

WORKFORCE SCHEDULING IN RETAIL STORE: MODELS AND SOLUTION APPROACHES



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Abstract

Understaffing and overstaffing due to uneven customer traffic are among the major issues which retail stores face frequently. In case of understaffing, retailers face the problems of lost sales, unsatisfied customers, negative feedback, and poor customer retention; whereas in case of overstaffing, they incur expenses on unutilized labors. In order to reduce various costs associated with understaffing and overstaffing, the number of workers should match the fluctuating customer traffic in each period of planning horizon. This study addresses the workforce scheduling problem in retail store to minimize the cost of understaffing and overstaffing by closely satisfying the periodic workforce requirements.

Labor cost in the retail industry generally accounts for 10 to 20% of total sales and sometimes even more than 50% of total operational costⁱ. Moreover, labor cost represents the second highest cost after cost of goods sold in the retail stores (Ton, 2009). The rising labor cost with the rate more than that of the profit margin has forced retailers to think about downsizing their staff; whereas, at the same time, increased competition and higher customer expectations for quality services have compelled retailers to employ skilled staff. Therefore, efficient workforce scheduling, by satisfying the needs of fluctuating customer traffic has become one of the primary challenges for the retailers to remain competitive and to gain operational efficiency (Lam, Vandenbosch, & Pearce, 1998).

The workforce scheduling in retail store becomes complex due to many non-standard shift patterns with varying start and end times, allocation of meal break, shifts of flexible

lengths and day-off requirements of the workers. Zolfaghari, El-Bouri, Namiranian, and Quan (2007) highlighted that generating all possible shift combinations with assignment of meal break results into a very large problem size and, consequently, the computational time required to find an optimal schedule may become too excessive. To ease the problem complexity, previous studies have considered the limited number of standard shifts for the workers, characterized with start time, shift length and implicit assignment of meal break which restricted them to consider greater flexibility (multiple combinations of non-standard shift and assignment of meal break) to effectively meet the fluctuating customer traffic. In addition, effects of various workforce policies (fixed shift length, working time account, overtime and part time workers) in retail store workforce scheduling have not been studied so far.

To fill the above mentioned gaps, this study makes three contributions: (i) a mathematical model (mixed integer program (MIP)) is proposed for each policy to obtain optimal schedule for the given number of workers. The MIP model uses the concept of deterministic finite automata and network flow theory that allowed consideration of multiple combinations of shifts under each policy. (ii) a heuristic is proposed to obtain optimal workforce size to satisfy the periodic workforce requirement, which iteratively solves MIP model by varying number of workers. (iii) a comparison of all the policies is performed from the retailer's perspective. Results show that among all the policies, working time account policy obtains the minimum cost of understaffing and overstaffing, overtime policy requires minimum workforce size to closely satisfy the given workforce

requirement, and part time workers policy requires minimum computation time to generate optimal workforce schedule.

Keywords: Retail store, workforce scheduling, understaffing and overstaffing, fixed shift length, working time account, overtime, part time, heuristic.

Table of Contents

Declaration.....	i
Abstract.....	ii
Acknowledgement.....	v
List of Figures.....	x
List of Tables	xii
Chapter 1	1
Introduction.....	1
1.1 Introduction	2
1.2 Motivation	6
1.3 Objectives of the study.....	7
1.4 Organization of the thesis.....	8
Chapter 2	10
Literature Review	10
2.1 Literature review	11
2.1.1 Difference and similarity of RWSP with other scheduling problems.....	12
2.1.2 Classification of RWSP	13
2.2 Research gaps	21
2.3 Scope of the study	22
2.4 Summary	23
Chapter 3	24
Retail Store Workforce Scheduling under WTA and FSL.....	24
3.1 Introduction	25
3.2 Literature review	27
3.3 Problem description.....	29
3.4 Preliminaries: DFA and its use in scheduling problems	30
3.5 Modeling workforce scheduling problem	32
3.6 Model formulation.....	34
3.7 Solution approach.....	38
3.7.1 Heuristic	38

