TABLE OF CONTENTS

COVER	
ORIGINALITY STATEMENT OF THE THESIS	
THESIS SUPERVISOR'S APPROVAL	
THESIS EXAMINATION COMMITTEE	
ABSTRACT	v
ABSTRAK	vi
ACKNOWLEDGEMENTS	vii
TABLE OF CONTENTS	ix
LIST OF FIGURES	xi
CHAPTER 1: INTRODUCTION	
1.1 BACKGROUND	1
1.2 PROBLEM IDENTIFICATION	3
1.3 PROBLEM LIMITATION	
1.4 PROBLEM DEFINITION	4
1.5 PURPOSE OF THE STUDY	5
1.6 OUTLINE	5
CHAPTER II: LITERATURE REVIEW	
2.1 GAUGING AIRLINE SATISFACTION	7
2.2 FACTORS THAT AFFECT AIRLINE SATISFACTION	9
2.3 ENSEMBLE LEARNING TECHNIQUES	14
2.3.1 BAGGING	
2.3.2 BOOSTING	18
2.3.3 STACKING	21
Chapter III: METHODOLOGY	23
3.1 DATASET	23
3.1.1 DATA PRE-PROCESSING	27

3.1.2 EXPLORATORY DATA ANALYSIS	30
3.2 EVALUATION METHOD	33
3.3 CALCULATION METHODS	35
CHAPTER IV: DATA AND DISCUSSION	38
4.1 RESULTS AND SCORES	38
4.2 DISCUSSION	42
CHAPTER V: CONCLUSION	43
REFERENCES	44

LIST OF FIGURES

Figure 1.0.1: the passenger traffic by each region from 2019 to 2024 prediction. Source:
(Airports Council International, 2023).
Figure 2.0.1: Graph showing the different results in rating of a survey of a restaurant. Source:
(Masoud Kamalahmadi, 2023).
Figure 2.0.2: A bar graph chart showing the reasons that affects a customer's loyalty towards
an airline. Source: (Neringa Slavinskaite, 2023)
Figure 2.0.3: bar chart showing the differences in overall rating between genders, with 1 being
male and 2 being female. Source: (Ashok K. Singh, 2019).
Figure 2.0.4: bar chart showing the age differences in rating the airline satisfaction, with 1
being under 18, 2 being 18-24, 3 being 25-34, 4 being 35-44, 5 being 45-54, 76 being 65 and
over, and 9 being multiple responses. Source: (Ashok K. Singh, 2019)
Figure 2.0.5: two eperate charts showing delay time and the emotion level of the passengers
before and during delay. Source: (Quan Shao, 2021)
Figure 2.0.6: the process of how bagging works. The "Bootstrap" is where subsets of a dataset
which are randomly selected with replacement, and then put into a classifier or regression to
each subset. Source: (Awan, 2023).
Figure 2.0.7: diagram demonstrating how Random Forest works. Source: (Chaudhary, 2023).
Figure 2.0.8: demonstration of how Decision Tree method works in understanding risks to
prevent heart attack. Source: (Navlani, 2023).
Figure 2.0.9: a flowchart showing the process of Boosting method. Firstly, the training dataset
is split into three equal-sized subsets with replacement, which are then used for each models
independently and in parallel, before finally combining each results through averaging or
voting to get the final result. Source: (Budu, 2023)
Figure 2.0.10: a flowchart showing the process of Stacking in ensemble learning. Source:
(Bantu, 2020)
Figure 3.0.1: dataset info for the "training" dataset for this study.

Figure 3.0.2: dataset attributes of the dataset "test".
Figure 3.0.3: the data attributes of the dataset "training" after the fix. The "unnamed column"
together with "id" column as seen on figure 3.0.1 has been removed, and most datatypes from
number 6 to 19 has been changed into "category" data type to better fit for inputting or
ensemble learning
Figure 3.0.4: dataset attributes of the dataset "test" after the fix. The "unnamed column"
together with "id" column as seen on figure 3.0.2 has been removed, and most datatypes from
number 6 to 19 has been changed into "category" data type to better fit for inputting or
ensemble learning
Figure 3.0.5: the list of total missing values on each column of "training" dataset. Note the
number of missing values in Arrival Delay in Minutes column
Figure 3.0.6: the list of total missing values on each column of "test" dataset. Note the number
of missing values in the Arrival Delay in Minutes column
Figure 3.0.7: the list of total missing values on the "training" dataset after the fix
Figure 3.0.8: the list of total missing values on the "test" dataset after the fix
Figure 3.0.9: Pie chart showing the overall number of neutral or dissatisfied, and satisfied
passengers within the dataset, overall "training" dataset is almost near balanced among both
level of satisfaction
Figure 3.0.10: correlation heatmap showing the relationship of each column with one another
in "training" dataset. Note the strong correlation between the columns departure delay and
arrival delay
Figure 3.0.11: the correlation heatmap showing the relations between quantitative values within
the dataset. Note the strong correlation between departure delay in minutes with the arrival
delay in minutes
Figure 3.0.12: bar chart showing the differences of satisfaction levels between the two genders
30
Figure 3.0.13: bar chart showing the total number of satisfied and neutral or dissatisfied
passengers, split between loyal and disloyal type of customer
Figure 3.0.14: box chart and histograph plot showing therelations of flight distance and inflight
entertainment with satisfaction levels
Figure 3.0.15: confusion matrix and what each value signifies.

Figure 3.0.16: an ROC curve, where scores above 0.5 and higher is accurate, while scores under
0.5 is less accurate. Values larger than 0.5 also indicates that model has an ability to
discriminate
Figure 3.0.17: a bar chart of Feature Importance. The higher the score is, the more it will affect
the overall model scoring
Figure 4.0.1: confusion matrix and precision, recall, f1-score, and support scores of Decision
Tree ensemble learning method
Figure 4.0.2: Feature importance for Decision Tree ensemble learning method
Figure 4.0.3: ROC curve for Decision Tree ensemble learning method
Figure 4.0.3: confusion matrix and precision, recall, f1-score, and support scores for the
Random Forest ensemble learning method
Figure 4.0.4: features importance of Random Forest ensemble learning method
Figure 4.0.6: ROC curve of Random Forest ensemble learning method
Figure 4.0.7: the confusion matrix and precision, recall, f1-score, and support scores for the
Boosting ensemble learning method
Figure 4.0.8: the features importance chart of the Boosting ensemble learning method 39
Figure 4.0.9: ROC Curve of the Boosting ensemble learning method
Figure 4.0.10: confusion matrix and precision, recall, f1-score, and support scores for Stacking
ensemble learning method
Figure 4.0.11: the features importance chart of the Stacking ensemble learning method 39
Figure 4.0.12: ROC curve of Stacking ensemble learning method