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SIMULATION AS A MARKET PLANNING TOOL

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ABSTRACT

Simulation is a market planning tool which is most sophisticated in its handling of uncertainty. A computer simulation exercise has been constructed to evaluate the feasibility of expanding the Benihana restaurant chain. The following paper describes the operation of this simulation exercise and contains some additional comments concerning the use of simulation as a pedagogical tool.

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INTRODUCTION

The Benihana of Tokyo case describes the development of a limited-menu restaurant chain.[1] The Benihana firm faces several alternatives for future growth, including carrying a successful concept into new geographic areas.[2] Benihana of Tokyo has repeatedly been a very popular case at The University of Michigan. The market planning issues which it raises are important, and the restaurant industry seems especially accessible and interesting to students. Benihana B, a case designed to complement the Benihana of Tokyo case, includes a simulation exercise which facilitates the investigation of key elements of restaurant management. Strategic planning issues are also highlighted.

In the original case, Rocky Aoki wonders what to do with the profits generated from his string of Benihana restaurants. One of his options is to build more such restaurants. As Rocky has already established his Benihana restaurant in most of the major U.S. markets, further expansion requires investment in smaller cities such as Des Moines, Cincinnati, or Indianapolis. Thus, Benihana B emphasizes the questions: "What business(es) should Rocky Aoki be in?" and "Where should Rocky Aoki go from here?"

If Rocky Aoki is to expand into the smaller markets, it is necessary for him to decide how big a restaurant to build. The heart of the Benihana B case is a computer simulation which has been constructed to approximate restaurant operation. By interacting with the simulation, the student can directly observe the impact that different restaurant sizes have on profits. Specifically, the student is able to experiment with the number of bar stools and the number of dining tables in a hypothetical restaurant in Des Moines, Iowa. On each simulation run (lasting approximately one minute, real time) the student is able to "build" a restaurant of specified proportions; summary statistics, describing restaurant operations, are outputted at the end of each interactive simulation run.

Teaching Objectives

1. To demonstrate the use of simulation as a tool to aid in market planning.

2. To demonstrate the importance of using sensitivity analysis and decision rules to evaluate simulation output.

3. To explore the Benihana restaurant operation in order to determine where the money is made in that business.

Suggested Student Assignments

The following assignment could be given to all of the students in the class:

1. reread Benihana of Tokyo

2. read Benihana B

3. interact with the simulation (following the instructions in the case)

4. fill in the profit and loss table (page 9 of the case)

5. answer the four guide questions on page 1 of the case:

   a. Should Rocky continue to expand the Benihana chain in the U.S. (which means expansion into smaller markets)?
   b. Will the Benihana prove profitable under all three classes of market research estimates?
   c. If Rocky does build in Des Moines how many bar stools should there be?
   d. How many dining tables should there be (each table seats eight)?

In addition, one student group or student team could be asked to prepare a class presentation on one or more of the following topics:

1) Perform a sensitivity analysis. After determining the optimum configuration, note the impact on profit of adding (or subtracting) one bar stool or one dining table. A batch run is suggested.

2) Implement one or more of the decision rules outlined in the Benihana B supplement. This assignment has produced especially good team presentations at The University of Michigan.

3) After identifying the two "best" configurations (in terms of number of bar stools and number of dining tables), perform a t test in order to see if the profit streams under the two configurations are significantly different. Again, a batch run is recommended to generate the profit streams under the two selected configurations. If the student wishes to compare more than two configurations simultaneously, then the Scheffé method of simultaneous confidence intervals could be employed.[3]

Teaching Strategy

Benihana of Tokyo is a very popular case with students as the restaurant industry is an extremely interesting and accessible industry. Rocky Aoki, owner of the Benihana chain, is a flamboyant character, and the problems he encounters in the original case are problems which beset all successful entrepreneurs at a certain, crucial stage in their careers. Benihana B highlights some of the major points of the original Benihana of Tokyo and provides an interactive simulation exercise which allows students to "build" Benihana restaurants of varying sizes in order to observe the profitability of these experimental restaurants.

