

ปัญหาปริมาณการสั่ง ที่มีหลายชนิด หลายขั้นตอน และมีความสามารถจำกัด

นางสาวสุภกัญญา ชินประทีป

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรดุษฎีบัณฑิต

สาขาวิชาวิศวกรรมอุตสาหการ ภาควิชาวิศวกรรมอุตสาหการ

คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2551

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

A MULTI-LEVEL MULTI-ITEM CAPACITATED LOT SIZING PROBLEM  
(MLCLSP) MODEL

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A Dissertation Submitted in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy Program in Industrial Engineering

Department of Industrial Engineering

Faculty of Engineering

Chulalongkorn University

Academic Year 2008


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511527


Thesis Title                    A MULTI-LEVEL MULTI-ITEM CAPACITATED LOT  
SIZING PROBLEM (MLCLSP) MODEL  
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Field of Study                    Industrial Engineering  
Thesis Advisor                    Assistant Professor Rein Boondiskulchok, D.Eng.

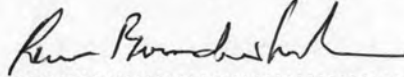
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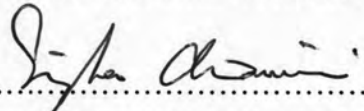
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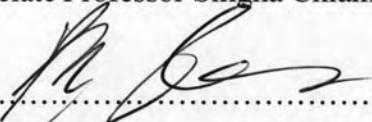
  
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ศุภกัญญา ชินประทีป : ปัญหาปริมาณการสั่ง ที่มีหลายชนิด หลายขั้นตอน และมีความสามารถจำกัด. (A MULTI-LEVEL MULTI-ITEM CAPACITATED LOT SIZING PROBLEM (MLCLSP) MODEL). อ.ที่ปรึกษา : ผศ.ดร.เหรียญ บุญดีสกุลโชค, 130 หน้า.

งานวิจัยนี้เกิดขึ้นจาก ปัญหาที่พบในอุตสาหกรรมที่มีหลายผลิตภัณฑ์ที่ผลิตจากหลายวัตถุดิบ องค์กรจำเป็นต้องใช้หลายปัจจัยในการพิจารณา อาทิ ปัจจัยด้านความสามารถการผลิตของสถานีนงานที่มีการเปลี่ยนแปลงตามช่วงเวลา, ปัจจัยด้านความสามารถในการจัดเก็บของคลัง, ปัจจัยด้านวัตถุดิบอันมีผลกระทบจากทั้งปริมาณที่มีหรือราคาเปลี่ยนแปลง และปัจจัยอื่น งานวิจัยนี้จึงได้วิเคราะห์และสร้างโปรแกรมเชิงเส้นจำนวนเต็มแบบผสมและแบบทวิภาค สำหรับการแก้ปัญหาการวางแผนการจัดซื้อและการผลิตในสถานการณ์ที่มี หลายชนิดสินค้า หลายช่วงเวลา หลายสถานีนงานที่มีความสามารถจำกัด และแบบจำลองที่พัฒนานี้เรียกว่า Multi-item Multi-level capacitated lot size with multi-workstation problem (MLCLSP-M). ด้วยปัญหานี้ซับซ้อนเกินไปที่จะใช้แก้ปัญหาที่มีขนาดใหญ่ได้ จึงได้พัฒนาฮิวริสติก 3 วิธี ได้แก่ Assignment-Lot size heuristic (A-LS), Partial Assignment – Lot size (PA-LS), และ Max Cover Period – Lot size (MCP-LS) วิธีทั้งหมดใช้หลักการแบ่งปัญหา MLCLSP-M ออกเป็น 2 ช่วง นั่นคือ การจัดงานด้วยปริมาณการสั่งที่กำหนด และ การหาปริมาณการสั่งด้วยการจัดงานที่กำหนด ในแต่ละรอบการหาคำตอบมีแบบจำลองคณิตศาสตร์สำหรับปัญหาย่อยดังกล่าวและใช้ AMPL/CPLEX 8.0.0 แก้ปัญหา งานวิจัยนี้ยังได้ทดสอบด้านการคำนวณเพื่อวิเคราะห์คุณภาพคำตอบและเวลาที่ใช้ในการหาคำตอบ เมื่อเปรียบเทียบกับปัญหาด้านฉบับผลการทดลองชี้ให้เห็นว่าวิธี A-LS เป็นวิธีที่ให้คำตอบที่น่าพอใจด้วยเวลาหาคำตอบที่รวดเร็วมาก, วิธี PA-LS เป็นวิธีที่ให้คำตอบที่ดีที่สุดด้วยเวลาหาคำตอบที่ยาวนาน และวิธี MCP-LS เป็นวิธีที่ให้คำตอบที่ดีด้วยเวลาการหาคำตอบปานกลาง

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ลายมือชื่ออาจารย์ที่ปรึกษา.....

