

## TABLE OF CONTENTS

<b>LETTER OF APPROVAL.....</b>	<b>i</b>
<b>DUAL DEGREE PROGRAM STATEMENT .....</b>	<b>ii</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>iv</b>
<b>PREFACE.....</b>	<b>v</b>
<b>PLAGIATION STATEMENT.....</b>	<b>vi</b>
<b>TABLE OF CONTENTS.....</b>	<b>vii</b>
<b>LIST OF FIGURES .....</b>	<b>ix</b>
<b>LIST OF TABLES .....</b>	<b>x</b>
<b>ABSTRACT .....</b>	<b>xi</b>
<b>CHAPTER I INTRODUCTION.....</b>	<b>1</b>
1.1 Background .....	1
1.2 Research Problem.....	4
1.3 Research Objective.....	4
1.4 Reseach Scope .....	4
1.5 Research Benefits .....	5
1.6 Company Descriptions .....	5
<b>CHAPTER II LITERATURE REVIEW .....</b>	<b>7</b>
<b>CHAPTER III THEORITICAL BACKGROUND .....</b>	<b>16</b>
3.1 Liner Shipping .....	16
3.2 Service Network Design.....	17
3.3 Physical Internet .....	19
3.4 Software.....	21
3.5 Mathematical Model in Linear Programming .....	22
<b>BAB IV RESEARCH METHOD.....</b>	<b>24</b>
4.1 Object Research.....	24
4.2 Research Tools .....	25
4.3 Research Procedure .....	26
<b>BAB V RESULT AND DISCUSSION .....</b>	<b>28</b>
5.1 Case Study .....	28
5.2 Route Based Models.....	31

5.3	Settings Frequency .....	46
5.4	Itinerary Based Model .....	53
<b>BAB VI CONCLUSION AND FUTURE SUGGESTION .....</b>		<b>58</b>
6.1	Conclusion.....	58
6.2	Suggestion and Future Work .....	58
<b>PERSONAL EXPERIENCE.....</b>		<b>60</b>
	About the work .....	60
	Contributions .....	60
	Challenges .....	61
<b>REFERENCES.....</b>		<b>62</b>

## LIST OF FIGURES

Figure 1.1 Estimated cost per 1000 container miles for different vessel	2
Figure 1.2 Estimated fuel consumption as a function of steaming speed and vessel size	3
Figure 4.1. Research Flow	27
Figure 5.1 (a) Mississippi River, (b) Magdalena River, (c) Danube River	29
Figure 5.2. Study Case Map	30
Figure 5.3 Route Map Single Type of Vessel	42
Figure 5.4 Route Map Vessel 1 (a) and Vessel 2 (b) Multi Type of Vessel	43
Figure 5.5 Route Map Single Type of Vessel	49
Figure 5.6 Route Map Vessel 1 (a) and Vessel 2 (b) Multi Type of Vessel	50
Figure 5.7 Itinerary Map Single Vessel	56
Figure 5.8 Itinerary Vessel 1 (a) and Vessel 2 (b) Multi Type of Vessel	56

## LIST OF TABLES

Tabel 2.1. Research Positioning	11
Table 5.1. Name and Type of Ports	39
Table 5.2. Name of Port Each Route	40
Table 5.3. Total Cost for Small Demand Instance	41
Table 5.4. Route Selected for Small Demand Instance	41
Table 5.5. Route Selected	41
Table 5.6. The Result of Each Port	44
Table 5.7. The Result of Each Number of Boat	44
Table 5.8. Total Flow in Each Route and Port	46
Table 5.9. Frequency Route Selected	47
Table 5.10. The Handling of Each Port	51
Table 5.11. The Cost of Each Number of Boat	51
Table 5.12. Total Cargo Flow in Each Route and Port	53
Table 5.13. Frequency services itinerary model	55