The simulation program is written in PL/1 and GPSS. Each run of the simulation models one evening's activities at a Des Moines, Iowa Benihana. Customers arrive, enter the bar, dine, and depart. At the evening's end, summary statistics are output. The case contains detailed instructions concerning the operation of both the interactive and batch run simulation models which are available. In step by step fashion, the case write-up details the moves that the student must make to interact with the simulation and to analyze simulation results.

Have the students answer the four guide questions presented in the case. Highlight some of the issues which are discussed in the following sections.

CASE ANALYSIS

I. Simulation as a Tool

Simulation is a computational technique for measuring parametric sensitivity. A common problem in all models is to determine the effect of variations in input data and/or structural parameters on output results. One reason for doing this is to compensate for inaccurate data, to see how the output would be affected by alternative estimates; another reason is that initial conditions in a simulation are often arbitrary, and it is important to determine whether the output is significantly affected by different starting conditions.[4] Sensitivity analysis is an especially good technique for analyzing simulation output, as it highlights the changes in output (profits) that occur as inputs to the system.

Marketing behavior and response are characterized by uncertainty, and simulation can be used as a vehicle for expressing and studying this uncertainty.[5] Simulation helps make assumptions explicit, thus causing the user to stop and think about a particular situation. "In the most general sense, simulation describes the act of creating a complex model to resemble a real process or system, and running and experimenting with the model in the hope of learning something about the real system."[6]

For these reasons, simulation is a good tool for evaluating the operation of the Benihana restaurant. The Benihana simulation models the real-world behavioral characteristics of a midwestern Benihana restaurant and enables the student to scrutinize the inputs, outputs, and processes of restaurant operation. In the Benihana simulation there are four stochastic elements (see Section III, "The Simulation Model").

The Benihana restaurant is run like an assembly line operation. Customers are expected to wait in the bar for twenty to thirty minutes; profit margins are higher on drinks than on food. The waiter/chefs are highly skilled and can usually insure that customers finish their meals within an hour, thus freeing up the table for more business. Such is the show and atmosphere at a Benihana restaurant that most customers do not even realize that their progress through the restaurant has been carefully and skillfully manipulated. Simulation is an especially good tool to monitor such an assembly line operation. In the interactive setting, the student can get a good idea of what is going on at each phase of restaurant operation.

II. The Market Research Report

A market research report for Des Moines, Iowa, is included in the case. This report estimates the number of customers that are expected to arrive at the restaurant each evening. Three classes of customer arrival estimates are given: most optimistic, most likely, and most pessimistic.

The market research report is designed so as to demonstrate the importance of repeat business. The three estimates--most optimistic, most likely, most pessimistic--differ only in that they make different assumptions about the amount of repeat business.

In all three estimates it is assumed that 29,243 individuals will be interested in attending a Benihana restaurant in Des Moines, Iowa. These 29,243 people represent about 9 percent of the metropolitan population in 1972. The estimates for each of the three classes are derived by making different assumptions about the "brand loyalty" of Benihana customers. For example, the most optimistic estimate assumes that .8 percent (233) of the 29,243 potential customers will attend the restaurant once a week or more. The most likely estimate assumes that .4 percent (116) of potential customers will attend once a week or more. The most pessimistic assumption says that only 58 people in Des Moines (.2 percent of potential customers) will come to the Benihana once a week or more. Thus, through a close examination of the market research report the students should be able to get a good idea of the importance of repeat business to the Benihana chain.

III. The Simulation Model

The simulation model is made up of two programs. The first program, which is written in PL/1, prompts the user for input and checks to make sure that the input is numeric and within the proper range. The second program, the GPSS program, models restaurant operation. A flow chart of the GPSS program is found in the text of the Benihana B case.

Basically, the model operates as follows: customer groups (ranging in size from one to eight) are generated and attempt to enter the restaurant. If the bar (and restaurant) is full, 85 percent of the arriving groups depart. People in Des Moines, Iowa, don't like to stand in line to eat at a restaurant. The customers who stay find seats in the bar and are formed into dining groups.

Customers are seated if all of the following conditions are met:

I. There is a waiter/chef available, and

II. There is a table available, and

III. At least one of the below is true:

a. there are four or more waiting customers;
b. any member of the party has been waiting more than forty minutes;
c. it is past 9 p.m. (closing time).

