OPTIMIZE THE MAXIMUM FLOW OF ELECTRICITY CAPACITY USING FORD FULKERSON, EDMONDS KARP AND GOLDBERG TARJAN ALGORITHM

NIK NUR DIYANA BINTI NIK MOHD HUZAIDI

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DECLARATION BY THE SUPERVISOR

This is to confirm that:

The research conducted and the writing of this thesis was under my supervision.

Signature: ______________________________________

Name of Main Supervisor: Dr. Nur Atikah binti Salahudin

Faculty: College of Computing, Informatics and Mathematics

UiTM Kuala Terengganu Kampus Kuala Terengganu

ABSTRACT

This research explores the optimization of electricity flow using the Ford Fulkerson, Edmonds Karp, and Goldberg Tarjan algorithms. The main goals are to study these algorithms for maximum electricity flow, implement them to find the best flow in electricity transmission, and optimize the flow using these methods. The process involves transforming data into a residual graph representing electricity flow through substations and power lines, then applying the algorithms step by step to determine maximum flow capacity. The result and conclusion show that Ford Fulkerson and Edmonds Karp achieve a maximum flow of 2500 MW, while Goldberg Tarjan achieves 2400 MW. The time complexity and execution time of each algorithm are analyzed and discussed. However, Goldberg Tarjan is more efficient in terms of time complexity and execution time. Despite a slightly lower flow, it processes faster and handles larger, more complex networks better, making it the best choice for optimizing power transmission.

CHAPTER ONE

INTRODUCTION OF RESEARCH

1.1 Introduction

This chapter outlines the research, covering its background, problem statement, objectives, significance, scope, benefits, and organization. It explains the context and importance of the study, defines the specific problem it addresses, and lists the main goals. The chapter also discusses the potential impact and benefits of the research, clarifies its boundaries, and summarizes the structure of the report, providing a clear overview of the project's purpose and framework.

1.2 Background of the study

A basic requirement for any country's development is energy. Even though energy comes in many forms, electrical energy is the most significant. Electrical energy is used in so many aspects of modern, civilized societies because it has shown to be the most powerful vehicle for facilitating industrial, economic and social developments (Bamigbola, 2014) . Increased demand for energy is a major issue facing the entire planet. People are now cooperating to find a solution by utilizing policies related to sustainable energy. The goal of these policies is to produce, transfer, and distribute power in an environmentally friendly manner. These three elements are essential because they guarantee the continuous, cost-effective and environmentally friendly production and delivery of energy. The kind of energy required for global electricity cannot be stored in large quantities because of its nature. Power plants are, nevertheless, typically found to be positioned far from the consumption zones, for technical, economic and environmental reasons. Currently, a partial resolution to this problem involves directing the generated energy to substations situated within the regions of consumption. Subsequently, it is distributed through networks to the ultimate consumption areas. In the initial phase, ensuring an adequate transmission capacity is crucial for the reliable and cost-efficient functioning of energy transmission systems (Bulut & Özcan, 2021).

The network model in this study has also been examined with graph theory, which allows for the examination of the network model in general and has been used in application areas like information networks, mechanical electronic systems, supply chains, traffic management, routing problems and transportation (Bulut & Özcan, 2021). Four different kinds of network models exist, such as the minimum spanning tree model, the maximum flow problem, the minimum cost capacitated network and the shortest path model (Jha, 2020). A flow graph is a directed graph with weighted values assigned to each edge and a capacity. Flow within a network should fulfil to the rule that the quantity of flow entering a node is equal to the quantity of flow exiting the node, which only receives incoming flow. A flow problem happens while trying to figure out the maximum current flows in a variety of applications such as computer network traffic, vehicle traffic, public transportation passengers, water in pipes,