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Early Bird & Night Owl Evaluation Tool (EBNOET) v2015

Gary Thompson
Cornell University School of Hotel Administration, gmt1@cornell.edu

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Abstract
The early bird and night owl restaurant tool found in the accompanying Excel file provides an estimate of the effects of offering off-peak special menu prices. Unlike the classic back-of-envelope calculation, the tool includes the effect of anticipated cannibalization of full-price covers and seeks to optimize table use. The tool also considers the revenue from new customers attracted by the early bird or night owl promotions, as well as the level of increased business needed to achieve the net monetary value target for the promotion.

Keywords
restaurants, specials, restaurant simulation, calculators, Cornell

Disciplines
Food and Beverage Management

Comments

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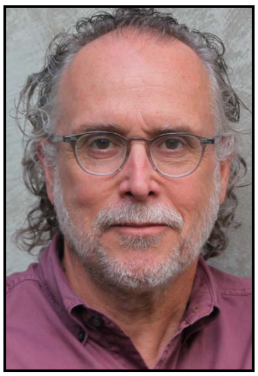
EXECUTIVE SUMMARY

The early bird and night owl restaurant tool found in the accompanying Excel file provides an estimate of the effects of offering off-peak special menu prices. Unlike the classic back-of-envelope calculation, the tool includes the effect of anticipated cannibalization of full-price covers and seeks to optimize table use. The tool also considers the revenue from new customers attracted by the early bird or night owl promotions, as well as the level of increased business needed to achieve the net monetary value target for the promotion.

ABOUT THE AUTHOR



Gary M. Thompson, Ph.D., is a professor of operations management in the School of Hotel Administration at Cornell University, where he teaches graduate and undergraduate courses in service operations management. Prior to joining Cornell in 1995, he spent eight years on the faculty of the David Eccles School of Business at the University of Utah. His current research focuses on restaurant revenue management, food and beverage forecasting in lodging operations, workforce staffing and scheduling decisions, wine cellars, scheduling conferences, and course scheduling in post-secondary and corporate training environments. His research has appeared in the *Cornell Hospitality Quarterly, Decision Sciences, Journal of Operations Management, Journal of Service Research, Management Science, Naval Research Logistics,* and *Operations Research.* He has consulted for several prominent hospitality companies and is the founder and president of Thoughtimus® Inc., a small software development firm focusing on scheduling products. From July 2003 through June 2006 he served as executive director of the school's Center for Hospitality Research.

Instructions for the Early Bird & Night Owl Evaluation Tool (EBNOET) v2015

by Gary M. Thompson

The purpose of this Excel-based tool is to help restaurateurs accurately evaluate the net monetary benefit of implementing Early Bird or Night Owl specials in their restaurants, before they actually implement either special. These instructions apply to the accompanying Excel file.

Several years ago, Michael Lefever gave an interesting narrative about his restaurant's experience with early bird specials:

> We tried advertising our early bird specials, half-price dinner entrées between 4:00 and 6:00 p.m. on weekdays, in the local newspaper. We would get dozens of phone calls from people asking if they could have the reduced price if they were "only an hour or so late." On Friday and Saturday nights we always would get a few customers who had "driven for hours just for the early bird special." The thing I remember most about our early bird ads is the account executive. For several weeks after we stopped advertising, she would ask if we would like to start again. We would say "No," and she would give us a cold, penetrating stare that stated clearly meant, "You'll be sorry." Unfortunately, we already were.[1]

Because of possible challenges in implementing Early Bird (or Night Owl) specials, as alluded to by Lefever, it is of paramount importance to accurately estimate their value before they are implemented. Cannibalization, less so demand, but particularly capacity, poses challenges in estimating the value of the specials simply and accurately. For example, customers arriving early during a meal period to take advantage of an early bird special may reduce the capacity available to serve full-fare customers who arrive later in the meal period.

A recent study showed that simple, back-of-the-envelope calculations are not accurate in predicting the monetary benefit of such specials, and that simulating restaurant operations proves much more effective.[2] The accompanying tool, which I am calling EBNOET, includes a simple back-of-the-envelope approach to estimating the value of the specials. More important, EBNOET can stimulate the restaurant to obtain a more accurate estimate, offering restaurateurs a means of avoiding the inherent inaccuracy of the back-of-the-envelope calculations, and leading to better decisions regarding whether to implement these specials. EBNOET can use an existing mix of tables in the restaurant, or it can search for the most effective mix of tables and base the estimate on the optimized mix. Finally, EBNOET can be used from two demand-based perspectives. The first, which I call the Demand Estimate Mode, uses one's estimates of the new demand that the special will generate, and then explores the net values that would be achieved under

[1] Michael Lefever, "Restaurant Advertising: Coupons, Clowns, and Cadillacs," *Cornell Hotel and Restaurant Administration Quarterly,* Vol. 29, No. 4 (February 1989), p. 101. Excerpted from: Michael Lefever: *Restaurant Reality: A Manager's Guide* (New York: Wiley and Sons, 1988).

[2] G.M. Thompson, "Deciding whether to offer 'early-bird' or 'night-owl' specials in restaurants: A cross-functional view." *Journal of Service Research*, Vol. 18, No. 4 (2015), pp. 498-512.

Exhibit 1

A legend shows the cell color-coding applied in EBNOET

KEY:	Labels	Inputs	Outputs	Decisions

Exhibit 2

Data inputs related to customer parties

	A	B	C	D	E	F	G	H	I
1	Party-Related Data								
2	Party Size	Probability	Cumulative Probability	Party Value	Service Duration w/o Special (minutes)		Service Duration w Special (minutes)		Max Tolerable Wait
3					Mean	Standard Deviation	Mean	Standard Deviation	
4	1	0.08	0.08	$ 10.00	60	12	60	12	30
5	2	0.25	0.33	$ 20.00	65	13	65	13	35
6	3	0.11	0.44	$ 30.00	70	14	70	14	40
7	4	0.19	0.63	$ 40.00	75	15	75	15	45
8	5	0.16	0.79	$ 50.00	80	16	80	16	50
9	6	0.11	0.9	$ 60.00	85	17	85	17	60
10	7	0.06	0.96	$ 70.00	90	18	90	18	65
11	8	0.02	0.98	$ 80.00	95	19	95	19	75
12	9	0.01	0.99	$ 90.00	100	20	100	20	75
13	10	0.01	1	$100.00	105	21	105	21	80
14	11	0	1	$110.00	110	22	110	22	80
15	12	0	1	$120.00	115	23	115	23	85
16	13	0	1	$130.00	120	24	120	24	90
17	14	0	1	$140.00	125	25	125	25	90
18	15	0	1	$150.00	130	26	130	26	90
19	16	0	1	$160.00	135	27	135	27	90
20	17	0	1	$170.00	140	28	140	28	90
21	18	0	1	$180.00	145	29	145	29	90
22	19	0	1	$190.00	150	30	150	30	90
23	20	0	1	$200.00	155	31	155	31	90

that estimate and progressively higher levels of demand. The second perspective, which I call the Target Value Mode, identifies the new demand level for the special that would be necessary to meet a target net monetary value.

