

Preface

This book is written for engineers, scientists, and students studying/working in the optimization, artificial intelligence (AI), or computational intelligence arena. The book discusses the core and underlying principles and analysis of the different concepts associated with an emerging socio-inspired AI optimization tool referred to as cohort intelligence (CI).

The book in detail discusses the CI methodology as well as several modifications for solving a variety of problems. The validation of the methodology is also provided by solving several unconstrained test problems. In order to make CI solve real-world problems which are inherently constrained, CI method with a penalty function approach is tested on several constrained test problems and comparison of the performance is also discussed. The book also demonstrates the ability of CI methodology for solving several cases of the combinatorial problems such as traveling salesman problem (TSP) and knapsack problem (KP). In addition, real-world applications of the CI methodology by solving complex and large-sized combinatorial problems from the healthcare, inventory, supply chain optimization, and cross-border transportation domain is also discussed. The inherent ability of handling constraints based on the probability distribution is also revealed and proved using these problems. A detailed mathematical formulation, solutions, and comparisons are provided in every chapter. Moreover, the detailed discussion on the CI methodology modifications for solving several problems from the machine learning domain is also provided.

The mathematical level in all the chapters is well within the grasp of the scientists as well as the undergraduate and graduate students from the engineering and computer science streams. The reader is encouraged to have basic knowledge of probability and mathematical analysis. In presenting the CI and associated modifications and contributions, the emphasis is placed on the development of the fundamental results from basic concepts. Numerous examples/problems are worked out in the text to illustrate the discussion. These illustrative examples may allow the reader to gain further insight into the associated concepts. The various algorithms for solving have been coded in MATLAB software. All the executable codes are available online at www.sites.google.com/site/oatresearch/cohort-intelligence.

The book is an outgrowth of the three-year work by the authors. In addition, Fazle Baki and Ben Chaouch from University of Windsor, ON, Canada, helped with the complex combinatorial problem formulations. Over the period of 3 years, the algorithms have been tested extensively for solving various real-world problems as well as published in various prestigious journals and conferences. The suggestions and criticism of various reviewers and colleagues had a significant influence on the way the work has been presented in this book. We are much grateful to our colleagues for reviewing the different parts of the manuscript and for providing us valuable feedback. The authors would like to thank Dr. Thomas Ditzinger, Springer Engineering In-house Editor, Studies in Computational Intelligence Series; Prof. Janusz Kacprzyk, Editor-in-Chief, Springer Intelligence Systems Reference Library Series; and Mr. Holger Schäpe, Editorial Assistant, Springer Verlag, Heidelberg, for the editorial assistance and excellent cooperative collaboration to produce this important scientific work. We hope that the reader will share our excitement to present this volume on *cohort intelligence* and will find it useful.

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