

**AN APPLICATION TO
THE TRAVELLING SALESMAN
PROBLEM**

By

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PG Diploma

2005

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THE TRAVELLING SALESMAN
PROBLEM**

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Thesis submitted to the University of Sri Jayawardenapura for the
award of the Post Graduate Diploma in Industrial Mathematics

DECLARATION

The work described in this thesis was carried out by me under the supervision of Dr. W.B.Daundasekara and a report on this has not been submitted in whole or in part to any university or any other institution for another Degree/Diploma.

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K.A.D.N.N. Bandara

November 2005

We certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the University for the purpose of evaluation.

Date:

30/12/2005



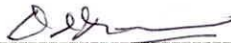
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ACKNOWLEDGEMENTS

My sincere gratitude to each and every person for his or her involvement to make this study a reality.

- Dr .W.B Daundasekera of University of Peradeniya, principal supervisor of this project, for his advice to select this research topic and providing the guidance to be successful in this study.
- Dr Boralugoda, course co-ordinator of M.Sc. in Industrial Mathematics of University of Sri Jayawardenapura, and also the co-supervisor of this project for his careful guidance and advice to make a success through out this study
- Mr. D.D.A.Gamini, co-supervisor of this project for his useful comments and valuable suggestions.
- Mr B .Giridarun, Department of Statistics and Computer Science, University of Peradeniya for his guidance for in developing the computer software.
- Mr Nalaka Jayasekara, of Surveyor General's Department, Badulla office for extending fullest corporation in collecting accurate data.
- Mr.A.S.Gajanayake, Service Manager of Edna Appliances (Pvt) Ltd. for providing vital information relevant to this study.
- Finally all others who extended their contributions to complete this task.

ABSTRACT

In this report we apply the Travelling Salesman problem to find a complete tour visiting each city exactly once such that the total distance travelled is minimum. We formulate the problem as a linear programming model and propose Heuristic Algorithm to solve the model. The algorithm and linear programming model are presented in the report.

The theory, which was developed in this project, has been applied to a private company, which undertakes regular services and maintenance of its sold appliances. Our objective was to prepare a monthly schedule for the company so that the company will be able to visits all customers within a month while minimizing the total distance travelled. We present the monthly schedule prepared by solving the linear programming model and compare it with the current schedule. Also, we discuss the advantages of using the proposed schedule.

CHAPTER 01

1.1 Introduction

Edna Appliances Company (pvt) Ltd. was established in November 1991 for the purpose of marketing a range of brand products; air conditioners, water pumps, ceiling fans, table and pedestal fans, four-wheel tractors and generators. The company is currently distributing these products island wide through a strong dealer network.

Edna Appliances company (pvt) Ltd. not only distributes air conditioners and accessories but also provides a comprehensive after sales service for its customers. For this purpose only, the company maintains a service department consists of a service manager, three engineers, thirty technicians, five motor vehicles and three motor bicycles. The main responsibilities of the department are to service the air conditioners purchased from the company and deploy mobile teams to attend break-downs.

In this research project our objective is to find a scientific method to optimize the cost involved in regular services conducted by the company.

Currently, the service department is facing a problem to minimize the cost for servicing air conditioners. The service department has to visit its customers in regular intervals to service the air conditioners. These customers are located every part of the country and therefore, travelling cost contributes a reasonable amount for the total cost on top of service cost. In Chapter 02, we discuss this problem in detail in a scientific view point.

Finding a method to minimize the travelling cost mentioned above is our main focus in this project. In Chapter 03, we discuss a methodology to achieve our objective. We formulate a mathematical model for the existing problem and propose an algorithm to solve the model.

In Chapter 04, we illustrate the method of solution by solving the existing problem using the proposed method.

In Chapter 05, we discuss the differences between the cost for the current schedule and for the proposed schedule. User manual of the computer software which is developed in this project to find the optimal tours is also given.

CHAPTER 02

2.1 Problem Definition

Edna Appliances (Pvt) Ltd. has supplied and installed a very large number of air conditioners all over the country. According to the service agreements, the company has to attend to urgent break- down calls promptly and also carry out regular service visits to each and every unit already installed. The company has a separate service department for this purpose.

Currently the service department is following a schedule of places to be visited, which is prepared by its Management Department. According to the present schedule, the entire country is divided into six regions for the convenience of carrying out regular service tours. The six regions are given in section 2.2. The **Figure 2.1** shows the route of the Tour No.1 and the rest of the service routes are given in Appendix A. The work teams attending to the services follow the schedule.

2.2 Service Tours

Region 1

Colombo, Nittabuwa, Peradeniya, Kegalle, Gampola, Mawanella, Nawalapitiya, Kothmale, Akurana, Kandy, Kundasale, Digana, Mahiyangana, Matale, Pussellawa, Dehiyattakandiya, Colombo.

Region 2

Colombo, Anuradapura, Kaduruwella, Manampitiya, Valachchanai, Batticalo, Samanthurai, Ampara, Colombo.

Region 3

Colombo, Dhargatown, Ahungalla, Hikkaduwa, Galle, Beruwela, Katukurunda, Matara Colombo.

Region 4

Colombo, Kochchikade, Wennappuwa, Lunuwila, Marawila, Chilaw, Puttalam, Wariyapola, Hettipola, Kuliyaipitiya, Narammala, Colombo.

Region 5

Colombo, Awissawella, Eheliyagoda, Rathnapura, Kalawana, Rathnapura, Pelmadulla, Embilipitiya, Middeniya, Hungama, Tangalle, Hungama, Tissamaharamaya, Katharagama, Moneragala, Badulla, Welimada, Bandarawella, Balangoda, Pelmadulla, Colombo.

Region 6

Colombo, Kurunegala, Uhumiya, Melsiripura, Galewela, Dambulla, Madawachchiya, Vavniya, Kebithigollewa, Tricomalee, Habarana, Colombo.