Revenue Management for Wizards on GW College Night

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1. Introduction

This paper presents the team work on the Revenue Management Consulting project of the GW college night event for Washington Wizards.

About client and background

The Washington Wizards team, is an american professional basketball team, competing in the National basketball Association (NBA) league. As shown in the following picture, according to ESPN, the prestigious sports media in North America, overall, the Wizards home game attendance rates were at the average level in the entire league. Wizards wants to make some changes and try to attract more loyal fans from D.C. area.

2019 Attendance		Home				Road			Overall		
RK	TEAM	GMS	TOTAL	AVG	PCT	GMS	AVG	PCT	GMS	AVG	PCT
1	76ers	41	838,092	**20,441**	100.6	41	17,895	94.3	82	19,168	97.5
2	Bulls	41	823,475	**20,084**	96.0	41	17,822	93.9	82	18,953	95.0
3	Mavericks	41	820,569	**20,013**	104.2	41	18,073	95.9	82	19,043	100.1
4	Raptors	41	812,822	**19,824**	100.1	41	18,239	95.7	82	19,032	98.0
5	Heat	41	805,264	**19,640**	100.2	41	18,176	95.5	82	18,908	97.9
6	Warriors	41	803,436	**19,596**	100.0	41	18,790	99.7	82	19,193	99.8
7	Trail Blazers	41	799,345	**19,496**	100.3	41	17,992	95.4	82	18,753	97.9
8	Cavaliers	41	793,337	**19,349**	99.6	41	17,632	92.6	82	18,490	96.1
9	NY Knicks	41	779,087	**19,002**	95.9	41	17,566	92.6	82	18,284	94.3
10	Lakers	41	778,877	**18,997**	99.7	41	18,862	100.3	82	18,929	100.0
11	Celtics	41	763,584	**18,624**	100.0	41	18,671	97.5	82	18,647	98.8
12	Nuggets	41	756,457	**18,450**	96.3	41	17,474	92.8	82	17,962	94.6
13	Spurs	41	750,616	**18,307**	98.5	41	17,381	92.3	82	17,844	95.4
14	Jazz	41	750,546	**18,306**	100.0	41	17,517	93.0	82	17,911	96.4
15	Thunder	41	746,323	**18,203**	100.0	41	17,866	94.7	82	18,034	97.3
16	Rockets	41	740,392	**18,058**	100.1	41	17,921	95.0	82	17,989	97.5
17	Bucks	41	721,692	**17,602**	101.5	41	18,185	95.1	82	17,893	98.1
18	Magic	41	720,024	**17,561**	93.2	41	17,659	92.4	82	17,610	92.8
19	Wizards	41	716,996	**17,487**	86.2	41	17,509	91.8	82	17,498	89.0
20	Clippers	41	710,327	**17,325**	90.9	41	17,233	91.4	82	17,279	91.2
21	Kings	41	700,975	**17,096**	97.7	41	17,199	91.1	82	17,148	94.3
22	Pacers	41	689,310	**16,812**	92.6	41	17,957	93.7	82	17,377	93.1
23	Hornets	41	676,570	**16,501**	86.5	41	17,648	92.8	82	17,074	89.7
24	Pistons	41	675,963	**16,486**	78.5	41	17,819	94.1	82	17,153	85.9
25	Pelicans	41	656,183	**16,004**	93.1	41	17,667	93.4	82	16,835	93.3
26	Grizzlies	41	607,564	**15,578**	86.0	41	17,579	93.3	82	16,604	89.8
27	Hawks	41	628,440	**15,327**	81.8	41	17,786	93.5	82	16,557	87.7
28	Timberwolves	41	627,543	**15,305**	80.7	41	17,641	93.7	82	16,473	87.1
29	Suns	41	627,023	**15,293**	83.0	41	17,982	95.3	82	16,638	89.2
30	Nets	41	612,597	**14,941**	84.3	41	18,085	94.7	82	16,513	89.7

Figure 1

Wizards aims to attract more international students in D.C. area. This group of people is definitely active in going out for entertainments events and would be very likely to contribute more if appropriate market promotions and price policies are made.

Problem identification

Based on the past promotional activities held by Wizards, we would suggest ‘College Night’ would be a good way to attract more new patrons to purchase their costumed student price ticket. For this event, Wizards provides three different level of seats at the Capital One Arena, and our team is supposed to generate recommendations on price setting to maximize ticketing revenue. The three different offered seats are distanced seats (section 405-412, etc), less distanced seats (section 413-414, etc), and closest seats (section 104-107, etc). The current prices for the three seats are $21, $29, and $50 respectively. Those seats can hardly be popular since they are far from the court thus only provide limited sights compared to other sections.

