Restaurant Table Simulator, version 2012

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Abstract
Restaurant Table Simulator (RTS) is an Excel-based model for simulating table usage in restaurants. RTS, which includes a charts and results tables, can be used to improve a restaurant's mix of tables. While the CHR already has a web-based tool for identifying restaurant table mixes, this version of RTS is useful in that it runs in Excel. The tool contains fill-in tables that will allow restaurant managers to run “what-if” scenarios for different table mixes, using different assumptions. Additionally it provides graphical information that the web-based tool doesn’t. Finally, it allows for situations where customers select their own tables, instead of being assigned to a table by a host or hostess, a scenario common in many restaurants. These features make this version of interest and more accessible to a wider group of restaurant managers and hospitality educators.

**In order to run this tool you need Excel 2007 or later (for PC), or Excel 2011 or later (for Mac). The models cannot currently be run using OpenOffice. You may also need to save first and then open the files**

Keywords
Cornell, tools, restaurants, simulations, table mix

Disciplines
Food and Beverage Management | Hospitality Administration and Management

Comments
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Restaurant Table Simulator
Version 2012

Cornell Hospitality Tools
Vol. 3, No. 3 (April 2012)

by Gary Thompson, Ph.D.

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Cornell University
School of Hotel Administration
Restaurant Table Simulator, version 2012

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EXECUTIVE SUMMARY

Restaurant Table Simulator (RTS) is an Excel-based model for simulating table usage in restaurants. RTS, which includes a charts and results tables, can be used to improve a restaurant’s mix of tables. While the CHR already has a web-based tool for identifying restaurant table mixes, this version of RTS is useful in that it runs in Excel. The tool contains fill-in tables that will allow restaurant managers to run “what-if” scenarios for different table mixes, using different assumptions. Additionally it provides graphical information that the web-based tool doesn’t. Finally, it allows for situations where customers select their own tables, instead of being assigned to a table by a host or hostess, a scenario common in many restaurants. These features make this version of interest and more accessible to a wider group of restaurant managers and hospitality educators.
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 focussing on scheduling products. From July 2003 through June 2006 he served as executive director of the school’s Center for Hospitality Research.
Model Purpose: This model is designed to simulate a restaurant, for the purposes of evaluating and improving upon the restaurant’s table mix. Based on an Excel platform, it allows users to input their data to model various table combinations under a variety of assumptions. This document explains how the simulator works and gives examples of various screens, including both inputs and outputs.
**Summary Instructions**

To use the model, please do the following:

(1) Specify the data in the light blue colored cells on first input screen (Exhibit 1).

(2) If customers will be picking their own tables, specify the data in the light blue colored cells on the ‘Inputs, Part 2’ sheet (Exhibit 2).

(3) Enter the starting table mix in the dark blue colored cells (Exhibit 4).

(4) Click “Clear Results Tracking” to delete any results information from previous trials stored on the “Alternatives Tried” sheet (Exhibit 10).

(5) Click “Simulate the Restaurant” to bring up the simulator interface form, where you specify additional parameters (Exhibit 5).

(6) After running the simulation, review the results in the Utilization Chart (Exhibit 7), on the Results sheet (Exhibit 8), and in the Alternatives Tried sheet (Exhibit 10). If desired, change the table mix in the dark blue cells, and return to step 5.

(7) Through trial and error, you should be able to find improved table mixes, though you will probably reach a point where additional improvements cannot be found. The ‘Alternatives Tried’ sheet can be helpful for reviewing your progress.

**Inputs**

In this model, inputs are shown in light-blue colored cells. There are a variety of inputs related to parties, by size:

- the proportion of all parties which that party represents;
- the value of the party (average check, for example);
- the mean and standard deviation of the service duration; and
- a limit on how long the party will wait for a table before departing.

These are illustrated in Exhibit 1.

