Lecture Notes in Operations Research

Lecture Notes in Operations Research is an interdisciplinary book series which provides a platform for the cutting-edge research and developments in both operations research and operations management field. The purview of this series is global, encompassing all nations and areas of the world.

It comprises for instance, mathematical optimization, mathematical modeling, statistical analysis, queueing theory and other stochastic-process models, Markov decision processes, econometric methods, data envelopment analysis, decision analysis, supply chain management, transportation logistics, process design, operations strategy, facilities planning, production planning and inventory control.

LNOR publishes edited conference proceedings, contributed volumes that present firsthand information on the latest research results and pioneering innovations as well as new perspectives on classical fields. The target audience of LNOR consists of students, researchers as well as industry professionals.

Angappa Gunasekaran · Jai Kishore Sharma · Samarjit Kar
Editors

Applications of Operational Research in Business and Industries

Proceedings of 54th Annual Conference of ORSI

Springer

Editors
Angappa Gunasekaran
California State University
Bakersfield, CA, USA

Samarjit Kar
Department of Mathematics
National Institute of Technology Durgapur
Durgapur, West Bengal, India

Jai Kishore Sharma
Amity Business School
Amity University
Noida, India

ISSN 2731-040X ISSN 2731-0418 (electronic)
Lecture Notes in Operations Research
ISBN 978-981-19-8011-4 ISBN 978-981-19-8012-1 (eBook)
https://doi.org/10.1007/978-981-19-8012-1

Preface

The International Conference on Applications of Operational Research in Business and Industries (AORBI 2021), 54th Annual Convention of ORSI, was organized at Indore during December 17–19, 2021. AORBI 2021 brought together leading international experts on production systems and business from academia, industry, and government to discuss the issues in intelligent manufacturing, operations management, financial management, supply chain management, and Industry 4.0 in the artificial intelligence era.

Operations research (OR) is an interesting and popularly used technique in activities involving grocery arrangement to military applications. Broadly, the OR allows problem-solving and decision-making by using systematic approaches. Engineering, management, and medical applications widely adopt OR techniques for reaching reasonable solutions. The conference provided a forum for scientists, researchers, software developers, and practitioners to exchange ideas and approaches, to present research findings and state-of-the-art solutions, to share their experience on potentials and limits, and to open new avenues of research and development, on all issues and topics related to operations research and applications in business and industry.

AORBI 2021 received overwhelming submissions covering different areas related to OR theory and its applications. With the help of our program committee and reviewers, these submissions went through an extensive peer-review process. This volume comprises thirty-two accepted papers, providing a comprehensive overview of the current research and future scope in OR models and applications.

The volume covers wide applications from the business and industry domains, including medical, engineering, and management. Broadly, the papers are based on two broad themes such as OR theories and models (for instance, optimization and control, combinatorial optimization, queuing theory, resource allocation models, linear and nonlinear programming models, dynamic optimization, evolutionary optimization, multi-objective decision models) and applications of OR models in real-life problems (domain-specific and interdisciplinary).

The important highlight of the current volume lies in the core theme of blending computing paradigms with OR. Specifically, industry-oriented computing paradigms such as big data, machine learning, and data science are some of the focus areas of the

present volume, and an amalgamation of these concepts with OR forms an attractive book that adheres to the emerging hot zones of research and development. These core themes in the present volume will not only help academicians to get an insight into the research advancement in OR but will also support practitioners in organizations to try these techniques for effectively solving their problems.

Bakersfield, USA — Angappa Gunasekaran
Noida, India — Jai Kishore Sharma
Durgapur, India — Samarjit Kar

Acknowledgments

The conference was supported by the Council of Scientific and Industrial Research, Government of India; Government Holkar Science College, Indore, MP, India. We are grateful to these organizations for their very generous support. We would like to acknowledge several individuals who assisted us in the presentation of this volume: Rathindarnath Mukherjee, Bijan Sarkar, Sanjib Biswas, and Chittaranjan Sharma. We would like to thank all participants for their contributions to the conference. We would like to thank all keynote speakers, invited speakers, session chairs, and authors for their excellent support to make AORBI 2021 a grand success. We are indebted to the program committee members and the reviewers for providing timely and quality reviews. Finally, we would like to thank all the volunteers for their tireless efforts contributing in making the conference run smoothly.