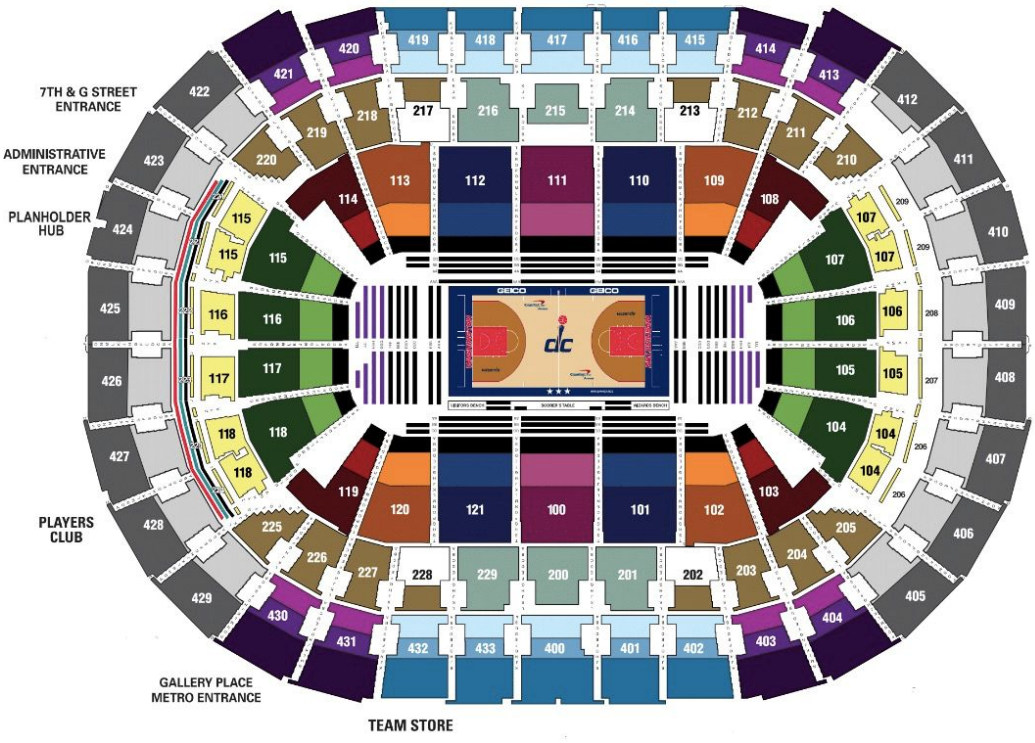

Figure 2

As the PRO Cube claims, “ right price, for every product, to every customer segment, through every channel all the time.” GW international students body is identified as a specific market segment in this case. This market segment may have a relatively lower willingness to support a unfamiliar team and low purchasing ability as a group without incomes. Through the channel of

Wizards promotional activity - College Night, students may have more interests to the team. In addition, affordable tickets make it possible for them to have the opportunity to consider a NBA game as a leisure event.

Having that being said, we also need to make sure that Wizards will be benefited from these low-fare sales and gain the maximum ticketing revenues.

In order to achieve the goals above, our team used Multinomial Logit Model to compute the probability that an individual student is going to buy the three products respectively. During the whole process, a survey was made to collect sample willingness to pay data among GW international students. Then, we implemented the Multinomial Logit Model for the three products to output the optimal pricing solution for the promotions on tickets. By doing so, we provide a recommended price set on Wizards college night, that is affordable to the students and also maximizes the Wizards' revenue.

2. Survey Design

To model our revenue management strategy, we handed out some surveys to international students at George Washington University in order to know the willingness to pay for the three different offered seating locations in Capital One Arena. As mentioned before, the three sections are distanced seat, less-distanced seat, and closest seat, which are defined based on their proximity to the court. Then we give 5 price options for each type of seat, and the price is based on current official ticket price of Wizards. Thus, our survey contains three questions with five options for each questions (see *Figure 3*), asking about what surveyee is willing to pay for three different sections. Note the 5 price options given to each seating location are also used as drafted prices in the following modeling process.

Drafted price	Distanced Seat	Less Distanced Seat	Closest seat
Price 1	12	20	50
Price 2	14	24	55
Price 3	16	28	60
Price 4	20	32	65
Price 5	24	36	70
Current price	21	29	55

Figure 3

The reason why we only give five price options for each section instead of allowing surveyee to fill in the willing to pay is that we want to avoid some extreme cases and invalid samples. For example, some surveyee may not be familiar with NBA ticket price, and therefore have no idea how much a ticket should be. At this point, providing price options could give them a hint of how much the normal ticket prices should be. It is also possible that there are some surveyee may not take the survey seriously and simply want to have a free lunch, leading a 0 being their willingness to pay for all sections. In this case, the survey would be invalid. All in all, giving them five options can avoid some extreme cases, making every survey tend to be valid.

