Contents

1 Introduction 4
- 1.1 Optimal Coalition Structure . . . 4
- 1.2 Motivation and Research Question . . . 5
  - 1.2.1 Motivation . . . 5
  - 1.2.2 Research Questions . . . 6

2 Background 7
- 2.1 Introduction to Optimal Coalition Structure . . . 7
  - 2.1.1 Coalition Formation . . . 7
  - 2.1.2 Example of Coalition Formation . . . 9
- 2.2 Optimal Coalition Structures . . . 10
  - 2.2.1 The Analysis of the Problem . . . 12
  - 2.2.2 Coalition Value Distribution . . . 12
- 2.3 Previous Works in Optimal Coalition Structures . . . 13

3 Partitioning Search Space 17
- 3.1 Partitioning Search Space . . . 17
  - 3.1.1 Partition Objectives . . . 17
  - 3.1.2 Generate Coalition Structures as Generating Trees . . . 18
  - 3.1.3 Analyzing Search Space . . . 19
  - 3.1.4 Worst Case Scenario . . . 21
- 3.2 Partitioning Search space . . . 23
  - 3.2.1 Distributing Chance Equally . . . 23
  - 3.2.2 Number of Coalition Structures of a Coalition . . . 23
  - 3.2.3 Nested Search Space . . . 24
  - 3.2.4 Size of Search Space Portion . . . 24
  - 3.2.5 Locating Head and Tails of Search Space Portion . . . 26

4 Searching for Optimal Coalition Structure 30
- 4.1 Data Structure . . . 31
  - 4.1.1 Storing Coalitions and Values . . . 31

4.1.2 Mutual Exclusive Validator 31
4.1.3 Coalition Structure Generation Tracer 32
4.1.4 Coalition Structure Template 32
4.2 Supportive Function 32
4.2.1 Pre-Process Preparation 32
4.2.2 Best Candidate Coalition 34
4.2.3 Function Extend() 34
4.2.4 Function Alter() 36
4.2.5 Function BestS() 36
4.2.6 Function NextS() 37
4.3 Search Algorithms 38
4.3.1 Main Algorithm 38
4.3.2 Breadth First Search Strategy 39
4.3.3 Main Loop 40

5 Experiments **44**
5.1 Settings 44
5.2 Results 46
5.3 Discussion 50

6 Conclusion **52**