If you select the option of parties selecting their own tables, you must also specify the likelihood that each size party will choose various table sizes. You do this on the “Inputs, Part 2” sheet, a screen capture of which is shown in Exhibit 2.
After specifying the data on the “Inputs, Part 1” sheet (and, if appropriate, on the “Inputs, Part 2” sheet), clicking the “Simulate the Restaurant” button will bring up the simulator interface form, which I describe on the next page. I show a screen capture of this form here and on the next page.

The simulator requires that you specify the number of parties that you expect to arrive, by 15-minute time period, during a peak period of up to 7 hours, as shown in Exhibit 3. You must also specify the space requirements of each size of table being considered, as shown in Exhibit 4.

Also illustrated in Exhibit 4 are the cells, colored in dark blue, where you specify the mix of tables you wish to evaluate. These dark blue cells are the decision cells for this model.
Decisions

After simulating a specific table mix, you can review the results (as I describe on the following pages) and perhaps identify a different table mix to evaluate. You would enter that new mix in the dark-blue cells of the screen in Exhibit 4. Through trial and error, you should be able to find improved table mixes, though you will probably reach a point where additional improvements cannot be found.

### Simulator interface screen and description of parameters

#### Exhibit 6

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Days to Simulate</strong></td>
<td>Number of days that will be simulated. More days require more time to run, but give a better estimate of the true performance.</td>
</tr>
<tr>
<td><strong>Maximum Number of Waiting Parties</strong></td>
<td>Think of this as a waiting area in the restaurant, for example. If a party arrives when the limit on the number of waiting parties has been reached, that party will be lost.</td>
</tr>
<tr>
<td><strong>Give Table to Party Waiting Longest</strong></td>
<td>If a table frees up, this rule will assign it to longest waiting party that will fit in the table.</td>
</tr>
<tr>
<td><strong>Give Table to Largest Party</strong></td>
<td>If a table frees up, this rule will assign it to the largest waiting party that fits in the table (ignoring waits).</td>
</tr>
<tr>
<td><strong>Parties Self-Select</strong></td>
<td>An arriving party will select their own table, from those available, based on the probabilities in the “Inputs. Part 2” sheet, Exhibit 2.</td>
</tr>
<tr>
<td><strong>Select Different Random Number Stream</strong></td>
<td>Selecting this option will give you different results when you run the model a second time because it will use different random numbers.</td>
</tr>
<tr>
<td><strong>Use Common History</strong></td>
<td>This option is useful for comparing different table mixes or table-assignment options, since it uses a common set of information on parties when conducting the simulation. To use this option you should run the “Create Common History” function only once.</td>
</tr>
<tr>
<td><strong>Create Common History</strong></td>
<td>This function will create a common set of randomly generated party information (arrival time, size, wait tolerance, service duration) that can then be used to evaluate different table mixes or table assignment options.</td>
</tr>
</tbody>
</table>
Key Outputs

There are three parts of the spreadsheet where useful results are presented: the Utilization Chart, the Results sheet (Exhibit 8), and the Alternatives Tried sheet. A screen shot of the Utilization Chart is shown in Exhibit 7.

In general, one would like to see high utilizations of all table sizes being considered. In addition, when the table mix is well-balanced with the customer mix, seat utilizations typically approach or exceed 80 percent.

To evaluate the existing table mix, one would obviously desire to have a high value of customers served, and a low value of customers lost. The information in Exhibit 8, which shows that about a quarter of the potential business is being lost, suggests that it could be useful to try improving the table mix.

The simulator also gives detailed information on results by party size, as shown in Exhibit 9.
Notable Limitations

This simulator has a number of assumptions:

- Tables cannot be combined.
- Parties will not split—if a large enough table is not available, the party is lost.
- Arrival distribution is Poisson, with a stable mean within each 15-minute period.\(^1\)
- The “Maximum Tolerable Wait” applies to waiting parties, not to parties arriving (i.e., applied to actual, not estimated wait).

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\(^1\) A Poisson distribution specifies the probability of the occurrence of independent events having a known average rate. This mimics a restaurant where business could die off entirely or you could be slammed during a particular meal period, but the average arrival rate is consistent over time.
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