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学 位 論 文 の 要 旨

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学位論文題目	Dynamic Models with Spatial Conditions in Revenue Management 和訳：レベニューマネジメントにおける空間的状況を考慮した動的モデル		

学位論文要旨

This paper shows some dynamic models in revenue management. Revenue Management (RM) is a field that deals with decision making under fixed capacity, uncertain demand, large fixed cost and perishable product. Under these conditions, revenue managers need to decide what product to sell to which customers at what price. Traditional applications in RM are airline, hotel and car rental industries. Recently, RM is applied to not only the traditional industries, but also hospitalities' services or entertainment industries, such as golf course, restaurant, casino, theater and etc. In the decision making of RM, there is allocation problem to decide when to sell to which customers. Models for the problem with requests simultaneously arriving are named dynamic model.

This paper focuses on the spatial seats' layout and suggests dynamic models that take up seats in a table and seats placed on lines such as a restaurant, theater or stadium. Examples for the seats are shown in Figure 1.

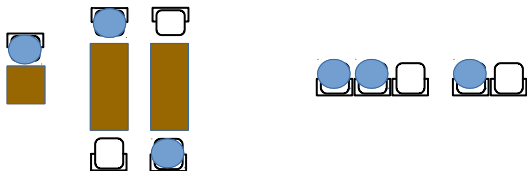

Figure 1

States of seats in the models stand for how seats are consumed by customers. In order to take account of the situation, we consider new dynamic models including spatial conditions, such as congestion and booking position which has not been treated in RM.

This study proposes a model with seats in tables and shows the model's properties such as monotonicity. In addition, from the monotonicities we can see that differences of departure rate among arriving parties cause to multiply variations of optimal policy. A tendency of a range where variation of optimal policies enlarges is shown by numerical examples. Monotonicity with degree of congestion of a facility and relation between the number of seats that a party has and the expected revenue are indicated. Specifically, the relation is that, revenue to which facilities draw

attention and surplus seats which customers want is trade-off. Finally, we mention relationship between a problem of this model and a challenge which is integration of RM and Customer Relationship Management (CRM).

For a problem for seats which are placed on lines, firstly we consider a simple case where seats are set on a single line. A model for the problem is named a single line seats model in this paper. System of the model decides which position should be allocated to which arriving parties. To this problem, it presents that ends of a block of vacant seats should be allocated to a party with any size and any fare class at any time period. We show an algorithm to calculate optimal policies and maximum expected revenue by this optimality. Further, the optimality shows that the single line seats model is an extended traditional dynamic model. This single line seats model can be utilized for facilities with seats placed on multiple lines under several assumptions, which is explained using some examples.

At the single line seats model, each request cannot choice its seating position when the request arrives, although there are actually many online reservation systems which allow doing so. Thus, we introduce choice seat position model where a customer selects a seating position in a facility with seats placed on multiple lines, and one seat bundles one fare class. This model is based on a choice-based network RM model which has been extensively studied for few decades. We apply Choice-based Deterministic Linear Programming (CDLP) and a decomposition approximation method to approximately compute optimal policies of the model. Solutions of the approximate methods can be efficiently obtained when customer's behavior is based on Multinomial Logit (MNL) choice model, although this model with large block of vacant seats is normally difficult to compute the solution. At numerical examples for the model, policies which are calculated from the approximate methods are estimated by Monte Carlo simulation. This model and the solution indicate that higher revenue is able to be implemented by considering customer's choice behavior among seat positions even though it is optimal to accept all requests at any time if we do not take account of the customer's choice behavior.

This paper shows some analytical results from considering special features for seats in tables and seats placed on lines. The results reveal that the models suggested in this paper are extended from existing models, and offer new insight which includes the points of view of congestion, parties' surplus seats and seating position into a theory of RM.