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 cost[i]. 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.

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