Samarjit Kar
J. K. Sharma
Angappa Gunasekaran

Contents

About the Editors

Prof. Angappa Gunasekaran is currently the Special Assistant to the Provost for Academic Affairs and Student Success Professor of Operations Management (Tenured) at California State University, Bakersfield (USA). He obtained Ph.D. in Industrial Engineering and Operations Research from IIT, Mumbai in 1988 and participated in several training programs/seminars/workshops organised by prominent institutions such as UMass Dartmouth, CSU Bakersfield, AACSB, NASPAA, NEASC, WASC, George Blumenthal Scholar, and CSUB Deans Academy to name a few. Apart from holding many key academic and administrative positions earlier, Professor Gunasekaran published over 400 research papers and authored several editorial notes on emerging areas of Operations Management and MIS. In addition to the recipient of many honours and awards, he is the Editor-in-Chief of several journals, including *OPSEARCH*.

Prof. Jai Kishore Sharma is at present Head, School of Business, Amity University, Noida (UP). Earlier, he was Professor, Faculty of Management Studies, University of Delhi. He was Visiting Professor, Department of Logistics and Production, Group ESSEC (Graduate School of Management), France; Amity University, Dubai Campus; and at Amity Institute of Higher Education, Mauritius. Apart from having different academic and administrative assignments at senior positions, his fields of academic interest are OR/decision science, supply chain management, business research methods, etc. He has 137 research papers, 24 case studies and 20 text-books to his credit. He is the President of Operational Research Society of India (ORSI).

Samarjit Kar is currently a professor in the Department of Mathematics, National Institute of Technology Durgapur, India. He is also an active participant in Chinese academia having served as a visiting professor at Tsinghua University since 2009. His academic collaborations/co-authors include academics from China, Poland, Norway, Canada, Serbia, Lithuania and Turkey. His current research interests include operations research and optimization, soft computing, machine learning and uncertainty modelling. He has published over 160 referred articles in international journals and

authored six edited book volumes in Springer. His articles have been cited more than 5200 times on Google Scholar and have appeared in prestigious journals. He is serving as an Associate Editor of *OPSEARCH* and Guest editors of *IEEE Transaction on Fuzzy Systems*, *Sustainability*, *Symmetry and Mathematics journals*. Presently he act as secretary to Operational Research Society of India (Kolkata Chapter).

Contributors

Gurudatt Rao Ambedkar Department of Mathematics, Hansraj College, University of Delhi, Delhi, India

Kuntal Bakuli Department of Statistics, Banwarilal Bhalotia College, Asansol, India

Balram Department of Mathematics, J C Bose University of Science and Technology, YMCA, Faridabad, Haryana, India

Gautam Bandyopadhyay Department of Management Studies, National Institute of Technology, Durgapur, West Bengal, India

Abhijit Barman Statistical Quality Control and Operations Research Division, Indian Statistical Institute, Kolkata, India

Sanjib Biswas Decision Sciences and Operations Management, Calcutta Business School, Bishnupur, West Bengal, India;
Department of Management Studies, National Institute of Technology, Durgapur, West Benga, India

Ashis Kumar Chakraborty Statistical Quality Control and Operations Research Division, Indian Statistical Institute, Kolkata, India;
SQC and OR Unit, ISI Kolkata, Kolkata, India

Sandip Chatterjee Department of Mathematics, Heritage Institute of Technology, Kolkata, India

Rubi Das Department of Mathematics, Barkhetri College, Mukalmua, Assam, India

Tapasi Das Department of Mathematics, University Institute of Technology, Burdwan University, Burdwan, India

Pijus Kanti De Department of Mathematics, National Institute of Technology Silchar, Silchar, Assam, India

Pabitra Kumar Dey Department of Computer Applications, Dr. B.C. Roy Engineering College, Durgapur, West Bengal, India