Thus it is possible for a customer to spend zero time in the bar and to proceed directly to the dining room, if conditions are right (i.e., if the dining room is not full when the customer arrives). The dining process is completed in 60 ± 5 minutes. If the bar begins to fill up, the waiter/chefs begin to work faster.

Other realistic aspects of the model include:

1) Customers arrive at differing rates, depending on the time of the evening.

5:00 - 5:30	5:30 - 7:30	7:30 - 9:00
business is slow	business picks up	business slows down again

2) Customers are seated according to a complex group of decision rules (see above). In fact, much logic is devoted to the "simulation" of an active and concerned *maître d'*.

3) Waiter/chefs work faster and more efficiently as the bar fills to capacity.

4) When arriving customers find the restaurant filled beyond capacity, 85 percent of them leave immediately. When the restaurant is filled to capacity, only 15 percent are willing to stand and wait outside.

5) The model operates in seconds. Customer arrival rates are Poisson-distributed. Thus interarrival times are exponentially distributed.[7]

6) There are four stochastic processes in the model:

a. customer arrival times
b. the number of customers in each arriving party
c. the determination of which arriving customer parties will leave when the bar is full
d. actual dining times.

IV. Analyzing Simulation Output

When analyzing simulation output, the following points can be emphasized:

1) Repeat business is important. This implies that the number of customers who are turned away should be kept at a minimum.

2) The waiter/chef and associates (busboy, waitress, and backroom cook) perform the important function of controlling the speed of the dining process. This insures an orderly, assembly-line type of operation.

3) The waiter/chef units should be kept working at full capacity.

4) The waiter/chef units are potentially scarce resources; in Des Moines, Iowa, replacements are difficult to get.

5) Drink profit margins are higher than food profit margins and, as such, are an important component of total profit.

6) If customers are "retained" in the bar for about one half-hour, drink profits are maximized.

7) The closing times of the restaurant under various configurations should be carefully noted. If the restaurant closes after 9 p.m., then overtime premiums come into effect and labor problems might develop (see 4 above). If the restaurant stays open too late, waiter/chefs begin to quit; the simulation model outputs messages to that effect to the user.

8) Profit streams should be analyzed over a period of many days, using different random number seeds.

V. Profit Calculation

It is suggested that the student summarize the results of the interactive and batch runs by filling in the chart on page 9 of the case. Inputs and outputs are recorded. By using the information provided in Exhibits 4 and 5, in combination with the outputs from the computer simulation, the student should be able to arrive at a profit figure for each night's operation.

The calculation of profit is, in fact, the key to the case. The interactive simulation itself is relatively easy for the student to operate. Once a simulation model has been built and verified, then the difficult task is to analyze the simulation output. The main idea is to get the students to think about the dynamics of restaurant operation and to think about where the money is made in this business.

A sample calculation of a night's profit can be found in Appendix I. Notice that the student is required to make several assumptions when making the profit calculations. The model could have been built to automatically calculate profit under each different configuration. This, however, would short-circuit the learning process. By interacting with the simulation directly and by going through some simple profit calculations, the students should be able to gain insight concerning proper restaurant size and restaurant operation. Also, as students supply some of their own figures to simulation output, there should be some variation throughout the class concerning restaurant profitability. With the customer arrival figures provided in the market research estimate, the Benihana is just marginally profitable in Des Moines. Good arguments can be made both for and against Rocky's expansion into such small markets.

VI. Some Limitations of the Simulation Technique

In order to keep the model simple so that students can directly observe the results of their experimentation, some variables have been fixed at certain levels rather than being allowed to vary at the user's discretion. For example, if the bar if full, 85 percent of arriving customers depart; realistically, this number could be allowed to vary. The seed for the random number generator which determines dining time is also set by the program; the user is not allowed to change this seed. Again, this is done for the sake of simplicity, since the model allows for five inputs only.

It can be argued that Rocky Aoki doesn't need to know how many bar stools or how many dining tables to put in his new Benihanas. An alternative strategy would be to build the restaurant so large that it never quite fills to capacity during peak periods. This excess capacity could then be taken up as business expands through the years. In this way, Rocky can plan for future growth and, in the short run, can assure himself that no potential customer is being turned away. Nonetheless, even under this system, Rocky will need to know how many waiter/chefs to hire. The simulation model, as it exists, is set up to help Rocky and his staff make this initial hiring decision.