EBNOET assumes that the value of a customer's choosing the special can be represented as a discount from a full-fare customer. This might mean, for example, that a discount is offered directly (e.g., "come in before 6:00 and get 20% off"), or that some special menu items or pricing is offered (e.g., "three courses for $40"). Later we see an example of how this might be calculated. EBNOET could be used to simultaneously evaluate Early Bird and Night Owl specials, if the discount is the same for both specials. The more common case is that a restaurateur would be considering only one type of special.

Below I describe EBNOET's data requirements, how it calculates a simple back-of-the-envelope estimate of the value of a special, and the results obtained when running the evaluation simulation. I explain two early bird examples and one night-owl example of how the tool can aid in the evaluation of a special and show how the tool can be used to evaluate another type of special. Finally, an appendix describes EBNOET's assumptions.

Instructions. All of the exhibits shown below are screen captures from EBNOET. The tool uses color coding to indicate the type of item in the spreadsheet cells, as shown in Exhibit 1.

Data inputs. Data inputs are illustrated in Exhibits 2 through 6 and 9. They are grouped based on being related to customer parties, restaurant tables, party arrivals, customers' table selections, and the restaurant simulation. Exhibit 2 shows the customer party–related data inputs on the **Data Inputs, Part 1** worksheet. For each size party, you must specify: the probability of that size party (column B); the average total revenue, or preferably average contribution (column D); and the mean dining duration in minutes, which should include the time necessary to seat the party and buss the table (column E). All of these data items are typically available in the POS data. If you wish to use EBNOET's simulation capabilities, you must also specify, by party size: the standard deviation of dining duration (column F) for standard customers; the mean dining duration and standard deviation of the dining duration for the customers selecting the special (columns G and H); and the maximum tolerable wait (column I). Since the maximum tolerable wait is not available in POS data, you would need to collect that information via observations of customers' behavior. EBNOET assumes that arriving parties will wait up to their tolerance point and then depart if they have not been seated. The data on dining times for customers selecting the special generally would not be available, so it would have to be estimated. As a starting point, you could assume it would be the same as for regular customers. We return to this at the end of the instructions.

Exhibit 3

Data input related to tables

K	L	M	N
Table-Related Data			
# Seats	Space Required	Valid to Use?	Number
1	1.625	FALSE	0
2	3.25	TRUE	4
3	4.875	FALSE	0
4	6.5	TRUE	3
5	8.125	FALSE	0
6	9.75	TRUE	2
7	11.375	FALSE	0
8	13	TRUE	1
9	14.625	FALSE	0
10	16.25	TRUE	1
11	17.875	FALSE	0
12	19.5	FALSE	0
13	21.125	FALSE	0
14	22.75	FALSE	0
15	24.375	FALSE	0
16	26	FALSE	0
17	27.625	FALSE	0
18	29.25	FALSE	0
19	30.875	FALSE	0
20	32.5	FALSE	0
		Total Seats:	50
		Total Space Used:	81.25
		Total Space Available:	82
		Net Discount Percentage	25
		Target Net Value of Special	100

Exhibit 4

Data inputs on the estimated arrival rate of parties under the status quo and under the special

P	Q	R	S	T	U
	Expected Number of Party Arrivals, by Period			With a Target Net Value of the Special	
		Estimated Arrivals With Special In Effect			
15-Minute Interval	Without Special (Status Quo)	Existing + Wants Special	New + Wants Special	Parties Lost to the Special	Proportion of Total Parties Wanting the Special who want it in the Period
18:00	1	0.25	2	0.25	0.25
18:15	1	0.25	2	0.25	0.35
18:30	1.5	0.25	2	0.25	0.4
18:45	2				
19:00	2				
19:15	2				
19:30	2.5				
19:45	3				
20:00	3				
20:15	3				
20:30	3				
20:45	2.5				
21:00	2				
21:15	2				
21:30	2				
21:45	1				
22:00	1				
22:15	1				
22:30	1				
22:45	1				
23:00	0				
23:15	0				
23:30	0				
23:45	0				
0:00	0				
0:15	0				
0:30	0				
0:45	0				
Totals:	37.5	0.75	6	0.75	1

Note that EBNOET uses the party probabilities to calculate cumulative probabilities, which must sum to 1.0. (The cumulative probabilities allow one to see that they do.) The **Cht—Party Size** worksheet displays the provided probabilities across party sizes.

Exhibit 3 shows the data inputs related to the restaurant's tables from the **Data Inputs, Part 1** worksheet. For each table size from 1 to 20 seats, you must specify whether it is a valid table size (column M) and, for the valid table sizes, the space required including access (column L). In the example shown, tables with 2, 4, 6, 8 and 10 seats are all valid. To use EBNOET's simulation capabilities, you must specify the total space available in the restaurant for seating including access (cell N26). If you wish to simulate restaurant performance with the restaurant's existing table mix, you must specify the number of each size table (column N). To estimate the value of the special, you must specify the net discount percentage offered to patrons selecting the Early Bird or Night Owl special (cell N28). Finally, if you are using the Target Value Mode, you must specify, in cell N29, the Target Net Value of the special that you wish to achieve.