Nitesh Dhiman Department of Mathematics, Chaudhary Charan Singh University, Meerut, India

Ramu Dubey Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology (VIT) University, Vellore, Tamil Nadu, India; Department of Mathematics, J C Bose University of Science and Technology, YMCA, Faridabad, Haryana, India

Pankaj Dutta Shailesh J. Mehta School of Management, Indian Institute of Technology, Mumbai, India

Neelanghsu Ghosh PRMS Mahavidyalaya, Bankura, West Bengal, India

Dipendra Nath Ghosh Controller of Examinations, Kazi Nazrul University, Asansol, West Bengal, India

Atul Kumar Goel Department of Mathematics, A.S. (PG) College, Mawana, Meerut, India

Banhi Guha Xavier Business School, St. Xavier's University, Kolkata, West Bengal, India

Kapil Gumte Department of Chemical Engineering, Indian Institute of Technology Hyderabad, Kandi, Telangana, India

Sanjay Jain Department of Mathematics, S. P. C. Govt. College, Ajmer, India

Pradeep K. Joshi Department of Mathematics, IPS Academy, Indore, India

Jyoti Department of Mathematics, J C Bose University of Science and Technology, YMCA, Faridabad, Haryana, India

Samarjit Kar Department of Mathematics, National Institute of Technology, Durgapur, West Bengal, India

Barin Karmakar SQC and OR Unit, ISI Kolkata, Kolkata, India

Kaushal Kumar Department of Operational Research, University of Delhi, Delhi, India

Ramesh Kumar Department of Mathematics, J C Bose University of Science and Technology, YMCA, Faridabad, Haryana, India

Mamta Kumari Department of Mathematics, National Institute of Technology Silchar, Silchar, Assam, India

Shuvendu Majumder HR and OB Area, Calcutta Business School, Bishnupur, West Bengal, India

Adarsh Mangal Department of Mathematics, Engineering College Ajmer, Ajmer, India

Anurag Mishra Shailesh J. Mehta School of Management, Indian Institute of Technology, Mumbai, India

Lakshmi Narayan Mishra Department of Mathematics, J C Bose University of Science and Technology, YMCA, Faridabad, Haryana, India

Noopur Mishra Department of Mathematics and Scientific Computing, Madan Mohan Malaviya University of Technology, Gorakhpur, Uttar Pradesh, India

S. K. Mishra Department of Mathematics, Institute of Science, Banaras Hindu University, Varanasi, India

Vinod Kumar Mishra Department of Mathematics and Scientific Computing, Madan Mohan Malaviya University of Technology, Gorakhpur, Uttar Pradesh, India

Vishnu Narayan Mishra Department of Mathematics, Indira Gandhi National Tribal University, Anuppur, Madhya Pradesh, India

Kishalay Mitra Department of Chemical Engineering, Indian Institute of Technology Hyderabad, Kandi, Telangana, India;
Adjunct Faculty, Department of Climate Change, Indian Institute of Technology Hyderabad, Kandi, Telangana, India

Sukarna Dey Mondal Department of Mathematics, Dr. B.C. Roy Engineering College, Durgapur, West Bengal, India

Pankaj Narang Department of Mathematics, National Institute of Technology Silchar, Silchar, Assam, India

R. N. Mukherjee Department of Mathematics, Burdwan University, Burdwan, India

S. Pavan Kumar School of Management, National Institute of Technology Karnataka, Surathkal, India

Sunil Pipleya Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India

Imnatila Pongen Department of Operations Management, Indian Institute of Management Ranchi, Ranchi, Jharkhand, India

B. Poorani Department of Mathematics, KCG College of Technology, Chennai, Tamil Nadu, India

Teja Praneet Shailesh J. Mehta School of Management, Indian Institute of Technology, Mumbai, India

Siva Prasad Reddy Shailesh J. Mehta School of Management, Indian Institute of Technology, Mumbai, India

Prasanna Venkatesan Shanmugam Department of Production Engineering, National Institute of Technology, Tiruchirappalli, Tamil Nadu, India

Sarin Raju School of Management, National Institute of Technology Karnataka, Surathkal, India