A more realistic simulation model would require that varying numbers of customers arrive, depending on the day of the week. The random elements in the arrival process do assure some variation along these lines. In addition, under present circumstances, the restaurant is open only one day at a time. Again, for simplicity's sake, there is no switch provided to differentiate a weekday from a weekend.

In summary, simulation is not a method which provides simple answers; assumptions have to be made. Hopefully, simulation can be used as an aid to help managers make their assumptions more explicit. This simulation exercise is designed to do just that.

Instructions for Implementing the Benihana Simulation

In order to set up the Benihana simulation it is necessary to have a PL/1 compiler and a GPSS/H compiler. Upon request, we will send you the following card files:

A. For interactive simulation

1. source PL/1 program (inputs and edits data; outputs results)

2. source GPSS program (models restaurant operation)

B. For batch simulation

3. source GPSS program

4. sample batch input file

5. modified PL/1 program

For interactive simulation, compile the source PL/1 program, thus creating an object program. From a terminal, run the PL/1 object and GPSS source programs together under GPSS/H. The PL/1 subroutine will be called via a GPSS HELP block. Input data from the terminal. Instructions from the PL/1 subroutine should be self-explanatory.

For batch simulation, compile the modified PL/1 program. Run the source GPSS program under GPSS/H from a batch situation and input data through the sample data file which we provide. You may create your own input data file, conforming to the specifications outlined on pages 7 and 8 of the Benihana B case write-up.

Inputting Data

The interactive simulation is extremely user-friendly. As is mentioned in the case write-up, the following inputs are required:

1) the market research estimate to be used (concerns customer interarrival time). Estimates one, two, or three (as follows) can be used:

- Estimate one (most optimistic): on the average, groups* of customers arrive every 4 minutes.

---

*The average customer group contains 4 members.

- Estimate two (most likely): on the average, groups of customers arrive every 6 minutes.

- Estimate three (most pessimistic): on the average, groups of customers arrive every 7.6 minutes.

2) the number of bar stools (can range from eight to ninety)

3) the number of dining tables (can range from one to twenty-five tables, each table seating up to eight customers)

Optional:

4) a 3-digit seed for the first random number generator (which determines customer interarrival time)

5) a 3-digit seed for the second random number generator (which determines the size of the arriving party)

Since there is such a small number of input variables, it should be easy to see the trade-offs which are made as the restaurant varies in size. This, in turn, should invite greater student experimentation with the model.

The interactive simulation is completely self-explanatory. Appendix II details the instructions and prompts that are provided to the user. The PL/1 segment of the program gives the user three opportunities (per input number) to enter data which is numeric and which falls within the proper range.

First, the interactive program provides the user with a brief background of the problem facing Rocky Aoki. Next, the user is prompted for five inputs (as specified in the case). The student has the option of supplying three inputs and taking defaults on the random number seeds. In order for two configurations (number of bar stools and number of tables) to be comparable, the same random number seeds should be used.

Once all inputs are properly entered, control passes to the GPSS program. Restaurant operation is simulated for one evening; the doors open at 5 p.m.

and no more customers are allowed inside after 9 p.m. Summary statistics are the five outputs detailed on page 2 of the Benihana B case write-up.

A batch-mode simulation is also available. Batch-mode operation is described in detail on pages 7 and 8 of the Benihana B case. Sample data cards, to be used with the batch run, are included in the card deck accompanying this document.

Benihana B--Past and Future

As was indicated earlier in this paper, the Benihana B case has been successfully used with M.B.A. students (both day and evening) as part of a course in Strategic Market Planning at The University of Michigan. Benihana B has proven to be an interesting pedagogical tool by which to introduce the student to computer simulation, and the case will continue to be used as a regular part of the Strategic Market Planning course. The authors welcome any comments or suggestions that future users of Benihana B might care to submit. The simulation model is a flexible one and can be adapted to fit any particular need or want that may arise.