Data inputs related to party arrival rates are illustrated in Exhibit 4 from the **Data Inputs, Part 1** worksheet. EBNOET

Exhibit 5

Data inputs required when customers select their own tables

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Party	Probability of the Party Self-Selecting a Table of the Specified Number of Seats																				
2	Size	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
3	1		0.76		0.15		0.05		0.03		0.01											1
4	2		0.64		0.2		0.1		0.05		0.01											1
5	3				0.77		0.15		0.05		0.03											1
6	4				0.65		0.2		0.1		0.05											1
7	5						0.8		0.15		0.05											1
8	6						0.7		0.2		0.1											1
9	7								0.85		0.15											1
10	8								0.8		0.2											1
11	9										1											1
12	10										1											1
13	11																					0
14	12																					0
15	13																					0
16	14																					0
17	15																					0
18	16																					0
19	17																					0
20	18																					0
21	19																					0
22	20																					0

Exhibit 6

Using the Discount Calculation worksheet to calculate the Net Discount Percentage

	A	B	C	D	E
1	To calculate the Net Discount Percentage, provide the revenue (and cost) information for a typical party.				
2		Full-Fare (Original)		With the Special	
3		Revenue	Variable Cost	Revenue	Variable Cost
4	Food	$ 50.00	$ 33.33	$ 37.50	$ 33.33
5	Beverage	$ 50.00	$ 16.67	$ 50.00	$ 16.67
6	Other				
7	Total	$ 100.00	$ 50.00	$ 87.50	$ 50.00
8	Contribution		$ 50.00		$ 37.50
9	Net Discount Percentage				25

requires estimated party arrival rates, by 15-minute period, for up to 7 hours (i.e., 28 periods). You must provide this information in column Q for the status quo—when no special is being offered—and information on what you expect to happen when the special is in effect, in columns R through U. Status quo arrival rates, which could be based on forecasts from historical POS data, are then displayed in the **Cht—Arrivals** worksheet.

If you are using the Demand Estimate Mode, you need to provide the information in columns R and S. In column R, you provide an estimate of the number of existing parties that would switch to the special. In column S, you provide an estimate of the number of new parties that would come to the restaurant for the special. Clearly these estimates would not be available in a POS, but could be estimated based on customer surveys and benchmarking with other restaurants offering specials. For the example illustrated, one in four parties (0.25) would be cannibalized by the special in each of the first three periods, while it is expected that the special would bring in two new parties in each of the first three periods.

To use the Target Value Mode, you must provide the information in columns T and U. In column T, you provide an estimate of the number of existing parties who would switch to the special. In column U, you provide an estimate of the proportion of total new parties that would want the special in each period. As with the estimates required for the Demand Estimate Mode, these estimates would not be available in a POS, but could be estimated based on customer surveys and benchmarking with other restaurants offering specials. For the example illustrated, I again estimate that 0.25 of parties would be cannibalized by the special in each of the first three periods and, of the total new parties wanting the special, 25 percent would appear in the first period (0.25), 35 percent in the second period (0.35), and 40 percent in period three (0.40).

In the event that your restaurant does not use a host or hostess to manage seating, you must provide information on customers' table choices to use EBNOET's simulation capability, as illustrated in Exhibit 5 from the **Data Inputs, Part 2** worksheet. These data typically would not be available in the POS data, so they would have to be collected via observation. The example shows that parties of one have a 76-percent chance of selecting a deuce, 15 percent for a four-top, 5 percent for a six-top, 3 percent for an eight-seat table, and 1 percent for selecting a table with ten seats, if all those table sizes were available.

The **Discount Calculation** worksheet, illustrated in Exhibit 6, is included to assist you in calculating the Net Discount Percentage. To use the calculator, you provide revenue and cost information for a typical party. In the example shown, the food portion of the order is discounted by 25 percent, yielding a discounted contribution of $37.50 compared to the original contribution of $50.00, for a Net Percentage Discount of 25 percent.

A simple approach to estimate the value of the special considers demand cannibalization, but ignores capacity cannibalization. It calculates the monetary value arising from all customers selecting the special and subtracts any loss from full-fare customers who converted to the special, thus:

Exhibit 7

The back-of-the-envelope estimate of the value of the special

Y	Z	AA
Party-Size Related Calculations		
Available Seats	Seated in Table	Captured $
-	2	$ 10.00
2	2	$ 20.00
-	4	$ 30.00
4	4	$ 40.00
-	6	$ 50.00
6	6	$ 60.00
-	8	$ 70.00
8	8	$ 80.00
-	10	$ 90.00
10	10	$ 100.00
-	n/a	
-	n/a	
-	n/a	
-	n/a	
-	n/a	
-	n/a	
-	n/a	
-	n/a	
-	n/a	
-	n/a	
Avg Value Per Party		$ 39.00
Simple Estimate of Daily Net $ of Special		$ 168.19

Exhibit 8

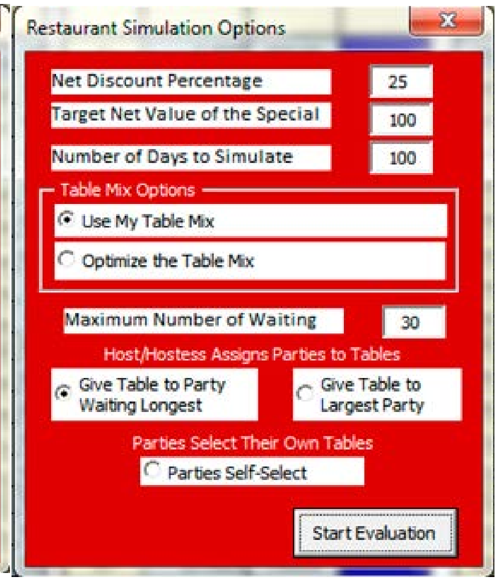
Evaluation options

Evaluate the Special using Estimated Demand	Evaluate the Special with a Target Monetary Value

Exhibit 9

Data inputs for the restaurant simulation

Demand Estimate Mode



Target Value Mode

Net Value of the Special = Mean Party Value * (Total New Parties Expected on Discount * (100-Net Discount Percentage)/100 – Total Full-Fare Parties Switching to the Discount * Discount Percentage / 100).

This value is reported in cell AA25 of the **Data Inputs, Part 1** worksheet as shown in Exhibit 7. The calculation uses the average party value, which is based on which parties can be served given the table sizes allowed in the restaurant.

