

**Michael Mutingi**  
**Charles Mbohwa**



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# Healthcare Staff Scheduling Emerging Fuzzy Optimization Approaches

**Zhe Xu**



### **Healthcare Staff Scheduling Emerging Fuzzy Optimization Approaches:**

*Healthcare Staff Scheduling* Michael Mutingi, Charles Mbohwa, 2015-09-08 Healthcare operations in hospitals and home healthcare settings are inundated with complex fuzzy features that impose difficulties in the creation of work schedules This book presents in depth research on emerging approaches to healthcare staff scheduling It starts by reviewing the key issues and challenges inherent in staff scheduling along with the basic concepts of fuzzy set theory Examining cutting edge research applications it details fuzzy optimization algorithms derived from biologically inspired approaches and fuzzy theory Facilitating a practical and in depth understanding of modern fuzzy metaheuristic optimization approaches the book presents recent research on multi criteria algorithms and their applications in healthcare operations particularly staff scheduling

**Grouping Genetic Algorithms** Michael Mutingi, Charles Mbohwa, 2016-10-04 This book presents advances and innovations in grouping genetic algorithms enriched with new and unique heuristic optimization techniques These algorithms are specially designed for solving industrial grouping problems where system entities are to be partitioned or clustered into efficient groups according to a set of guiding decision criteria Examples of such problems are vehicle routing problems team formation problems timetabling problems assembly line balancing group maintenance planning modular design and task assignment A wide range of industrial grouping problems drawn from diverse fields such as logistics supply chain management project management manufacturing systems engineering design and healthcare are presented Typical complex industrial grouping problems with multiple decision criteria and constraints are clearly described using illustrative diagrams and formulations The problems are mapped into a common group structure that can conveniently be used as an input scheme to specific variants of grouping genetic algorithms Unique heuristic grouping techniques are developed to handle grouping problems efficiently and effectively Illustrative examples and computational results are presented in tables and graphs to demonstrate the efficiency and effectiveness of the algorithms Researchers decision analysts software developers and graduate students from various disciplines will find this in depth reader friendly exposition of advances and applications of grouping genetic algorithms an interesting informative and valuable resource

**Emerging Trends in Electrical, Electronic and Communications Engineering** Peter Fleming, Nalinaksh Vyas, Saeid Sanei, Kalyanmoy Deb, 2017-01-19 The book reports on advanced theories and methods in two related engineering fields electrical and electronic engineering and communications engineering and computing It highlights areas of global and growing importance such as renewable energy power systems mobile communications security and the Internet of Things IoT The contributions cover a number of current research issues including smart grids photovoltaic systems wireless power transfer signal processing 4G and 5G technologies IoT applications mobile cloud computing and many more Based on the proceedings of the first International Conference on Emerging Trends in Electrical Electronic and Communications Engineering ELECOM 2016 held in Voila Bagatelle Mauritius from November 25 to 27 2016 the book provides graduate students researchers and professionals with a snapshot of the

state of the art and a source of new ideas for future research and collaborations