Pritee Ray Department of Operations Management, Indian Institute of Management Ranchi, Ranchi, Jharkhand, India

T. M. Rofin National Institute of Industrial Engineering (NITIE), Mumbai, Maharashtra, India

Sudipta Roy The Heritage Academy, Kolkata, India

Moulipriya Sarkar Department of Mathematics, Heritage Institute of Technology, Kolkata, India

Chitaranjan Sharma Department of Mathematics, Government Holkar Science College, Indore, India

M. K. Sharma Department of Mathematics, Chaudhary Charan Singh University, Meerut, India

Rajeev Sharma Department of Mathematics, A.S. (PG) College, Mawana, Meerut, India

Gyan Shekhar Department of Mathematics, Bhagwant University, Ajmer, India

Chaman Singh Department of Mathematics, Acharya Narendra Dev College, University of Delhi, Delhi, India

Ranu Singh Department of Mathematics and Scientific Computing, Madan Mohan Malaviya University of Technology, Gorakhpur, Uttar Pradesh, India

R. Sridharan National Institute of Technology Calicut, Calicut, Kerala, India

Chetan Swarup Department of Basic Science, College of Science and Theoretical Studies, Saudi Electronic University, Riyadh, Saudi Arabia

Pawan Kishor Tak Department of Mathematics, Bhagwant University, Ajmer, India

Ajinkya N. Tanksale Department of Mechanical Engineering, Indian Institute of Technology (BHU), Varanasi, India

Hemlata Thakur Department of Mathematics, Government College Rau, Indore, India

B. Thilaka Department of Applied Mathematics, Sri Venkateswara College of Engineering, Kancheepuram, Tamil Nadu, India

Justin Thomas Department of Civil Engineering, National Institute of Technology, Tiruchirappalli, Tamil Nadu, India

Gynaesh Tripathi Department of Mechanical Engineering, Indian Institute of Technology (BHU), Varanasi, India;
Indian Railway Services of Mechanical Engineering, Jamalpur, India

Ronak Tiwari National Institute of Technology Calicut, Calicut, Kerala, India

Badri Toppur Rajalakshmi School of Business, Chennai, Tamil Nadu, India

S. Udayabaskaran Department of Mathematics, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu, India

T. P. Vivek Department of Civil Engineering, National Institute of Technology, Tiruchirappalli, Tamil Nadu, India

Monika Vyas Swarrnim Startup and Innovation University, Gandhinagar, India

Gunjan Yadav Swarrnim Startup and Innovation University, Gandhinagar, India

Applications of Operational Research in Business and Industries pp 21–34

Investigate the Reason for Students' Absenteeism in Engineering College in Fuzzy MCDM Environment

Sukarna Dey Mondal, Dipendra Nath Ghosh & Pabitra Kumar Dey

Conference paper | First Online: 22 May 2023

Part of the Lecture Notes in Operations Research book series (LNOR)

Abstract

For the progress of any nation, education system always plays a dynamic role. Best academic institutes are national assets, and students are major assets of any institute. However, today's students are less focused on their studies. As an effect, they are avoiding their important classes due to various reasons. A huge number of students are absent from class which may be destroyed their careers. These are the well-known images of the school and colleges. When a student is frequently

absent from class, it has an unfavorable outcome on their academic performance and a few must repeat a grade level. Therefore, it is critical to conduct research that will point the way to understand the key that minimizes student absenteeism. So, an effort was made here to assess some criteria and sub-criteria using analytical hierarchy process (AHP) and techniques for order preference by similarity to ideal solution (TOPSIS) in Type 1 interval fuzzy (T1-IF) and Type 2 interval fuzzy (T2-IF) atmospheres for alternative ranking that depicts student absenteeism, as well as to make comparisons of T1-IF set and T2-IF set. In the end, the group decision-making (GDM) method is used. Questionnaire sessions are used to identify the major causes of student absenteeism. Finally, the outcome of the study builds a more practical way out to acknowledge the actual alternative which eradicates student absenteeism according to pre-assigned criteria and sub-criteria.