To use EBNOET's restaurant simulation capabilities, click either of the buttons at the bottom of the **Data Inputs, Part 1** worksheet and illustrated in Exhibit 8. Use the left button for the Demand Estimate Mode and the right button for the Target Value Mode. When you do this, it will bring up one of the forms shown in Exhibit 9. *Net Discount Percentage* has been mentioned earlier and can be entered on the **Data Inputs, Part 1** worksheet or via a version of this form. On the form you will see when running the Target Value Mode, you can set the *Target Net Value of the Special*, which, as noted earlier, could also be specified on **Data Inputs, Part 1** worksheet. The *Number of Days to Simulate* parameter controls the number of distinct days that will be simulated. In general, using more days is preferable since the results will be less variable, and more days are better with lower customer volumes. While using 100 or more days is a good rule of thumb, it is best to run the simulation several times to see whether the estimated values of the special are consistent. If they are not consistent, increase the number of days being simulated.

EBNOET has two options with respect to table mix: using the mix in the restaurant itself, which is specified via the **Data Inputs, Part 1** worksheet (column N), or searching for the best table mix. The *Maximum Number of Waiting Parties* parameter allows you to limit the number of parties, for example, based on waiting space. Any party that arrives when the number of waiting parties is at its maximum is lost. There are three table-selection options: host-based, longest wait; host-based, largest party; and customer-based. As you might expect, the host-based, longest wait option assigns an open table to the party waiting the longest that fits the table, ignoring party size. On the other hand, the host-based, largest party option assigns an open table to the largest party that fits, ignoring waiting times. The customer-based table selection option uses the probabilities specified on the **Data Inputs, Part 2** worksheet to mimic how customers select their own table. Once the inputs have been specified, click the "Start Evaluation" button. When the simulation is running, if you have selected the "Optimize the Table Mix" option, EBNOET searches 200 table mixes, looking for the best. A study I conducted with Sheryl Kimes found that a search process using 100 table mixes found solutions within 0.02 percent of the best possible.[3] The Excel status bar shows the current table mix being evaluated, as shown in Exhibit 10. After the table mix has been identified (either using the search or the mix you specified), EBNOET steps through 21 progressively higher demand levels. While this is happening you will see the status bar as illustrated in Exhibit 11.

After running the restaurant simulation, the optimized table mix (if you selected that option) can be found on the **Recommended Table Mix** worksheet, illustrated in Exhibit 12, and the results can be found on the **Results** worksheet, illustrated in Exhibit 13. Please note that because EBNOET uses a simulation, the results can vary, so you should not be concerned if your results are different than those shown in the following exhibits. Columns B through G on the **Results** worksheet report results for the status quo, while columns H through O do the same for the special, using the lowest level of demand investigated. The status quo results report, for all party sizes and overall, the number of parties served (column B); the number of

Exhibit 10

Spreadsheet status bar when EBNOET is searching for the best table mix

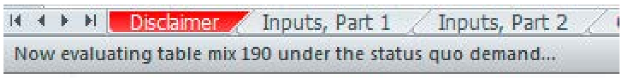


Exhibit 11

Spreadsheet status bar when EBNOET is evaluating the special under progressively higher levels of demand

Exhibit 12

Optimized table mix

	A	B
1	Table Size (Seats)	Recommended Number of Tables
2	1	0
3	2	3
4	3	0
5	4	2
6	5	0
7	6	3
8	7	0
9	8	1
10	9	0
11	10	1
12	11	0
13	12	0
14	13	0
15	14	0
16	15	0
17	16	0
18	17	0
19	18	0
20	19	0
21	20	0

Exhibit 13

Value of the special, based on the restaurant simulation

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1		Status Quo						With Special							
2	Party Size	Number Parties Served	Number Parties Lost	Avg Wait (min)	Avg Daily Longest Wait	Daily Value Lost	Daily Value Served	Number Full-Fare Parties Served	Number Discount Parties Served	Number Full-Fare Parties Lost	Number Discount Parties Lost	Avg Wait (min)	Avg Daily Longest Wait	Daily Value Lost	Daily Value Served
3	All	33.93	4.09	12.09	NA	$ 206.90	$1,266.90	32.72	6.26	5.71	0.34	16.60	NA	$ 310.21	$1,382.14
4	1	3.03	0.12	3.29	15.14	$ 1.20	$ 30.30	2.93	0.50	0.13	0.01	3.73	15.58	$ 1.30	$ 33.01
5	2	9.74	0.17	3.69	21.09	$ 3.40	$ 194.80	9.32	1.71	0.20	0.02	4.44	20.49	$ 4.22	$ 212.07
6	3	3.48	0.56	7.78	25.12	$ 16.80	$ 104.40	3.65	0.66	0.66	0.03	13.70	28.20	$ 20.62	$ 124.11
7	4	6.66	0.64	10.44	33.22	$ 25.60	$ 266.40	6.59	1.23	0.73	0.04	15.56	34.60	$ 30.34	$ 300.35
8	5	4.31	1.25	18.30	42.37	$ 62.50	$ 215.50	4.17	0.91	1.94	0.12	26.42	43.63	$ 101.60	$ 242.78
9	6	3.67	0.47	24.03	46.59	$ 28.20	$ 220.20	3.54	0.68	0.77	0.03	32.78	48.44	$ 47.93	$ 242.72
10	7	1.68	0.48	28.68	49.71	$ 33.60	$ 117.60	1.51	0.34	0.78	0.05	40.45	52.52	$ 57.52	$ 123.32
11	8	0.78	0.15	29.72	48.40	$ 12.00	$ 62.40	0.59	0.13	0.18	0.01	46.21	53.76	$ 15.48	$ 54.98
12	9	0.27	0.14	54.17	83.04	$ 12.60	$ 24.30	0.22	0.06	0.17	0.01	53.80	62.61	$ 16.16	$ 23.78
13	10	0.31	0.11	47.64	70.33	$ 11.00	$ 31.00	0.21	0.06	0.14	0.01	56.65	61.93	$ 15.05	$ 25.03
14	11					$ -	$ -							$ -	$ -
15	12					$ -	$ -							$ -	$ -
16	13					$ -	$ -							$ -	$ -
17	14					$ -	$ -							$ -	$ -
18	15					$ -	$ -							$ -	$ -
19	16					$ -	$ -							$ -	$ -
20	17					$ -	$ -							$ -	$ -
21	18					$ -	$ -							$ -	$ -
22	19					$ -	$ -							$ -	$ -
23	20					$ -	$ -							$ -	$ -
24											Net Daily Value of the Special				$ 115.24
25											% of Simple Estimate				68.52%

[3] S.E. Kimes and G. M. Thompson. "An evaluation of heuristic methods for determining the best table mix in full-service restaurants." *Journal of Operations Management*, Vol. 23, No. 6 (2005), pp. 599-617.