**Emerging Methods in Predictive Analytics: Risk Management and Decision-Making** Hsu, William H., 2014-01-31 Decision making tools are essential for the successful outcome of any organization Recent advances in predictive analytics have aided in identifying particular points of leverage where critical decisions can be made Emerging Methods in Predictive Analytics Risk Management and Decision Making provides an interdisciplinary approach to predictive analytics bringing together the fields of business statistics and information technology for effective decision making Managers business professionals and decision makers in diverse fields will find the applications and cases presented in this text essential in providing new avenues for risk assessment management and predicting the future outcomes of their decisions [INFORMS Annual Meeting](#) Institute for Operations Research and the Management Sciences. National Meeting, 2003 [Documentation Abstracts](#) , 1998 **Electrical & Electronics Abstracts** , 1997 **Fuzzy Heuristic Approaches for Healthcare Staff Scheduling** Michael Mutingi, 2015 **Brinkman's cumulatieve catalogus van boeken** , 2000 Voorts een alphabetische lijst van Nederlandsche boeken in Belgi uitgegeven **A Stochastic Optimization Approach for Staff Scheduling Decisions at Inpatient Clinics** Sajjad Dehnoei, 2020 Staff scheduling is one of the most important challenges that every healthcare organization faces Long wait times due to the lack of care providers high salary costs rigorous work regulations decreasing workforce availability and other similar difficulties make it necessary for healthcare decision makers to pay special attention to this crucial part of their management activities Staff scheduling decisions can be very difficult At inpatient clinics there is not always a good estimate of the demand for services and patients can be discharged at any given time consequently affecting staff requirements Moreover there are many other unpredictable factors affecting the decision process For example various seasonal patterns or possible staff leaves due to sickness vacations etc This research describes a solution approach for staff scheduling problems at inpatient clinics where demand for services and patient discharges are considered to be stochastic The approach is comprehensive enough to be generalizable to a wide range of different inpatient settings with different staff requirements patient types and workplace regulations We first classify patients into a number of patient groups with known care provider requirements and then develop a predictive model that captures patients flow and arrivals for each patient category in the inpatient clinic This model provides a prediction of the number of patients of each type on each specific day of the planning horizon Our predictive modelling methodology is based on a Discrete Time Markov model with the number of patients of different types as the state of the system The predictive model generates a potentially large set of possible scenarios for the system utilization over the planning horizon We use Monte Carlo Simulation to generate samples of these scenarios and a well known Stochastic Optimization algorithm called the Sample Average Approximation SAA to find a robust solution for the problem across all possible scenarios The algorithm is linked with a Mixed Integer Programming MIP model which seeks to find the optimal staff schedule over the planning horizon while ensuring maximum demand coverage and cost efficiency are

achieved To check the validity of the proposed approach we simulated a number of scenarios for different inpatient clinics and evaluated the model s performance for each of them

*An Adjustable Robust Optimization Approach to Multi-objective Personnel Scheduling Under Uncertain Demand* Roshanak Mahdavi,2020 In this thesis we address a multi objective personnel scheduling problem where personnel s workload is uncertain and propose a two stage robust modelling approach with demand uncertainty In the first stage we model a multi objective personnel scheduling problem without incorporating demand coverage and in the second stage we minimize over or under staffing after the realization of the demand and the assignments from the first stage Two solution approaches are introduced for this model The first approach solves the proposed model through a cutting plane strategy known as Benders dual cutting plane method and the second approach reformulates the problem based on the strong duality theory As a case study the proposed model and the first solution approach are applied to an existing scheduling problem in the pathology department at The Ottawa Hospital It is shown that the proposed model is successful at reducing the unmet demand while maintaining the performance with respect to other metrics when compared against the deterministic alternative

**Novel heuristic and metaheuristic approaches to the automated scheduling of healthcare personnel** Timothy Curtois,2008

*Optimization Methods for Physician Scheduling* Hannah Kolberg Smalley,2012 This thesis considers three physician scheduling problems in health care systems Specifically we focus on improvements to current physician scheduling practices through the use of mathematical modeling In the first part of the thesis we present a physician shift scheduling problem focusing on maximizing continuity of care i e ensuring that patients are familiar with their treating physicians and vice versa We develop an objective scoring method for measuring the continuity of a physician schedule and combine it with a mixed integer programming model We apply our methods to the problem faced in the pediatric intensive care unit at Children s Healthcare of Atlanta at Egleston and show that our schedule generation approach outperforms manual methods for schedule construction both with regards to solution time and continuity The next topic presented in this thesis focuses on two scheduling problems i the assignment of residents to rotations over a one year period and given that assignment ii the scheduling of residents night and weekend shifts We present an integer programming model for the assignment of residents to rotations such that residents of the same type receive similar educational experiences We allow for flexible input of parameters and varying groups of residents and rotations without needing to alter the model constraints We present a simple model for scheduling 1st year residents to night and weekend shifts We apply these approaches to problems faced in the Department of Surgery Residency Program at Emory University School of Medicine Rotation assignment is made more efficient through automated schedule generation and the shift scheduling model allows us to highlight infeasibilities that occur when shift lengths exceed a certain value and we discuss the impact of duty hour restrictions under limitations of current scheduling practices The final topic of this thesis focuses on the assignment of physicians to various tasks while promoting equity of assignments and maximizing space

utilization We present an integer programming model to solve this problem and we apply this model to the physician scheduling problem faced in the Department of Gynecology and Obstetrics at Emory University Hospital and generate high quality solutions very quickly      **Optimisation Methods for Staff Scheduling and Rostering** Roger Alan Knight,2008

A Domain Transformation Approach for Addressing Staff Scheduling Problems Geetha Baskaran,2016

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