3.8	Numerical example	42
3.8.1	Modeling workforce scheduling problem using DFA	42
3.9	Computational results and discussion	49
3.9.1	Experimental setup.....	50
3.9.2	Comparison of FSL and WTA policies	51
3.9.3	Heuristic performance.....	55
3.10	Summary	59
Chapter 4	.....	62
Retail Store Workforce Scheduling considering Overtime.....		62
4.1	Introduction	63
4.2	Literature review	65
4.3	Problem description.....	66
4.4	Mathematical model.....	67
4.5	Solution approach.....	73
4.6	Numerical example	74
4.7	Computational results and discussion	75
4.7.1	Experimental setup.....	75
4.7.2	Comparison of FSL and OTP	77
4.7.3	Heuristic performance.....	79
4.8	Summary	84
Chapter 5	.....	86
Retail Store Workforce Scheduling considering Part time Workers.....		86
5.1	Introduction	87
5.2	Literature review	88
5.3	Problem description.....	90
5.4	Mathematical model.....	91
5.5	Solution approach.....	96
5.6	Numerical example	98
5.6.1	Modeling workforce scheduling problem using DFA	98
5.7	Computational results and discussion	104

5.7.1	Experimental setup.....	104
5.7.2	Comparison of FSL and PWP.....	105
5.7.3	Heuristic performance.....	108
5.8	Summary	112
Chapter 6	.....	113
Conclusion	.....	113
6.1	Conclusion.....	114
6.2	Future directions and limitations.....	119
References	.....	120

List of Figures

Figure 3.1: DFA corresponding to regular expression $bb * aa * +cc *$	32
Figure 3.2: Heuristic to find optimal number of workers (Emp^*).....	41
Figure 3.3: DFA corresponding to regular expression Rw	43
Figure 3.4: DFA corresponding to regular expression Rf	44
Figure 3.5: Combined layered directed multi-graph under WTA policy.....	46
Figure 3.6: Combined layered directed multi-graph under FSL policy.....	47
Figure 3.7: DFA corresponding to regular expression Rd	48
Figure 3.8: Layered directed multi-graph for day-off scheduling	48
Figure 3.9a & 3.9b: Settings of demand instances Vs Total cost	57
Figure 3.10a & 3.10b: Settings of demand instances Vs Total CPU time at Emp^*	58
Figure 3.11a & 3.11b: Settings of demand instances Vs Total run time of heuristic	58
Figure 3.12a & 3.12b: Settings of demand instances Vs Total MIP Gap.....	59
Figure 4.1a & 4.1b: Settings of demand instances Vs Total cost	82
Figure 4.2a & 4.2b: Settings of demand instances Vs Total CPU time at Emp^*	83
Figure 4.3a & 4.3b: Settings of demand instances Vs Total runtime of heuristic.	83
Figure 4.4a & 4.4b: Settings of demand instances Vs Total MIP gap.....	84
Figure 5.1: Heuristic to find optimal number of workers and their schedule	97
Figure 5.2: DFA for full time workers corresponding to regular expression Rf	99
Figure 5.3: DFA for part time workers corresponding to regular expression Rp	99
Figure 5.4: Multi-graph $G1$ for the full time workers.....	101
Figure 5.5: Multi-graph $G2$ for the part time workers	102

Figure 5.6: DFA corresponding to regular expression Rd for day-off scheduling.....	103
Figure 5.7: Layered multi-graph for day-off scheduling	103
Figure 5.8: Demand settings Vs Various parameters.....	111
Figure 6.1a & 6.1b: Total workforce size Vs various policies	117
Figure 6.2a & 6.2b: Total cost Vs various policies.....	117
Figure 6.3a & 6.3b: Total CPU time Vs various policies	118

List of Tables

Table 3.1: Parameters settings considering Uniform distribution (WTA & FSL).....	50
Table 3.2: Parameters settings considering Poisson distribution (WTA & FSL)	51
Table 3.3: Computational results for Uniform demand instances (WTA & FSL).....	53
Table 3.4: Computational results for Poisson demand instances (WTA & FSL)	54
Table 4.1: Parameters settings considering Uniform distribution (OTP & FSL)	76
Table 4.2: Parameters settings considering Poisson distribution (OTP & FSL).....	76
Table 4.3: Computational results for Uniform demand instances (OTP & FSL)	80
Table 4.4: Computational results for Poisson demand distribution (OTP & FSL).....	81
Table 5.1: Parameters settings considering Uniform distribution (PWP & FSL).....	105
Table 5.2: Parameters setting considering Poisson distribution (PWP & FSL)	105
Table 5.3: Computational results for Uniform demand instances (PWP & FSL)	109
Table 5.4: Computational results for Poisson demand instances (PWP & FSL).....	110