

When Bid Price is not enough: taking better allotment decisions for Camping Revenue Management

Keywords: Network Revenue Management, Markov Decision Process, Combinatorial Optimisation, Lagrange Relaxation, Stochastic Knapsack, Hospitality, Camping, Campsite

1 Campsite Revenue Management Context

After airline, train, cruise and hotel industries, the camping industry in Europe has been launching significant Revenue Management programs in the last 5 years. Within Europe, France has from far the largest park with about 9 000 campsites and more than 2 billion euros of revenue with a steady growth. Among the 940 000 pitches, more than 53% today have been equipped with mobile homes or chalets, increasing the REVPAR. For one week mobile home rental, the prices can vary from €100 in the low season up to €2500 in the peak season for 5 stars campsites. To our knowledge, less than 10% of French campsites use today dynamic pricing techniques.

On a revenue management point of view, campsites differ from hotels on many aspects such as average length of stay, distance to arrival date purchase, ancillary costs, price elasticity, inventory size, inventory heterogeneity, customer segments, BtoB deals and of course inventory mobility. For example, the average length of stay is close to 11 days in summer, and reservations for summer can occur more than 9 months in advance for early bookers. Some campsites allow unsynchronised arrivals (Wednesday, Saturday, Sunday) when others impose Saturday to Saturday stays.

Those differences make it hard for standard hospitality approaches to capture the stakes of campsite RM. This is typically the case of allotment optimisation strategies which advocates for ad hoc policies.

In the tourism industry, an allotment is a block of pre-negotiated “rooms” or “seats” which have been bought out by a travel agency or a tour operator. In the context of campsites, allotments play an important role in the distribution process and represent a significant share of the mobile homes sales. Having 20% of the inventory sold via allotment is not uncommon in France. The discount offered to the tour operators can go up to 50% according to the campsites and tour operator respective negotiating power.

Once the tour operator has contracted the allotment – say 20 mobile home weeks starting on the 1st of August in a four star campsite with 100 mobile homes near Nice – its role is to resell the mobile home weeks to final customers through its networks and channels. For each allotment contract, a release back period is negotiated, typically 30 days before the check-in, where the tour operator can release a part of the unsold block, with or without penalties. The campsite will then be obliged to sell the remaining mobile homes by its own means. For the campsite owner, dealing with tour operator allotment requests is a poisoned chalice. On one hand these pre-booked sales are more or less a guarantee of selling a good share of its inventory with little effort, early in the sales time frame. More-over, if the tour operator is well exposed to say, the Belgium market, these sales will fill holes in the capacity of a French campsite. On the other hand, the discount level – according to the

negotiating power of the tour operator – is so high that selling the whole inventory through allotments would potentially ruin the campsite business. Hence, a balance must be found between allotment contracts and estimated direct sales to final customers (at full price, or lightly discounted price). If allotments volumes and prices are known in advance, early in the season, the final customer demand is of course only known by forecast, 6 to 9 month in advance. What is more, tour operators ask for large quantities (take or leave), that are more efficiently sold on the web, which increases the risk for the campsite.

2 The Campsite Allotment Optimisation Problem

The revenue manager of a group of campsites receives allotment requests coming from dozens of tour operators at the opening of the sales i.e. between October and November. The issue is to define the strategy (accepting or refusing each allotment request) that maximizes its revenue expectancy. The sales chronology typically includes: Allotments, Special Offers via “Corporate work councils”, Tour Operators and other Aggregators, Individual demand on various channels.

The optimisation problem consists in taking the optimal set of decisions for all tour operator requests, with respect to capacity constraints and expected demand per fare class. The purpose of our work is to show that the stochastic optimisation problem at stake is highly combinatorial and that algorithmic approaches relying on a fluid vision of the demand behave poorly when the ratio “size of the allotment on total campsite capacity” is high. More-over, introducing recourse strategies, like promotions after the release dates, might advocate for higher risk taking in the allotment phase. Those recourses are difficult to exploit through “displacement” models or deterministic “bid price” policies frequently used by classic Revenue Management methods. Our experimental results compare optimal strategies – using Markov Decision Process models – to fluid approaches and ad-hoc heuristics, exploiting the combinatorial structure of the problem. When the overall demand is fixed, we will show that the RevPAR (average revenue per available mobile home) is not a decreasing function of the capacity, due to the loss induced by the allotment discrete sizes and the “tetris effect” of their combination. This effect is not fully compensated by the “yield management” effect on the demand.

Striking a balance between massive early allotments in November and promotions in March is not a straightforward move. We will draw the picture of almost 4 years of effective change management in an environment not used to revenue management. Today, a team of 7 analysts pilot the prices of 300 campsites and 20 000 mobile homes, when they were none in 2012.

3 Extension to the Multi-Site Allotment Optimisation Problem

Some particularly large tour operators, with high negotiating power may ask for multi-site allotments within a group of campsites all over Europe. For a company having hundreds of campsites in France, Italy, and Spain, the decision to take is no more local, a given service level rate having to be fulfilled for each of these large tour operators.

Needless to say, the discount rate proposed by the tour operator might be closely related to the service level reached by the camping company. As expected, a pure Dynamic Programming approach becomes a victim of the curse of dimensionality and finding an optimal strategy for a set of 100 campsites is out of reach. Thus, we developed a decomposition technique based on a Lagrange relaxation of the service level constraint of each tour operator. The master problem of fixing the Lagrange multipliers is solved by the subgradient algorithm when the sub-problems takes into account the stochastic dimension of the problem, through Dynamic Programming. Such decomposition schemes have been proposed in [2] for solving the airline network revenue management problem, and in [3] for the hospitality length of stay optimisation problem.

We will compare our approach with greedy strategies (fixing decisions campsite after campsite until service level is satisfied) and will provide experimental results on 200 campsites, 20000 mobile homes and 15 tour operators benchmarks with data sets inspired by the European leading company in the campsite industry.

References

[1] Thierry Benoist, Eric Bourreau, Yves Caseau, Benoît Rottembourg, *Towards Stochastic Constraint Programming: A Study of Online Multi-Choice Knapsack with Deadlines*. Principles and Practice of Constraint Programming — CP 2001. Lecture Notes in Computer Science Volume 2239, 2001, pp 61-76.

[2] Huseyin Topaloglu *Using Lagrangian Relaxation to Compute Capacity-Dependent Bid Prices in Network Revenue Management*. Operations Research, Issue 3, Volume 57, Feb 2009, pp 637 - 649

[3] B. Rottembourg, S. Lautier *Relaxation lagrangienne pour le calcul de Bid Price en Revenue Management hôtelier*, In ROADEF'13, Troyes, Feb 2013