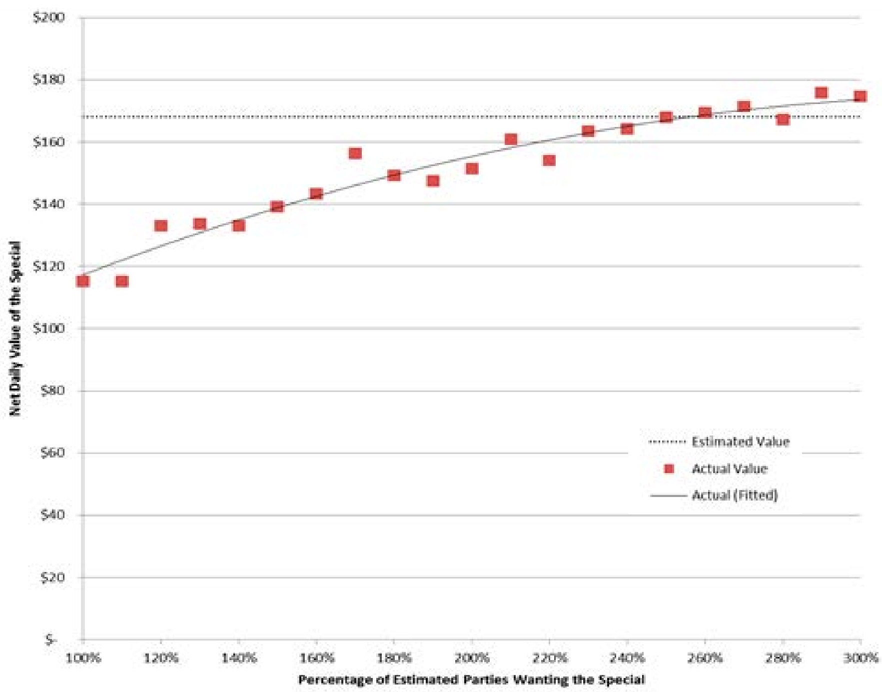
Exhibit 14

The value of the special and progressively higher levels of demand, from the Demand Estimate Mode

Y	Z	AA
With Estimated Demand		
Customer Volume Level	Estimated Value	Actual Value
100%	$ 168	$ 115
110%	$ 168	$ 115
120%	$ 168	$ 133
130%	$ 168	$ 134
140%	$ 168	$ 133
150%	$ 168	$ 139
160%	$ 168	$ 143
170%	$ 168	$ 156
180%	$ 168	$ 149
190%	$ 168	$ 148
200%	$ 168	$ 151
210%	$ 168	$ 161
220%	$ 168	$ 154
230%	$ 168	$ 164
240%	$ 168	$ 164
250%	$ 168	$ 168
260%	$ 168	$ 169
270%	$ 168	$ 171
280%	$ 168	$ 167
290%	$ 168	$ 176
300%	$ 168	$ 175

Exhibit 15

The relationship between the value of the special and progressively higher levels of demand, from the Demand Estimate Mode



parties lost (whether turned away or departed (column C); the average wait for a table, in minutes (column D); the average longest wait for any party of that size in a day (column E); the value of customers lost (column F); and the value of customers served (column G).

The special results report, for the lowest level of demand investigated, for all party sizes and overall: the number of full-fare parties served (column H); the number of parties wanting the special that were served (column I); the number of full-fare parties lost (column J); the number of parties wanting the special that were lost (column K); the average wait for a table, in minutes across all parties (column L); the average longest wait for any party of that size in a day (column M); the value of customers lost (column N); and the value of customers served (column O).

The ranges of demand levels investigated merit an explanation. In the Demand Estimate Mode, the lowest level is the estimated level of demand provided by the user (column S on the **Data Inputs, Part 1** worksheet), while the highest level is 300 percent of the lowest. In the Target Value Mode, the lowest level is the estimated breakeven quantity of demand based on the target net value, while the highest level is three times the breakeven quantity.

Cell O24 of the **Results** worksheet reports the net value of the special, which is $115.24 for the example. As noted in the introduction, the results from the simulation are more accurate than those of the back-of-the-envelope calculation, because an envelope outcome cannot account for capacity cannibalization. Comparing the values in columns C and J, one can see in this example that more full-fare customers are lost when the special is in effect than in the status quo, meaning that capacity was cannibalized.

Perhaps the most useful capability of EBNOET is to allow one to examine the effect of progressively higher numbers of customers taking the special. Exhibits 14 and 15 do this for the Demand Estimate Mode, while Exhibits 16 and 17 do the same for the Target Value Mode. Starting at the level of new demand for the special, from the specified estimates (in column S on the **Data Inputs, Part 1** worksheet), and stepping through demand levels of three times that, Exhibit 14 reports the net value that would be achieved. The "Estimated Value" is based on the simple back-of-the-envelope calculation presented earlier. Exhibit 15 presents the same information in a graph. We note that the values achieved under increasing demand do not fall perfectly on the fitted line, because the results are based from a simulation of restaurant performance, which has inherent variability. From the graph, we can see that new demand for the special would

