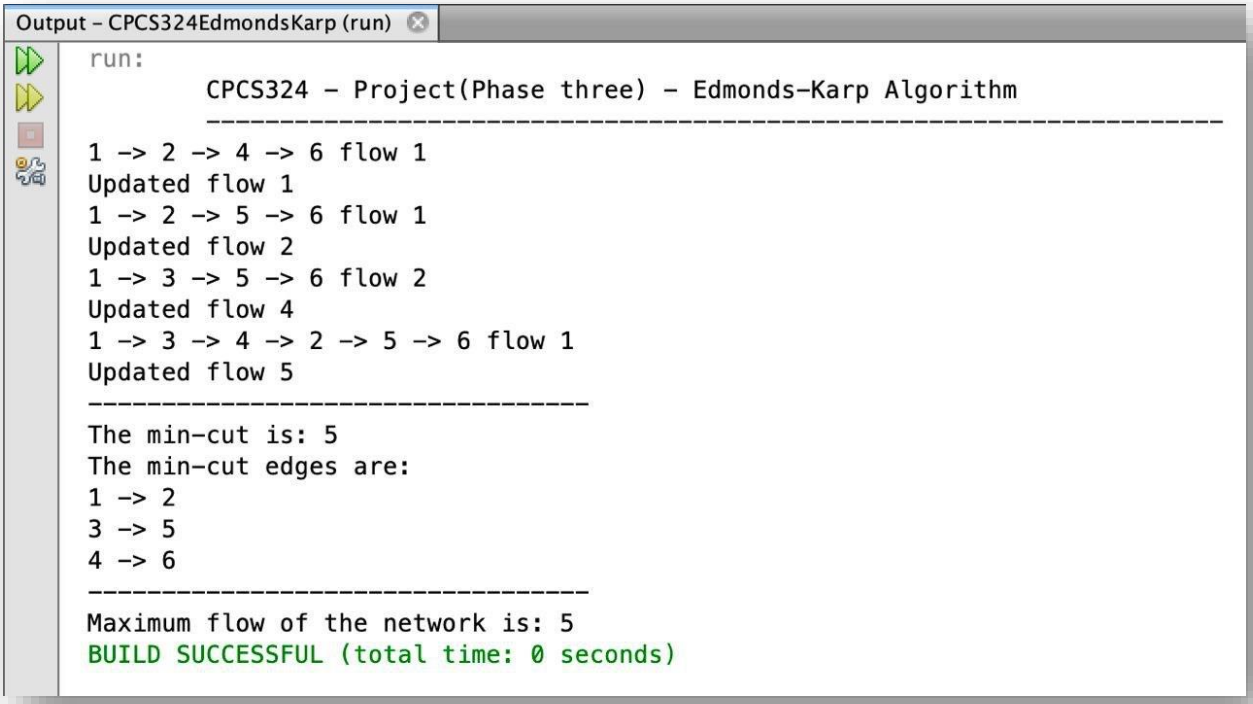
1. Introduction

This report is going to discuss two algorithms in computer science, Ford-Fulkerson and Maximum Bipartite Matching.

The Ford-Fulkerson is an algorithm was discovered in 1956 by Ford and Fulkerson, it uses Iterative Improvement to solve the max-flow min-cut problem which is for a given a network with vertices and edges between those vertices that have certain weights, it is determine the amount of flow that the network can process at a time. Flow means data through a computer network. It assumes that the input will be a weighted graph. There must also be a source vertex and sink vertex to understand the beginning and end of the flow network.

There are many real world problems that can be formed as Bipartite Matching, where A Bipartite Graph is a graph whose vertices can be divided into two disjoint sets with no cycle. A matching in a Bipartite Graph is a set of the edges chosen in such a way that no two edges share an endpoint. The maximum bipartite matching (MBP) problem can be solved by converting it into a flow network, A maximum matching is a matching of maximum size (maximum number of edges) and there can be more than one maximum matching for a given Bipartite Graph.

2. Screenshots for the outputs



2. Difficulties

We faced some difficulties during this project such as coding a new concept and implementing it, we overcame it by researching and investigating more on it. Also, we faced difficulty in meeting in-person due to COVID-19, we overcame it by staying in contact regularly with online meetings, we used screen sharing and annotation to enable everyone to stay focused and learn everything we needed to.

4. Conclusion

To conclude, in this report we solve the max-flow min-cut problem by using Ford-Fulkerson algorithm that uses Iterative Improvement to get the optimized solution. And, and we find the maximum matching for bipartite graph using maximum-matching algorithm.

We observe that the Ford-Fulkerson has a time complexity of O(|E| f*) where f* is the maximum flow of the network. And maximum-matching algorithm has a time complexity of O(n(n+|E|)) where n is the number of vertices in the graph.

5. References

1. Levitin, A. (2012,2007,2003). *Introduction to The Design & Analysis of Algorithms.* New Jersey: Addison-Wesley.
2. https://www.geeksforgeeks.org/ford-fulkerson-algorithm-for-maximum-flow-problem/
3. https://www.geeksforgeeks.org/maximum-bipartite-matching/

GitHub Links:

Ford-Fulkerson code :
https://github.com/demaAlolayan/CPCS324EdmondsKarp

Maximum-Matching for Bipartite graph code :
https://github.com/demaAlolayan/CPCS324Bipartite