Footnotes

[1]Sasser, W. Earl, "Benihana of Tokyo," in Management of Service Operations Text, Cases, and Readings by W. Earl Sasser, R. Paul Olsen, and D. Daryl Wycoff (Boston: Allyn and Bacon, Inc., 1978), pp. 44-57. Also available from the Intercollegiate Case Clearing House, Soldiers Field, Boston, MA 02163. (Case #9-673-057)

[2]"Benihana of Tokyo Teaching Note" (5-677-037), Copyright 1976 by the President and Fellows of Harvard College.

[3]Hays, William L., Statistics for the Social Sciences (New York: Holt, Rinehart and Winston, Inc., 1973), pp. 607-15.

[4]Kotler, Philip, and Randall L. Schultz, "Marketing Simulations: Review and Prospects," The Journal of Business 43 (July 1970), pp. 237-95.

[5]Ibid., pp. 237-95.

[6]Ibid., p. 238.

[7]Schriber, Thomas J., Simulation Using GPSS (New York: John Wiley & Sons, 1974), p. 163.

APPENDICES

Appendix I ....Sample Profit Calculations

I.A thru I.H

Appendix II......................Inputting Data to the Interactive Simulation

II.A thru II.D

APPENDIX I

Sample Profit Calculations

The following represent two possible analyses based on simulation output. Note that the first analysis recommends that Rocky Aoki not expand the Benihana restaurant into smaller markets, while the second analysis favors such expansion. Both conclusions seem reasonable on the basis of their respective assumptions and inputs. The Benihana simulation is constructed so that the restaurant is just marginally profitable in Des Moines, Iowa.

ANALYSIS 1

When various restaurant configurations are examined, the following relationships soon become apparent. As the number of customers arriving increases, the number of bar stools available also has to increase or too many customers will go away mad. With this rise in the number of bar stools, the number of tables has to increase or the chefs can't handle all of the diners fast enough and, as a result, will be working past 12 o'clock and threatening to quit. But if the number of tables increases too quickly, then the waiting time in the bar diminishes, resulting in less alcohol revenues and subsequently less profits (the margin being better on alcoholic sales than it is on food).

Exhibit 1 shows the payoff matrix reflecting the optimal profits that can be realized for each of the ideal table/bar stool configurations under all the possible arrival rates and two classes of revenue figures. Given the payoffs shown in each situation in Exhibit 1, it is necessary to decide which configuration is best. There are good arguments for each configuration, with the exception of the two involving three and four tables. In these two cases, there are times when too many people arrive and either go away mad or so fill up the bar that the chefs quit because they have to work so late. As a result, neither of these configurations is really feasible.

Five decision-making criteria, each reflecting a different risk aversity on the part of the decision maker, can be used to decide between the possible configurations. These criteria are maximin, maximax, minimax regret, Laplace, and expected monetary value. A payoff matrix based on these decision criteria can be found in Exhibit 2. Exhibit 3 details a decision tree which is used to determine the probabilities which are input to Exhibit 2.

The results of the application of these various decision-making criteria are interesting and point rather clearly to one decision: the five-table, 65-bar stool configuration. This is the decision arrived at by three of the five decision-making methods; and the other decisions, which point to the three-table and 45-bar stool arrangement, are not feasible under all of the three arrival rates. The five-table arrangement seems to be the best.

Given that the five-table and 65-bar stool configuration is optimal, it is then necessary to determine if this configuration will generate enough profits to make the investment in the restaurant worthwhile to Rocky Aoki and his associates. Using a 300-day work year as typical and an expected monetary value of $89.00 a night (see Exhibit 2), a figure of $26,700 NPBT a year results. When lunch profits (roughly equal to 35 percent of dinner profits) are added in, this total NPBT figure becomes $41,000 a year. This does not seem to be sufficient return to justify the $300,000 investment in the restaurant that Rocky will have to make. Coupled with the payback time of more than seven years, and the risks involved in receiving these profits over that period of time, it is strongly recommended that Rocky stay out of the small city market.

To sum up, simulation is only one in a long list of decision-making tools. It should only serve as an aid to indicate potential trends, and is only as good as the information it is constructed upon. It is up to Rocky to use his own knowledge, experience, and intuition to augment these simulation results.