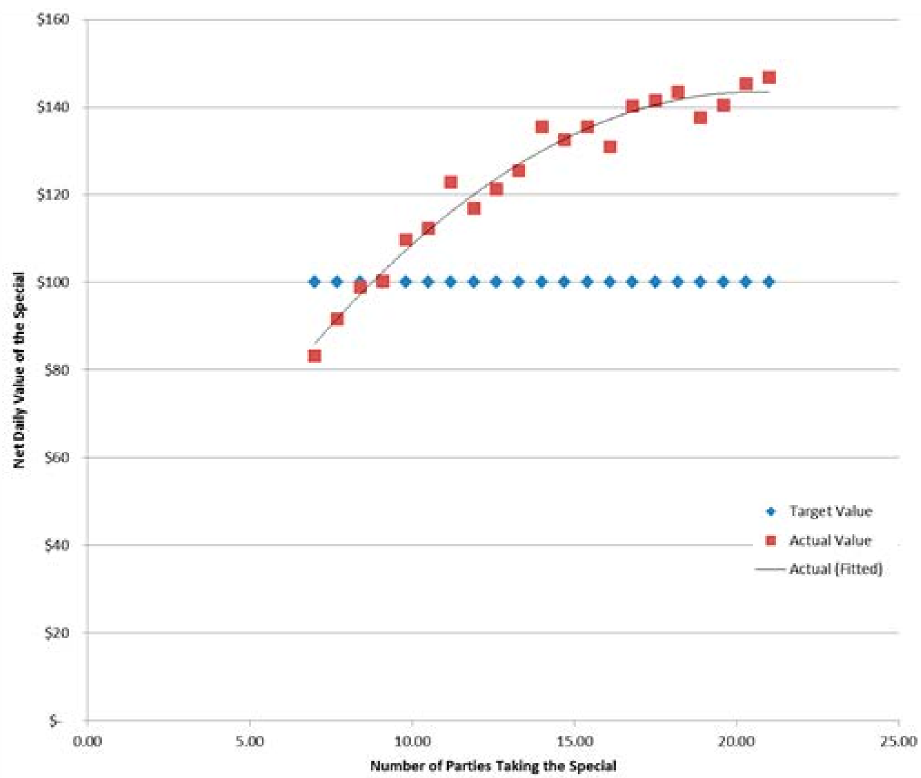
Exhibit 16

The value of the special and progressively higher levels of demand, from the Target Value Mode

AC	AD	AE
For a Target Net Value		
Number of Parties Wanting the Special	Target Value	Actual Value
7.00	$ 100	$ 83
7.70	$ 100	$ 92
8.40	$ 100	$ 99
9.10	$ 100	$ 100
9.80	$ 100	$ 110
10.50	$ 100	$ 112
11.20	$ 100	$ 123
11.90	$ 100	$ 117
12.60	$ 100	$ 121
13.30	$ 100	$ 125
14.00	$ 100	$ 135
14.70	$ 100	$ 133
15.40	$ 100	$ 136
16.10	$ 100	$ 131
16.80	$ 100	$ 140
17.50	$ 100	$ 141
18.20	$ 100	$ 143
18.90	$ 100	$ 138
19.60	$ 100	$ 141
20.30	$ 100	$ 145
21.00	$ 100	$ 147

Exhibit 17

The relationship between the value of the special and progressively higher levels of demand, from the Target Value Mode



need to be about 2.5 times the level that was estimated for the restaurant to achieve the same value from the special as the level that was calculated from the original demand estimate. This, then, would offer a reality check to the restaurateur considering implementing the special.

For the Target Value Mode, five parties would be needed to break even with the Discount Percentage of 25 percent, the estimate that the special would cannibalize 0.75 existing parties, and the Target Net Special Value of $100. Starting at that level of new demand for the special, and stepping through demand levels of up to three times that, Exhibit 16 reports the net value that would be achieved. The "Target Value" is the specified $100. Exhibit 17 presents a graph of the same information. From the chart, it can be seen that about eight new parties would need to purchase the special to meet the target value of $100. Again, this can serve as a reality check for the restaurateur.

Exhibits 15 and 17 illustrate an important reality: increasing demand for the special yields declining marginal benefits. The reason for this decline is capacity cannibalization. The more customers taking the special, the less capacity available to serve the full-fare customers. I reiterate that because EBNOET can simulate restaurant operations, it offers restaurateurs a means of avoiding the inherent inaccuracy of the back-of-the-envelope calculations, and so can lead to better decisions regarding whether to implement these specials.

Two Early Bird Examples

These examples are based on modifications of the data presented earlier. For the first example, consider that customers who order the special may take less time to dine. If we assume that dining times (and standard deviations) are 20-percent lower for guests who order the special than for full-fare customers, we would see no change in the back-of-the-envelope calculation. However, the special yields a higher value at every level of demand, as illustrated in Exhibit 18. In this case, demand needs only to be about 20-percent higher than estimated for the special to yield the value originally estimated, which is notably less than was necessary when the durations were the same (see Exhibit 15). The reason for the higher values is that with shorter dining durations much less full-fare capacity is cannibalized in the peak periods, since most parties taking the special will have departed before the peak. From this we can see that reducing the dining duration for the early bird specials, perhaps by carefully restricting the menu offerings, would likely be more effective than just discounting the standard menu items.

The second example examines how optimizing the table mix can affect the results, as illustrated in Exhibit 19. It uses the same Target Value Mode information presented earlier, the results for which were seen in Exhibit 17, but it optimizes the table mix instead of using the restaurant's existing mix. Here we see that the target value of $100 is achieved with fewer than eight parties taking the special, compared to the eight parties required with the existing mix. An optimized mix not only can increase the status quo value achieved, but can also lower the level of new demand necessary to achieve a target value from the special.

Exhibit 18

The relationship between the value of the special and progressively higher levels of demand, from the Demand Estimate Mode, when the dining duration is 20-percent lower for the customers taking the special

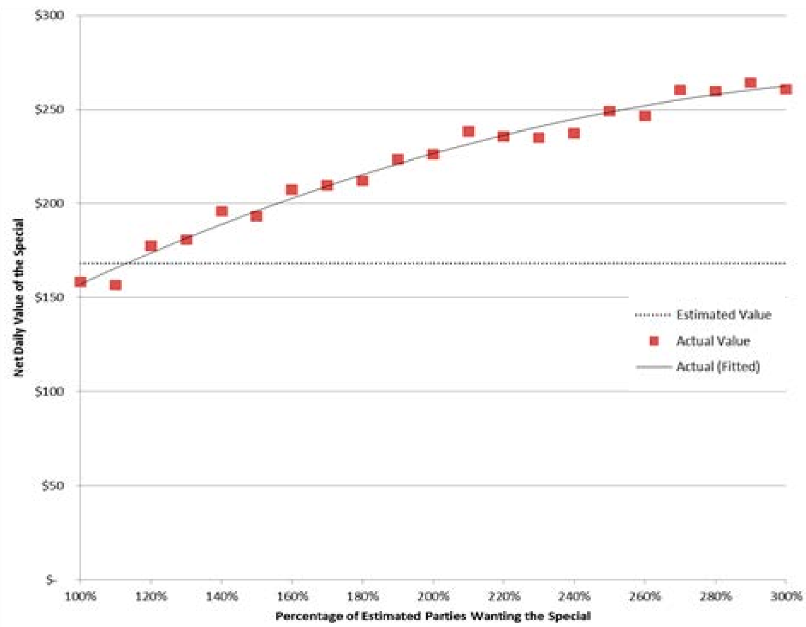


Exhibit 19

The relationship between the value of the special and progressively higher levels of demand, from the Target Value Mode, with an optimized table mix

