Evaluation of a Medical Center Lab Layout by Applying a Heuristic Algorithm with a Flexible-Bay Structure

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Abstract

A model has been developed to optimize the layout of the medical lab of East Alabama Medical Center (U.S.A.) in order to determine the best locations for the departments of lab by focusing on two objectives. The first one is to minimize the cost of work flow and the second objective is to maximize what is known by the adjacency relations among departments by increasing the closeness rating of departments work interactions. A mathematical model of these conflicting objectives will be considered in this work, where the aims are to minimize the flow cost between each two departments of the facility and to maximize the total closeness rating, whereas compatible objectives aim to minimize the distance, weighted cost of several attributes, flow of job orders, hazardous movements, etc. The optimal design of the existent area that is available for the total facility will be the focus in this work to determine the best location of work departments which have different area dimensions. The methodology used to solve the problem of this work is to partition the facility into several sub-regions in a bay structure and have a number of departments with appropriate dimensions, then determine an optimal solution after several iterations of possible permutations for the departments between these sub-regions until reach the final best solution, which gives the minimum value of the total flow cost and maximum weight of the closeness rating.

Keywords
Facility layout, bay structure, heuristic algorithm, flow-cost, adjacency.

Biography

Soroor Al Khafaji is an Assistant Professor, director of Quality Assurance Committee, at Mechanical Engineering Department, College of Engineering of Baghdad University, Baghdad, Iraq. She earned B.S in Electrical Engineering, and Masters in Industrial Engineering from the University of Technology, Baghdad, Iraq, and a Ph.D. in Industrial Engineering from College of Engineering, Baghdad University. Dr. Al Khafaji worked as a Visiting Scholar with Auburn University, at Industrial and Systems Engineering Department, Auburn, AL, USA for two separate years, 2008-2009 and 2012-2013. Her research interests include reliability engineering, modeling and optimization, quality control, lean manufacturing, lines balancing, and facility layout optimization. She is a member of Scholar Rescue (SRF) project of IIE (Institute of International Education, USA).

Alejandro Teran-Somohano is a PhD candidate in Industrial and Systems Engineering at Auburn University. He obtained his bachelor's degree at the Instituto Tecnologico Autonomo de Mexico (ITAM) in Mexico City in 2009, and his Master's degree in Industrial and Systems Engineering at Auburn University in 2011. He is a member of the Institute of Industral Engineers (IIE) and the Institute of Electrical and Electronics Engineers (IEEE). His research interests include facility design for hospitals and the application of meta-heuristics to optimization problems.

Alice E. Smith is Reed Professor of the Industrial and Systems Engineering Department at Auburn University, where she served as Department Chair from 1999-2011. During spring of 2013, she was a Senior Fulbright Scholar and Visiting Professor at the Department of Industrial Engineering at Bilkent University in Ankara, Turkey. She was on the faculty of the Department of Industrial Engineering at the University of Pittsburgh from 1991-99, which she joined after industrial experience with Southwestern Bell Corporation. Dr. Smith has degrees from Rice

University, Saint Louis University and Missouri University of Science and Technology. Dr. Smith holds one U.S. patent and several international patents and has authored more than 200 publications which have garnered over 1,700 citations (ISI Web of Science). Dr. Smith is an Area Editor of both *INFORMS Journal on Computing* and *Computers & Operations Research* and an Associate Editor of *IEEE Transactions on Evolutionary Computation*. Dr. Smith has been a principal investigator on over $6 million of sponsored research. Her research in analysis, modeling and optimization of complex systems has been funded by NASA, U.S. Department of Defense, Missile Defense Agency, NIST, U.S. Department of Transportation, Lockheed Martin, Adtranz (now Bombardier Transportation), the Ben Franklin Technology Center of Western Pennsylvania and U.S. National Science Foundation, from which she has been awarded 16 grants including a CAREER grant in 1995 and an ADVANCE Leadership grant in 2001. Dr. Smith is a fellow of the Institute of Industrial Engineers, a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and of the Society of Women Engineers, a member of Tau Beta Pi, and the Institute for Operations Research and Management Science, and a Registered Professional Engineer in Alabama and Pennsylvania. She was elected to serve on the Administrative Committee of the IEEE Computational Intelligence Society from 2013-15.