EXHIBIT 1

PAYOFF MATRIX

OUTCOMES (NPBT/DAY)

# of Tables	# Bar Stools	Pessimistic Conserv.	Pessimistic Optim.	Most Likely Conserv.	Most Likely Optim.	Optimistic Conserv.	Optimistic Optim.
3	45	$54	$110	--	--	--	--
4	45	39	104	57	142	--	--
5	65	37	104	51	136	78	190
6	50	25	82	48	133	71	180
7	30	29	85	48	133	67	180

--Indicates not feasible due either to too many customers being turned away or to our chefs quitting.

EXHIBIT 2

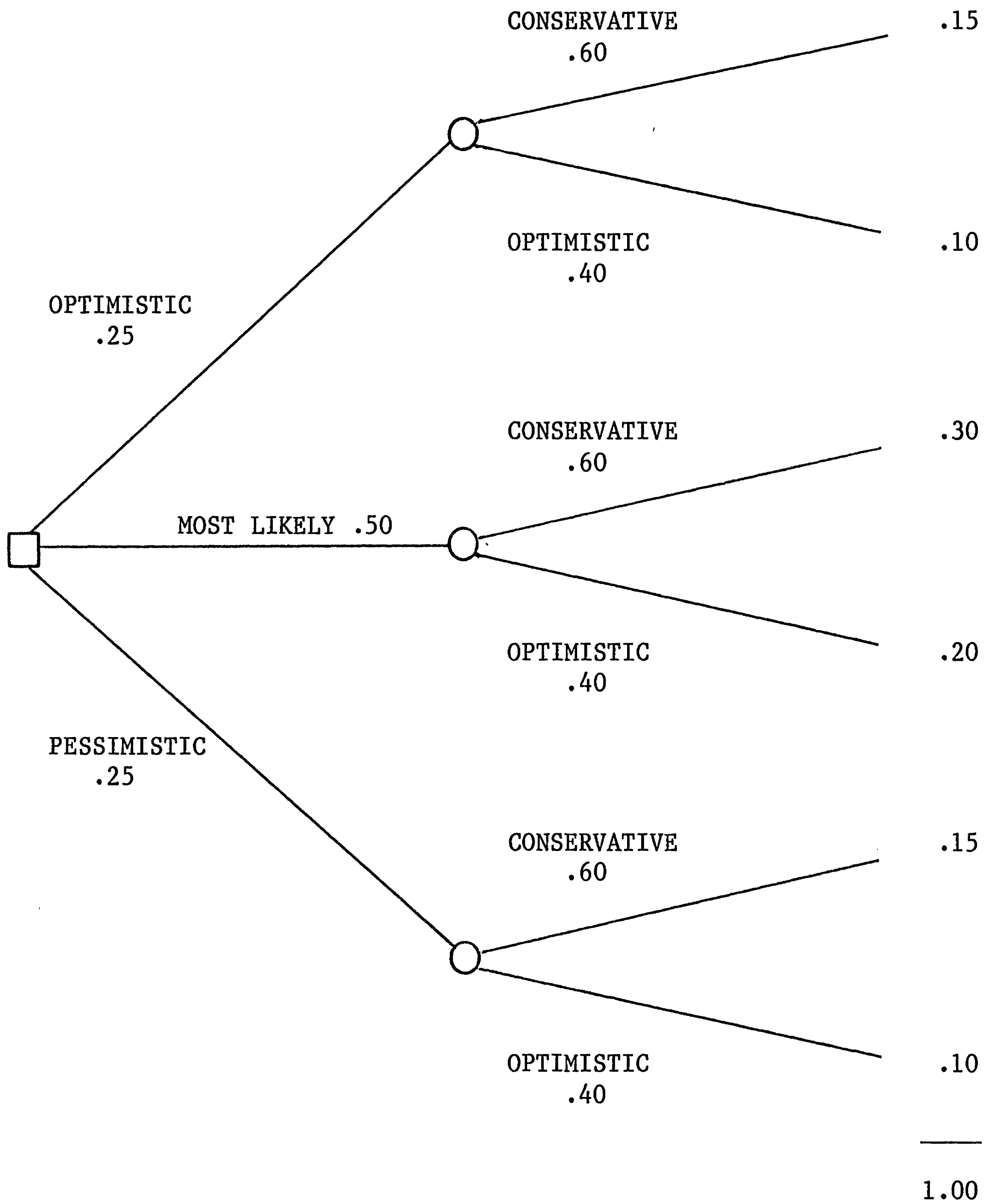
DECISION-MAKING CRITERIA

		TABLES	NPBT/DAY
I.	MAXIMIN CRITERION:	3	$ 54
		4	39
	(3 tables, 45 bar stools)	5	37
		6	48
	Maximize the minimum payoff for each configuration.	7	48
II.	MAXIMAX CRITERION:	3	$110
		4	142
	(5 tables, 65 bar stools)	5	190
		6	184
	Maximize the maximum payoff for each configuration.	7	181
III.	MINIMAX REGRET:	3	$ 56
		4	103
	(3 tables, 45 bar stools)	5	153
		6	136
	Considers greatest opportunity losses for each configuration, then minimizes it. The opportunity loss = greatest payoff - least payoff in each configuration.	7	133
IV.	LAPLACE CRITERION:	3	NOT POSSIBLE
		4	NOT POSSIBLE
	(5 tables, 65 bar stools)	5	$101
		6	92
	Maximize the average expected value. Equal probabilities assigned to each payoff.	7	92
V.	EXPECTED MONETARY VALUE CRITERION:	3	NOT POSSIBLE
		4	NOT POSSIBLE
	(5 tables, 65 bar stools)	5	$ 89
		6	82
	Use subjective probabilities (Exhibit 6) and maximize expected value.	7	82

I.F

EXHIBIT 3

EXPECTED MONETARY VALUE PROBABILITIES



ANALYSIS 2

COST AND REVENUE FIGURES

Assumptions:

FIXED COSTS, which vary with restaurant size

5 Tables	25 Tables
$100/night	$190/night

8 Bar Stools	90 Bar Stools
$55/night	$110/night

FIXED COSTS, which do not vary with restaurant size

$300 per night