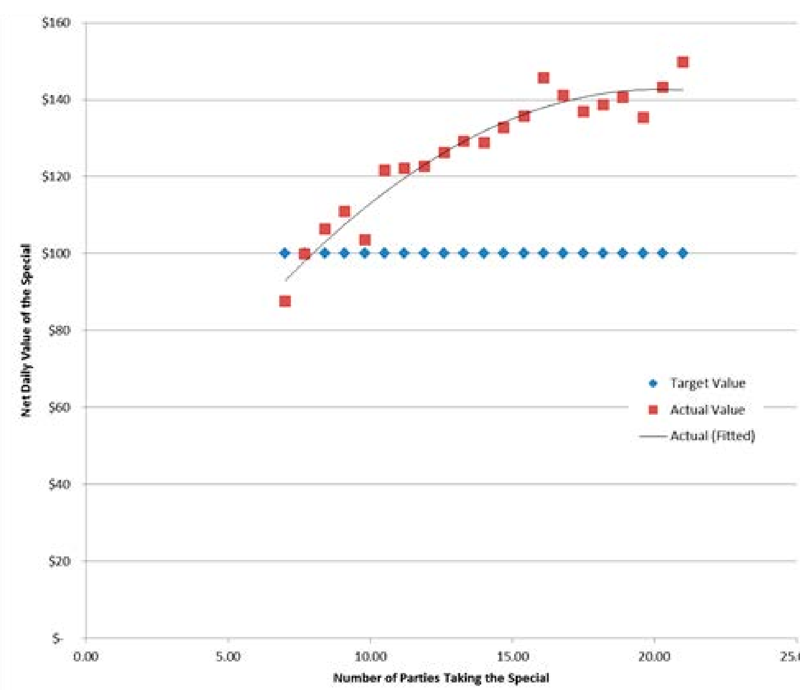


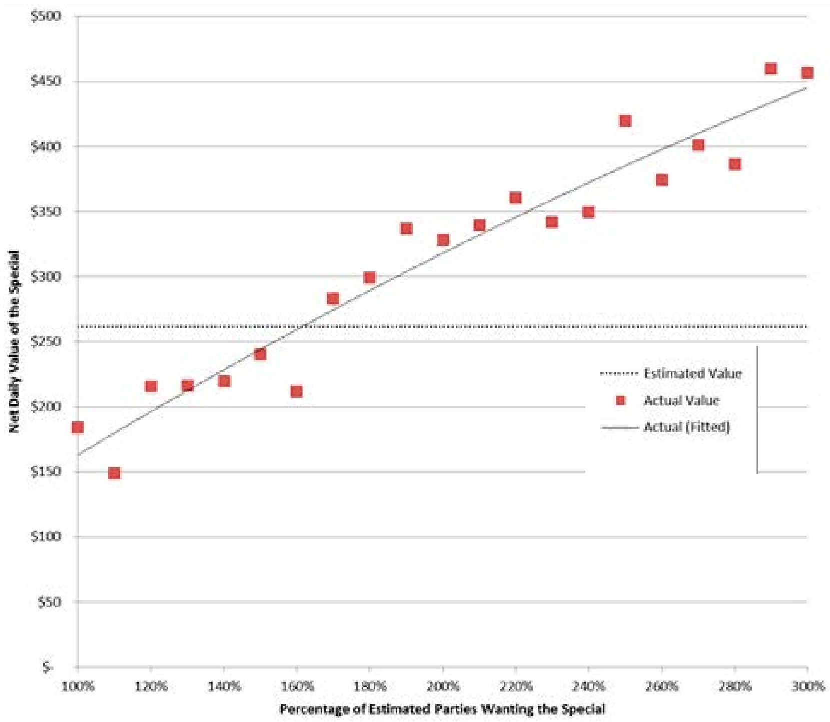
Exhibit 20

Demand estimates for applying a Night-Owl Special to a lunch

P	Q	R	S
	Expected Number of Party Arrivals, by Period		
15-Minute Interval	Without Special (Status Quo)	Estimated Arrivals With Special In Effect	
		Existing + Wants Special	New + Wants Special
11:15	0		
11:30	0.1		
11:45	0		
12:00	1.1		
12:15	2.2		
12:30	4.4		
12:45	4		
13:00	4		
13:15	1.9		
13:30	1.4	0.35	2
13:45	1.6	0.4	1.75
14:00	1.6	0.4	1.5
14:15	0.8	0.2	1.25
14:30	0.4	0.1	1
14:45	0.2	0.05	0.75
15:00	0.1		
15:15	0		
15:30	0		
15:45	0		

Exhibit 21

Results from applying a Night-Owl Special to a lunch



A Night-Owl Lunch Example

This example is drawn from a college campus restaurant, popular at lunch, and is included in a separate Excel file as part of this tool. The data provided is for Mondays in September and October, which is the slowest lunch of the week. A low waiting time tolerance of five minutes was used, to reflect the timeliness important to lunch diners. To boost Monday lunch demand the manager could consider offering a "Night-Owl" special to diners arriving between 1:30 p.m. and 3:00 p.m., with the estimated effects on demand as reported in Exhibit 20. About one quarter of the existing customers are estimated to switch to the special if they arrived during the time it was offered, while new demand is also expected, greatest in the 1:30 p.m. period and tailing off later in the meal period. The special would be generous, with a net discount of 30 percent, which gives an estimated value of the special of $261.84 (this example uses revenue, not contribution).

Running EBNOET's Demand Estimate Mode, we obtain the results illustrated in Exhibit 21. At the estimated level of new demand, the revenue increase would be about $170, while to achieve the estimated revenue bump of $261.84, new demand for the special would need to be about 60-percent higher than was estimated. Given that, and the fact that this analysis was based on revenue, not contribution, the manager might well conclude that the special would not be effective.