Finally we gathered 50 valid samples, and we will use data in the samples to model our revenue management for Wizards.

3. Model

Background on Multinomial Logit Model

In this case, students can choose from 3 products, each one for a different price and proximity to the stage. For each student k, his/her willingness to pay for the product i is $u_i + \epsilon_i^k$, i = 1, 2, 3. Here, u_i represents the average willingness to pay for the product i. And, ϵ_i^k is a random, consumer-specific WTP perturbation around the average value, which differentiates consumers among themselves. This is because there exists some degree of uncertainty when it comes to every individual purchase decision. As is learned at class, ϵ_i^k follows follows a Gumbel distribution with zero mean and shape parameter μ, and specifically the Stdev(ϵ_i^k) = πμ/√6). And the probability of a customer k purchasing i is

P (choose i) = $v_i/(1+v_1+v_2+v_3)$,
Where v = $\exp[(u_i-p_i)/\mu]$
Therefore, the demand in a market where the market size noted as N is
Demand (product i) = N*P (choose i)

Data collection

Survey generated sample WTP data for the three different offered products. And from the sample data, MNL model parameters could be extracted:

(1) The average WTP sample data for each product is noted as $u_{1,2,3}$

(2) The average variance WTP sample data denoting by V, could be computed as $V = (V_1+V_2+V_3)/3$

(3) μ of the sample WTP data could be computed as $\mu = \frac{\sqrt{6V}}{\pi}$

Calculation process

In order to use MNL model equations, we need to know three things - the average WTP for product i, the drafted price for product i and μ value across all sample data and all products. Therefore, Excel is used to first generate all possible price combinations for the three products. Then MNL model equations are employed to compute the probability that an individual buys product i. In the following example, the price combination of $12 for distanced seat, $20 for less distanced seat and $50 for closest seat is used as an example to demonstrate how to compute the individual purchase probabilities.

Step 1: Use the function $\mu = \frac{\sqrt{6V}}{\pi}$, μ is 4.

Step 2: Then compute v values for three products using the function $v = \exp[(u_i-p_i)/\mu]$

Product	u_i	p_i	$v = \exp[(u_i-p_i)/\mu]$
Distanced	16	12	exp[(16-12)/4]=3.04
Less distanced	24	20	exp[(24-20)/4]=2.44
Closest	55	50	exp[(55-50)/4]=3.29

Step 3: Finally compute P (choose i) using the equation $P \text{ (choose i)} = v_i/(1+v_1+v_2+v_3)$

Product	$P \text{ (choose i)} = v_i/(1+v_1+v_2+v_3)$
Distanced	3.04/(1+3.04+2.44+3.29)=0.31
Less distanced	2.44/(1+3.04+2.44+3.29)=0.25

Closest	3.29/(1+3.04+2.44+3.29)=0.34
No purchase	1-0.31-0.25-0.34=0.1

4. Solution Approach

Based on the Multinomial logit models, the individual probabilities of purchase each product is computed, and the demand as well as the respective revenue is calculated by the following formulas. All the alternative combinations are shown in the excel file.

Demand = population of GW international students(4,000) * probability

Revenue = demand * price

The price combination of max revenue, $152,732, is shown in the figure below.

Figure 4.1 *Best price combination*

	Distanced	Less Distanced	Closest
Drafted price	$28	$36	$50
Probability	0.013011	0.010457	0.74911
Demand	52	41	2996
Revenue	$1456	$1476	$149800

For the current price of student price, the revenue is $105,145, as is shown in Figure 4.2. Compared with the current price, the max revenue increased by **45.26%**, which is a significant improvement for Washington Wizards.

Figure 4.2 *Current price combination*

	Distanced	Less distanced	Closest
Current price	$21	$29	$55
Probability	0.128204	0.103035	0.374836
Demand	512	412	1499
Revenue	$10752	$11948	$82445

The reason why this price combination is the best could be that there is not much difference between the price of closest seats ($50) and the prices of the other two kinds of seats ($28 & $36). It is very likely that in this situation, students are tended to buy the closest seats to maximize their net utility.

In sum, the best price combination for the GW college night event for Wizards we recommend is $28 for distanced seats, $36 for less distanced seats and $50 for closest seats.

However, there are still some limitations in our research. First, our sample size is too small compared with the population, the sample size only occupied 1.25%. For a population between 1000 to 5000, a sample size reaching 10% will be better. Besides, the sample is not representative enough. The characteristics of the respondents should be controlled in the sample. A larger and more diversified sample will help us get a more accurate result and give a more helpful recommendation to the GW college night.