Keywords

Student's absenteeism **T1-IF set** **T2-IF set**

AHP **TOPSIS** **GDM method**

Spearman's rank correlation coefficient (SRCC)

- DOI: 10.1007/978-981-19-8012-1_2
- Chapter length: 14 pages
- Instant PDF download
- Readable on all devices
- Own it forever
- Exclusive offer for individuals only
- Tax calculation will be finalised during checkout

- ISBN: 978-981-19-8012-1
- Instant EPUB and PDF download
- Readable on all devices
- Own it forever
- Exclusive offer for individuals only
- Tax calculation will be finalised during checkout

- ISBN: 978-981-19-8011-4
- Dispatched in 3 to 5 business days
- Exclusive offer for individuals only
- Free shipping worldwide
  See shipping information.
- Tax calculation will be finalised during checkout

References

1. Zadeh, L. A. (1975). The concept of a linguistic variable and its application to approximate

reasoning—II. *Information Sciences, 8*(4), 301–357.

2. Zimmermann, H. J. (1992). *Fuzzy set theory and its applications*. Kluwer.

3. Chen, P. (2009). A fuzzy multiple criteria decision making model in employment recruitment. *International Journal of Computer Science and Network Security, 9*(7), 113–117.

4. Chang, D. Y. (1996). Applications of the extent analysis method on fuzzy AHP. *European Journal of Operational Research, 95*, 649–655.

5. Rana, S., Dey, P. K., & Ghosh, D. N. (2012). Best engineering college selection through fuzzy multi-criteria decision making approach: A case study. *UNIASCIT, 2*(2), 246–256.

6. Bojadziev, G., & Bojadziev, M. (1998). *Fuzzy sets and fuzzy logic applications*. World Scientific.

7. De, A., Kundu, P., Das, S., & Kar, S. (2020). A ranking method based on interval type-2 fuzzy sets for multiple attribute group decision making. *Soft Computing, 24*, 131–154.

8. Pamucar, D., Behand, M., Božanic, D., & Behzad, M. (2022). Designing a fuzzy decision support framework for assessing solid waste management in the South European region. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-022-1889-y

9. Biswas, S., Majumder, S., Pamucar, D., & Dawn, S. K. (2021). An extended LBWA framework in picture fuzzy environment using actual score measures application in social enterprise systems. *International Journal of Enterprise Information Systems (JEIS),* 32. https://doi.org/10.4018/IJEIS.2021100103

10. Saaty, T. L. (1980). *The analytic hierarchy process*. McGraw-Hill.

11. Saaty, T. L. (1983). Priority setting in complex problems. *IEEE Transactions on Engineering Management, 30*(3), 140–155.

12. Zahedi, F. (1977). The analytic hierarchy process—A survey of the method and its applications. *Interfaces, 16*, 343–350.

13. Hwang, C. L., & Yoon, K. (1981). *Multiple attribute decision making methods and applications*. Springer.

14. Abo-Sinna, M. A., & Amer, A. H. (2005). Extensions of TOPSIS for multi-objective large-scale nonlinear programming problems. *Applied Mathematics and Computation, 162*, 243–256.

15. Jahanshahloo, G. R., Hossein, F., Zadeh, L., & Izadikhah, M. (2005). An algorithmic method to extend TOPSIS for decision-making problems with interval data. *Applied Mathematics and Computation*.

16. Chen, P. C. (2009). A fuzzy multiple criteria decision making model in employee recruitment. *International Journal of Computer Science and Network Security, 9*(7), 113–117.

17. Kousalya, P., Ravindranath, V., & Vijayakumar, K. (2006). Student absenteeism in engineering colleges: Evaluation of alternatives using AHP. *Journal of Applied Mathematics & Decision Sciences, 2006*, 1–26. Article ID 58232.

18. De, A., Das, S., & Kar, S. (2021). Ranking of interval type 2 fuzzy numbers using correlation

coefficient and Mellin transform. *OPSEARCH, 58*, 1018–1048.

19. Biswas, S., Bandyopadhyay, G., Guha, B., & Bhattacharjee, M. (2019). An ensemble approach for portfolio selection in a multi-criteria decision-making framework. *Decision Making: Applications in Management and Engineering, 2*(2), 138–158.