Thinking Outside the Box

With a little creative thinking, EBNOET can be used to evaluate other types of specials. Consider, for example, offering a discount to customers who dine quickly.[4] For the sake of the example, assume that the fast-dining parties will take 75-percent as long as the times shown in columns E and F of Exhibit 2 (i.e., the values in columns G and H are 75 percent of the corresponding values in columns E and F). Also assume that 20 percent of the parties will want to dine more quickly. If we use the Demand Estimate Mode, the values in column R of Exhibit 4 would be 20 percent of the corresponding value in column Q, while column S would be all zeros (meaning that 20 percent of the existing demand would move to the special, and that no new customers were expected). Finally, the Discount Percentage would be zero. With a Discount Percentage of zero, the estimated value of the special is zero because nothing is lost when

[4] Such a promotion, Lunch by the Minute, was devised in the mid-2000s by the Line, a restaurant in the Singapore Shangri-La hotel. Guests would earn a discount if they finished their meal in 30 minutes or less. See: Sheryl E. Kimes, Cathy A. Enz, Judy Siguaw, Rohit Verma, and Kate Walsh, "Cases in Innovative Practices in Hospitality and Related Services: Set 2," *Cornell Hospitality Report*, Vol. 10, No. 4 (February 2010), Cornell Center for Hospitality Research.

a full-fare party converts to the discount. Since we do not assume any new demand for the faster dining, there is no new demand to inflate. The quicker dining yields $23.77 per day for the restaurant, across the 6.66 parties using the faster dining, as reported in Exhibit 22. Those 6.80 parties represented a total of 24.9 customers, so the savings works out to $0.96 per person. This would be the upper limit on the value of the discount offered to fast-dining parties.

To summarize, the key value of EBNOET is its ability to give a more accurate prediction of the value of a special, so that managers can make informed decisions about whether and in what form to offer the specials. ■

Exhibit 22

Results obtained when estimating the value of offering an incentive for faster dining

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1		Status Quo						With Special							
2	Party Size	Number Parties Served	Number Parties Lost	Avg Wait (min)	Avg Daily Longest Wait	Daily Value Lost	Daily Value Served	Number Full-Fare Parties Served	Number Discount Parties Served	Number Full-Fare Parties Lost	Number Discount Parties Lost	Avg Wait (min)	Avg Daily Longest Wait	Daily Value Lost	Daily Value Served
3	All	33.93	4.09	12.09	NA	$ 206.90	$1,266.90	27.78	6.66	2.71	0.68	13.28	NA	$ 182.67	$1,290.67
4	1	3.03	0.12	3.29	15.14	$ 1.20	$ 30.30	2.35	0.58	0.05	0.01	2.43	13.62	$ 0.56	$ 29.31
5	2	9.74	0.17	3.69	21.09	$ 3.40	$ 194.80	7.57	1.85	0.06	0.02	2.80	16.56	$ 1.56	$ 188.42
6	3	3.48	0.56	7.78	25.12	$ 16.80	$ 104.40	3.12	0.74	0.26	0.07	9.37	23.78	$ 10.08	$ 115.86
7	4	6.66	0.64	10.44	33.22	$ 25.60	$ 266.40	5.54	1.28	0.30	0.08	11.14	28.86	$ 15.16	$ 272.64
8	5	4.31	1.25	18.30	42.37	$ 62.50	$ 215.50	3.87	0.94	0.96	0.24	21.38	39.42	$ 60.15	$ 240.75
9	6	3.67	0.47	24.03	46.59	$ 28.20	$ 220.20	3.06	0.72	0.35	0.09	26.04	43.40	$ 26.88	$ 226.56
10	7	1.68	0.48	28.68	49.71	$ 33.60	$ 117.60	1.33	0.33	0.46	0.10	35.49	49.13	$ 39.06	$ 115.99
11	8	0.78	0.15	29.72	48.40	$ 12.00	$ 62.40	0.53	0.12	0.10	0.03	40.91	51.32	$ 10.24	$ 51.84
12	9	0.27	0.14	54.17	83.04	$ 12.60	$ 24.30	0.22	0.04	0.09	0.02	42.86	60.40	$ 10.08	$ 23.40
13	10	0.31	0.11	47.64	70.33	$ 11.00	$ 31.00	0.21	0.05	0.07	0.02	52.04	61.02	$ 8.90	$ 25.90
14	11					$ -	$ -							$ -	$ -
15	12					$ -	$ -							$ -	$ -
16	13					$ -	$ -							$ -	$ -
17	14					$ -	$ -							$ -	$ -
18	15					$ -	$ -							$ -	$ -
19	16					$ -	$ -							$ -	$ -
20	17					$ -	$ -							$ -	$ -
21	18					$ -	$ -							$ -	$ -
22	19					$ -	$ -							$ -	$ -
23	20					$ -	$ -							$ -	$ -
24											Net Daily Value of the Special				$ 23.77
25											% of Simple Estimate				n/a

Appendix

Tool Assumptions

EBNOET has the following assumptions:

1. The restaurant only takes walk-in parties.

2. Tables cannot be combined.

3. Parties will not split—if a large enough table is not available, the party is lost.

4. Parties arrive following a Poisson distribution, with a stable mean within each 15-minute period. Poisson arrival patterns—randomly timed arrivals with reasonably predictable means—are common in service businesses.

5. The "Maximum Tolerable Wait" applies to waiting parties, not to parties arriving (i.e., it is applied to the actual wait and not the estimated wait).

6. All parties wishing to receive the special will be given it.

7. You must run the tool on Office 2007 or later on a PC, or Office 2011 or later on a Mac.

8. You have calculated a Net Discount Percentage for the special, considering all relevant cost and revenue components (e.g., food, beverage, retail).

Assumptions 1 through 7 are similar to those in an earlier CHR Tool, the Restaurant Table Simulator v2012, which I developed.[5] EBNOET includes a worksheet to assist in the calculation of the Net Discount Percentage, as described earlier.—*G.M.T.*

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[5] G. Thompson, "Restaurant Table Simulator, version 2012," *Cornell Hospitality Tool,* Vol. 3, No. 3 (2012), Cornell Center for Hospitality Research.

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Christopher K. Anderson, Director
Carol Zhe, Program Manager
Glenn Withiam, Executive Editor
Kate Walsh, Acting Dean, School of Hotel Administration

Center for Hospitality Research
Cornell University
School of Hotel Administration
389 Statler Hall
Ithaca, NY 14853

607-254-4504
chr.cornell.edu