

Master thesis

**Work Distribution for a Heterogeneous Library Staff -
A Personnel Task Scheduling Problem**

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LITH - MAT - EX - - 04 / 04 - - SE

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Exam work: **30 hp**

Level: **A**

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Linköping: **June 2016**

Abstract

The distribution of tasks to a heterogeneous work force at libraries and other service institutions is time consuming for manual schedulers, but well suited for optimization softwares. The problem studied concerns five types of tasks, two types of worker qualifications and around 100 tasks per week.

During weekends there is a demand for staff members. Also, worker satisfaction is taken into account to avoid unfairness and fatigue.

The main objective is to create a optimal ten week rotating schedule, in which the stand-in staff members are evenly distributed. That results in a robust schedule, as absence of staff members is a common issue.

A mathematical model is formulated for the problem, which is solved using the commercial solver, CPLEX and by using two different large neighbourhood search heuristic implementations. The first heuristic assigns complete week blocks to the staff members, while the second distributes one task at a time. The latter heuristic works better than the former and achieves results comparable to those of the commercial solver. Our conclusion is that the second heuristic works better because it focuses on finding a good weekend distribution, before creating the rest of the schedule.

Keywords: Optimization, Scheduling, Task distribution, LNS, Weekend Scheduling, Heterogeneous workforce

URL for electronic version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-77777>

Acknowledgements

We would like to express our deepest gratitude to our supervisor Torbjörn Larsson at Linköping University, who has helped us find our way in moments of uncertainty and who has been guiding us through the whole project. Thank you for the time and effort you have spent on our thesis. We would also like to thank Elina Rönnerberg, who has provided encouraging words and valuable insights throughout the project.

Furthermore, we would like to thank Elisabeth Cserhalmi and Ingrid Loeld Rasch at Norrköpings Stadsbibliotek for providing us with an interesting thesis topic and for answering all our questions many times over.

We thank our opponents, Akdas Hossain and Emma Miléus, for their comments and thoughts on this report.

Lastly, we would like to thank our families and loved ones, who have supported us until the end.

Nomenclature

Most of the reoccurring terms and abbreviations are described here.

Optimization terms

Heuristic An algorithm designed to find feasible, but not necessarily optimal, solutions.

Library terms

Fetch list The library task of collecting books from shelves, to be delivered elsewhere.
Library on wheels The task of driving a library bus with books to remote areas of town.

Abbreviations

Exp Service counter (sv. expeditionsdisken)
Info Information counter (sv. informationsdisken)
PL Fetch list (sv. plocklistan)
BokB Library on wheels (sv. bokbussen)
HB Hageby library

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Week block table

Table B.1: Number of assignable unique blocks for the workers based on their availability and qualification.

Worker	Weekend	Weekrest	Weekday
1	532	347	1580
2	1580	1580	1580
3	1063	347	1580
4	557	165	779
5	261	130	531
6	532	130	1580
7	261	130	531
8	261	29	531
9	115	12	247
10	532	130	1580
11	9	8	8
12	1063	347	1580
13	771	92	1190
14	265	29	489
15	51	18	120
16	495	130	843
17	237	69	267
18	532	279	1580
19	495	47	843
20	532	130	1580
21	227	227	227
22	2	1	1
23	3	2	2
24	11	5	47
25	1063	279	1580
26	5	4	4
27	213	106	425
28	2	2	2
29	426	106	1281
30	127	126	455
31	495	130	843
32	261	29	531
33	72	45	306
34	425	425	425
35	91	20	221
36	55	27	101
37	1063	347	1580
38	3	1	1
39	2	1	1

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