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Comparison of computer models in forecasting hotel and motel guestroom supply

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COMPARISON OF COMPUTER MODELS

IN

FORECASTING HOTEL AND MOTEL GUESTROOM SUPPLY

by

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A thesis presented in partial fulfillment
of the requirements for the degree of

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ABSTRACT

"Comparison of Computer Models in Forecasting Hotel and Motel Guestroom Supply" developed a methodology and a model for estimating the number of guestrooms for a destination area. Several traditional forecasting models, as well as a software package called PLAN, were compared. The computer forecasting models were applied to Las Vegas, Nevada, using tourism and hospitality statistics from the Las Vegas Convention and Visitors Authority. The purpose of this study was to determine (1) whether these models generate accurate forecasts; (2) which is the most realistic model; (3) if these model(s) could be used to reduce guestroom overbuilding.

Data analysis involved four steps. First, statistics, from 1972 to 1990 relating visitor counts and the Las Vegas lodging industry, were collected. Second, the primary data were analyzed to determine if any trends existed over the nineteen year period. Factors that did not show a trend were deleted from the study. Third, the computer forecasting models were applied to the remaining variables. Fourth, the model results were evaluated to identify those having optimal forecasting capabilities.

The following is the projected 'best estimate' guestroom supply for Las Vegas, Nevada for 1991 to 2000, as generated by PLAN.

Year	'Best estimate' guestroom supply
1991	78,965
1992	81,603
1993	84,242
1994	86,880
1995	89,518
1996	92,156
1997	94,794
1998	97,432
1999	100,071
2000	102,752

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INTRODUCTION

The research objective is to forecast the number of lodging guestrooms for Las Vegas, Nevada for the years 1991 through 2000. A subobjective is to attempt to use a software program, PLAN, for the first time in the hospitality industry and determine its validity in forecasting the number of guestrooms for Las Vegas, Nevada. In addition to the models available in PLAN, this study examines the accuracy of a curvilinear regression model and double exponential smoothing with linear trend for projecting the total number of lodging guestrooms. The purpose of this study is to determine (1) whether these models generate accurate forecasts; (2) which is the most realistic model; (3) if these model(s) could be used to reduce guestroom overbuilding.

Limitations

A limitation associated with this study is the accuracy of the data. The secondary data are compiled yearly by survey responses of 1,500 visitors.

Delimitations

The area under study is limited to Las Vegas, Nevada. A second delimitation is the use of statistical data from the Las Vegas Visitors and Conventions Authority. Also, the data

associated with revenue were not adjusted for inflation. Although many computer models exist, this study was limited to curvilinear regression, time series forecasting programs in the software package of Quantitative Systems for Business Plus (QSB+) (Chang and Sullivan, 1989), and the software package called PLAN (Six, 1992).

Justification

In recent years, many hotels within the United States have gone bankrupt with management stating that overbuilding of guestrooms was the contributing factor. However, operators and developers in Las Vegas continue to build guestrooms. Within the last five years, this city has seen the opening of The Mirage with approximately 3,000 guestrooms, The Excalibur, the world's largest hotel with 4,032 guestrooms and other smaller properties. Besides new properties, existing hotel-casinos, including the Las Vegas and Flamingo Hiltons, Stardust, Bally's, and Harrah's, have built new towers and added guestrooms to their inventory. Las Vegas, Nevada was selected as the area for analysis because many investors claim this city is overbuilt (Lee, 1991). Yet, construction has begun for approximately 11,000 additional guestrooms, which will be added to the existing base as of December 31, 1991 of 76,879 guestrooms.

This research paper attempts to provide planners, operators and investors with a model and methodology with

which to make their decisions to build a new property, expand an existing property, or do nothing at all.

Definitions

Guestroom: hotel and motel rooms.

Market: customers who support the hotel/motel industry.

Revenue: income produced by the sale of guestrooms, food, and beverage, (also referred as Lodging Revenue).

Sigma: standard deviation.

Total revenue: revenue plus gaming income.

Turnarounds: the process of turning a hotel/motel from unprofitable to profitable.

REVIEW OF LITERATURE

Introduction

The literature review concentrates on articles discussing overbuilding, forecasting, and selected computer software models used in the hospitality industry. Hotel/motel overbuilding was researched to become familiar with its effects on a local market. Reviews of forecasting articles provided information on the relations of proper forecasting and successful operations. An introduction to the software program PLAN is also given in this chapter. The final area reviewed are nineteen years of statistics from the Las Vegas Visitors and Convention Authority which form the primary data base for the research.

Overbuilding

During the past three years, overbuilding has become a common term in the hospitality industry. The industry experienced a rapid building growth in the late '80s. Five main factors that supported the construction boom were:

(1) The passage of the 1981 tax law that allowed generous depreciation, low-interest loans, and other tax shelters to developers;

(2) The development of marginally viable hotel

properties by parent chains intent on gaining a market presence;

(3) The influx of funds, particularly foreign, to invest in new or acquired hotels;

(4) The creation of a funding vehicle (syndications) that distributed risk to limited partners and generated immediate profits for developers and operators; and

(5) The attractiveness of real estate in an inflationary environment and the strength of hotels' financial performance (Culligan, 1990).