Simulation analysis indicates that the optimum restaurant configuration consists of 22 Bar Stools and 7 Dining Tables. See Exhibit 4 on the following page. The average nightly profit expected under this configuration is $169.00.

If the Benihana were open 300 days, then total dinner profits would amount to:

$50,700.

Total profits (including both dinner and lunch) equal:

$72,429.

Thus return on sales = 9.5%. This ROS figure falls well within the target range specified by management in the Benihana case and compares favorably with the ROS figures of existing Benihana restaurants. Therefore, it is recommended that Rocky Aoki add a Des Moines branch to his restaurant chain.

EXHIBIT 4

AVERAGE PROFIT PER NIGHT
UNDER DIFFERENT RESTAURANT CONFIGURATIONS

Number of Bar Stools	3	4	5	6	7	8	9	10	11	12	13	14
31												
30			160									-230
29			161									
28			162									-229
27			164									
26			164									-227
25	53		165			101						
24			166									-226
23	82	146	167	113								
22		147	**169**	114		56		-25		-158		-225
21		122	159	114		55		-26		-160		
20			147									-223
18					86							-221
17												
16												
15												
14					62							
13			103		57		0		-67		-142	-218

Number of Tables

APPENDIX II

Inputting Data to the Interactive Simulation

```
#SOU N929:ROCKY *
#$RUN UNSP:GPSSH+N929:OBJ+*PL1LIB SCARDS=N929:PROJ SPRINT=*DUMMY*  T=3 PAR=NOS
#EXECUTION BEGINS
```

A SIMULATION TO INVESTIGATE THE IDEAL

BAR/RESTAURANT CONFIGURATION FOR

A BENIHANA RESTAURANT.

THE NUMBER OF BAR STOOLS CAN RANGE FROM 1 TO 90;

THE NUMBER OF DINING TABLES CAN RANGE FROM 1 TO 25.

AFTER EACH QUESTION, TYPE IN THE DATA REQUESTED,

FOLLOWED BY A "CARRIAGE RETURN."

TYPE INPUT DATA STARTING IN COLUMN 1;

HIT "ATTN" OR "BREAK" KEY IF YOU WANT TO BAIL OUT.