## 467 18504 21: MAJOR INDUSTRIAL ENGINEERING

KEYWORD; LOT-SIZING MODEL/ PURCHASING AND PRODUCTION PLANNING SYSTEM/ ON-HAND INVENTORY/ MULTI-WORKSTATION/ HEURISTICS.

SUPAKANYA CHINPRATEEP : A MULTI-LEVEL MULTI-ITEM CAPACITATED LOT SIZING PROBLEM (MLCLSP) MODEL. THESIS ADVISOR : ASSIST. PROF. REIN BOONDISKULCHOK, D.ENG., 130 pp.

This research was motivated by problems arising from manufacturing of end product from various raw materials. The firm also needs to take into account of other factors, for example: workstation capacity changes over time period; warehouse capacity; raw materials are affected by either availability or price and etc. The purchasing and production planning in multi-item multi-period multi-workstation capacitated lot size situation is discussed and formulated as a Mixed Integer Programming model (MIP) and can be called as a Multi-item Multi-level capacitated lot size with multi-workstation problem (MLCLSP-M). With too complexity of the solving large problem, three heuristic methods are developed, tested and compared based on standard library, illustrating the solution quality and computational time. The proposed heuristics are Assignment-Lot size heuristic (A-LS), Partial Assignment – Lot size (PA-LS), and Max Cover Period – Lot size (MCP-LS). These methods are based on the decomposition of the MLCLSP-M into two phases consisting of an assignment with given lot size phase and a lot size with given assignment phase. Each iteration, the sub problem mathematical models are solved with AMPL/CPLEX 8.0.0 solver. Computational test results are analyzed and discussed on performance and running time. On comparing with the original mathematical model solving, the results indicate that the A-LS heuristic gives a satisfactory solution with very fast solving time, the PA-LS heuristic gives a closely optimal solution with very long solving time, and the MCP-LS gives a good solution with medium solving time.

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 Field of study..... Industrial Engineering  
 Academic year..... 2008

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## ACKNOWLEDGEMENTS

This is a great opportunity to express my respect to my advisors, Assistant Professor Rein Boondiskulchok, D.Eng., for his strong commitment to assisting me achieves my research goals, continuous encouragement, and endless patience throughout my Ph.D. study. Thank you for your belief in me no matter what circumstances. During my study, he gives me the great opportunity to be his teacher assistant and to work in the ROM. This is a priceless experience for me.

I am also grateful for the useful suggestions, invaluable comments, devoting so much time and positive criticisms that Professor Sirichan Thongprasert, Ph.D., Assistant Professor Manop Reodecha, Ph.D., and Assistant Professor Paveena Chaovalitwongse, Ph.D., and Associate Professor Singha Chiamsiri, Ph.D. as members of the examination committee provided me during my study.

I am also grateful for people at industrial engineering department who have provided me with necessary assistance for my research including invaluable comment and other helpful. I would like to thank all my colleagues for their great friendship and creating such a nice work atmosphere, P'Jitti, P'Mai, Cherry, Arm, Big, Kac, Mee, P'Chang, P'Paitoon, P'Boy, and P' Ay. Especially Arm, he helps me a lot in the part of program coding. Thank you to all other friends for all their encouraging words and for supporting me. Special thanks are also extended to my dearest friend, Be and Nan, whenever I have a problem seriously or not, they always being so patient, standby me and giving me strength and hope. Especially Be, thank you so much for discussing these and many other with me at all possible and impossible times.

A very special thanks goes to people who supported me more than anyone else, I wish to express my deepest gratitude to my parents, who are everything to me and everything I am, and my grateful thanks to my sister and brothers for their unconditional supporting, encouragement, pushing me up and staying by my side during my five years study that have driven me to become successful.

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