20. Biswas, S. (2020). Measuring the performance of healthcare supply chains in India: A comparative analysis of multi-criteria decision-making methods. *Decision Making: Applications in Management and Engineering, 3*(2), 162–189.

21. Das, S., Malakar, D., Kar, S., & Pal, T. (2018). A brief review and future outline on decision making using fuzzy soft set. *International Journal of Fuzzy System Applications, 7*, 1–43. https://doi.org/10.4018/1JFSA.2018040101

22. Sujit, D., Samarjit, K., Tandra, P., & Mohuya, B. K. (2018). An approach for decision making using intuitionistic trapezoidal fuzzy soft set. *Annals of Fuzzy Mathematics and Informatics, 16*, 99–116. https://doi.org/10.30948/afmi.2018.16.1.99

23. Woodbury, G. (2002). *Introduction to statistics*. Thomson Learning.

24. Karnik, N. N., & Mendel, J. M. (2001). Centroid of a type-2 fuzzy set. *Information Sciences, 132*, 195–220.

25. Dey, S., & Ghosh, D. N. (2019). Comparative evaluation of students' performance in campus recruitment of a technical institution through fuzzy-MCDM techniques. *International Journal of Computer Sciences and Engineering, 7*(special issue 1).

26. Dey, S., & Ghosh, D. N. (2015). Non-teaching staff performance analysis using multi-criteria group decision making approach. *International Journal of Education and Learning, 4*(2), 35–50.

27. Kaya, S. K., Pamucar, D., & Aycin, E. (2022). A new hybrid fuzzy multi-criteria decision methodology for prioritizing the antivirus mask over COVID-19 pandemic. https://doi.org/10.15388/22-INFOR475

28. Chatterjee, K., & Kar, S. (2016). Multi-criteria analysis of supply chain risk management using interval-valued fuzzy TOPSIS. *OPSEARCH, 53*, 474–499.

29. Karnik, N. N., & Mendel, J. M. (2001) Centroid of a type-2 fuzzy set. *Information Sciences, 132*, 195–220.

30. Mendel, J. M. (2007). Type-2 fuzzy sets and systems: an overview. *IEEE Computational Intelligence Magazine, 2*(1), 20–29.

31. Mendel, J. M., John, R., Liu, F. (2006). Interval type-2 fuzzy logic systems made simple. *IEEE Transactions on Fuzzy Systems, 14*(6), 808–821.

Author information

Authors and Affiliations

Department of Mathematics, Dr. B.C. Roy Engineering College, Durgapur, West Bengal, India

Sukarna Dey Mondal

Controller of Examinations, Kazi Nazrul University, Asansol, West Bengal, India

Dipendra Nath Ghosh

Department of Computer Applications, Dr. B.C. Roy Engineering College, Durgapur, West Bengal, India

Pabitra Kumar Dey

Corresponding author

Correspondence to Sukarna Dey Mondal .

Editor information

Editors and Affiliations

California State University, Bakersfield, CA, USA

Angappa Gunasekaran

Amity Business School, Amity University, Noida, India

Jai Kishore Sharma

Department of Mathematics, National Institute of Technology Durgapur, Durgapur, West Bengal, India

Samarjit Kar

Rights and permissions

Copyright information

About this paper

Cite this paper

Mondal, S.D., Ghosh, D.N., Dey, P.K. (2023). Investigate the Reason for Students' Absenteeism in Engineering College in Fuzzy MCDM Environment. In: Gunasekaran, A., Sharma, J.K., Kar, S. (eds) Applications of Operational Research in

Business and Industries. Lecture Notes in Operations Research. Springer, Singapore.
https://doi.org/10.1007/978-981-19-8012-1_2

.RIS .ENW .BIB

DOI
https://doi.org/10.1007/978-981-19-8012-1_2

Published	Publisher Name	Print ISBN
22 May 2023	Springer, Singapore	978-981-19-8011-4

Online ISBN	eBook Packages
978-981-19-8012-1	Business and Management Business and Management (R0)