NOTE THAT NEGATIVE NUMBERS ARE NOT ALLOWED;

ALSO NOTE THAT ALL VALUES SHOULD BE EXPRESSED AS INTEGERS.

*Underlined items are typed in by the user. All else represents instructions or responses output by the simulation program.

ROCKY AOKI WANTS TO BUILD A NEW BENIHANA IN DES MOINES, IOWA. HE HAS ACCESS TO A MARKETING STUDY WHICH PREDICTS AN AVERAGE CUSTOMER INTERARRIVAL TIME, POISSON DISTRIBUTED.

THIS MARKETING RESEARCH STUDY PROVIDES THREE ESTIMATES FOR CUSTOMER INTERARRIVAL TIME:

1. MOST OPTIMISTIC ---- 4 MINUTE INTERARRIVAL TIME
2. MOST LIKELY ---- 6 MINUTE INTERARRIVAL TIME
3. MOST PESSIMISTIC ---- 8 MINUTE INTERARRIVAL TIME

ROCKY WANTS TO KNOW HOW BIG TO BUILD HIS RESTAURANT. HE KNOWS THAT IOWANS WILL NOT STAND IN LINE OUTSIDE OF THE RESTAURANT. IF THE BAR IS FULL, THE IOWAN GOES AWAY MAD.

THE FOLLOWING SIMULATION HAS BEEN DESIGNED TO APPROXIMATE RESTAURANT OPERATION. ROCKY CORDIALLY INVITES YOU TO EXPERIMENT.

HOW BIG SHOULD THE RESTAURANT BE?

WHICH MARKETING RESEARCH ESTIMATE DO YOU WANT TO USE:

1. MOST OPTIMISTIC

2. MOST LIKELY

3. MOST PESSIMISTIC

TYPE IN "1", "2", OR "3".
1.

TYPE IN THE NUMBER OF BAR STOOLS.
23

TYPE IN THE NUMBER OF DINING TABLES;

EACH TABLE SEATS 8 CUSTOMERS.
8

DO YOU WANT TO SUPPLY SEEDS FOR THE 2 RANDOM NUMBER GENERATORS?

TYPE "Y" OR "N"
Y

THE FIRST RANDOM NUMBER GENERATOR DETERMINES

THE CUSTOMER INTERARRIVAL TIME.

TYPE IN A THREE DIGIT SEED FOR THIS FIRST GENERATOR.
368

THE SECOND RANDOM NUMBER GENERATOR DETERMINES THE

SIZE OF AN ARRIVING PARTY.

TYPE IN A THREE DIGIT SEED FOR THE SECOND GENERATOR.
443

SYSTEM INITIALIZATIONS:

MARKETING RESEARCH ESTIMATE # 1 WAS USED.

CUSTOMER GROUPS ARE EXPECTED TO ARRIVE EVERY 4 MINUTES.

THE NUMBER OF BAR STOOLS = 23

THE NUMBER OF TABLES = 8

TOTAL DINING CAPACITY = 64

RANDOM SEED #1 = 368

RANDOM SEED #2 = 443

RESULTS OF THE SIMULATION:

226 CUSTOMER(S) COMPLETED THE DINING PROCESS.

0 POTENTIAL CUSTOMER(S) FOUND NO ROOM IN THE BAR AND WENT AWAY MAD.

THERE WERE ON AVERAGE 1 CUSTOMER(S) AT THE BAR.

THE AVERAGE CUSTOMER SPENT 1 MINUTE(S) IN THE BAR.

0 CUSTOMER(S) HAD TO WAIT MORE THAN 20 MINUTES IN THE BAR BEFORE THEY WERE SEATED.

THE RESTAURANT DOOR CLOSED AT 9:00 PM. 0 HOUR(S) AND 52 MINUTE(S) LATER, THE LAST CUSTOMER LEFT THE RESTAURANT; AND PERSONNEL BEGAN CLEANING UP FOR THE NIGHT.

DO YOU WANT TO SPECIFY ANOTHER CONFIGURATION (TYPE Y OR N)
N

BENIHANA SAYS, "GOODBYE."

#EXECUTION TERMINATED
#