Name of Candidate: Fatma Elzahraa Mohammed Zaki

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Department: Industrial Engineering

Title of Thesis: MATHEMATICAL MODELLING AND OPTIMIZING OF SOLID WASTE MANAGEMENT SYSTEMS IN DEVELOPING COUNTRIES

Supervisors: 1- Prof. Dr. Islam Helaly Abdelazaiz Afify

2- Assoc. Prof. Dr. Ahmed Shaban Shaban Khalifa

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ABSTRACT

Solid waste management is a crucial trouble for towns and societies in developing countries. Only a small percent of municipal solid waste is disposed in a secure way in developing countries, at the same time as the bulk is left withinside the streets or disposed of/burnt in open landfills. Most countries strive to establish a solid waste management system (SWMS) that is able to handle and safely dispose of daily generated waste at the lowest cost possible and in a sustainable way. A typical SWMS consists of waste sources, waste collection stations, landfills, incinerators, and recycling plants, as well as a transportation network that links the system components. When developing or reconfiguring a SWMS, decision-makers must determine the optimal supply chain network configuration for such systems in order to treat and dispose of all daily generated waste at the lowest possible cost.

The goal of this research is to develop a general optimization model that can be used in SWMS optimization in developing countries. A new mixed-integer linear programming (MILP) model is developed for a SWMS configuration that includes waste generation sources, collection/transfer stations, recycling

plants, incinerators, and landfills. The proposed MILP model is designed to determine the optimal locations of the various facilities as well as the optimal flow of waste in the system in order to minimize the net daily cost incurred in

the system. The MILP model was used in a case study on the SWMS in Egypt's Fayoum Governorate. This study contributed to the development of a generic optimization model that can be used to optimally design solid waste management systems in developing countries. The model assumptions, in particular, are best suited to SWM systems that can be deployed in Egyptian cities. Furthermore, an optimal design for the Fayoum governorate's SWM system (Egypt) has been provided