These factors have no significant influence today. The tax law has changed and does not allow the generous tax shelters that were once available. Also, economically, the industry is not as attractive. The industry is seriously overbuilt and occupancy rates are continuing to decrease (Lang, 1989).

One apparent effect of overbuilding is low lodging occupancy and a reduction in hotel/motel profitability. Overbuilding can be due to many reasons. Overbuilding may be having too many rooms in an area, putting new rooms into a market where demand is not growing, or simply developing a market that has not experienced growth in the period preceding the new construction (Acquaro and Sahlins, 1989).

Another problem facing the U.S. hotel/motel industry is mis-management. Empty guestrooms are blamed on increased

competition brought on by unwarranted construction (Nozar, 1990). For example, a certain city with no Holiday Inn has at best marginal occupancy levels at present properties. Now, Holiday Inn decides to open a new hotel and successfully operates at a high occupancy. The other hotels become less profitable and blame their current situation on the new Holiday Inn and cite overbuilding as the cause of their failure.

Some failures are even blamed on accountants because their feasibility studies suggested success for a specific hotel type at a specific location (Nozar, 1990). Geographic hotel/motel industries exist that were built in anticipation of an increase of business that never arrived. A potential to succeed, based on the ability to attract guests, exists even in this type of a market. Stating that a hotel's success probability is dependent upon the number and quality of its competitors removes responsibility for operation from the operators (Nozar, 1990). A number of management companies, such as Lodging Unlimited, specialize in turnarounds. For the most part, they are challenged by and not afraid of "overbuilt" industries. According to Lasky, president of Lodging Unlimited, some turnarounds can be accomplished by improving the management (Stuart, 1989).

As the term overbuilding becomes more common, Las Vegas, the city with the most total number of hotel/motel guestrooms in the United States, continues to build more lodging

guestrooms. The Excalibur in Las Vegas, Nevada was referred to as a new castle of excess (Furlong, 1990). The opening of the 3,000-room Mirage and the 4,000-room Excalibur forced the local Las Vegas industry into a Darwinian struggle in which older, undercapitalized properties fell behind more modern competitors. For example, The Landmark Hotel filed for bankruptcy and eventually closed; the Aladdin, Rivera, Bally's, Maxim's, and Main Street Station have all experienced financial hardships. David Shulman, a Salomon Brothers economist who tracks real estate markets, believes Las Vegas is an accident waiting to happen. The only reason Las Vegas has been successful is due to the support from Southern Californians (Barsky and Yoshihashi, 1990). In 1989, Donald Trump was reportedly dissuaded from investing in Las Vegas because he felt the hotels were expanding too much and that the city would have problems in about a year and a half (Lalli, 1989).

Some operators, however, are optimistic about Las Vegas. Stephen A. Wynn feels the Mirage and other projects help Las Vegas attract a whole new generation of visitors. He believes if a 'wonderment' is created, people want to be a part of it and therefore will continue to come to Las Vegas (Yoshihashi, 1989). More recently, with the announced expansion plans of an additional 10,000+ rooms by 1994, Circus Circus President Glenn Schaeffer was optimistic because the city had just absorbed 13,000 (new) guestrooms during the Gulf War and an

economic recession in 1991. He was confident the economy was going to be better in the next year (Mulligan, 1991).

The building boom is expected to create a competitive shakeout in Las Vegas. The city had a 20% increase in guestrooms over the past two years. With the addition of 10,000 more rooms in the next two years, Williard Brown, a gaming industry analyst for Dean Witter Reynolds in New York, claims smaller casinos and casinos with weak management are going to face some tough times. He predicted that a number of casinos will barely be profitable in 1994 (White, 1991).

Investors are concerned that an overbuilt situation is developing in Las Vegas. However, as gaming continues to gain increasing social acceptance, Las Vegas visitor counts are expected to continue to grow and a moderate amount of new guestroom capacity can continue to be added without negatively affecting city-wide occupancy levels, which have always been 10-15% above the national average (Lee, 1991). This is supported by the fact that less than 15% of American adults have ever visited a casino (Lee, 1991).

Forecasting

Proper forecasting enables operators to maximize profit and control labor cost. Forecasts should be used to assist managers in predicting future business. Often, forecasts are simply a rerun of previous forecasts with little consideration of how current conditions impact upon the business activity levels of the hotel. The consequences of this are generally

negative and result in missed sales opportunities and incorrect staffing (Hott and Nusbaum, 1989).

The need to forecast accurately is especially important in the lodging industry because of the 'perishable' nature of the product. Unfilled hotel/motel rooms can not be stockpiled and guestroom demand must be anticipated by proper forecasting (Archer, 1987). The value of forecasting is to make approximate predictions of the future so effective decisions can be made (Bloss, Miller and McCahon, 1991).

In a competitive industry, such as the hospitality industry, mathematical forecasting models can provide users with a critical advantage over non-users. Forecasts generated by mathematical models are rarely entirely accurate, but one that is reasonably accurate is usually better than a projection based on intuition or informed estimates. Research indicates that even simple quantitative models outperform the unstructured, intuitive estimates of experts (Miller, Miller and McCahon, 1991).

Unfortunately, time series models have frequently been ignored in hospitality forecasting because the applications to the hospitality industry have not been adequately addressed in the industry's academic literature (Andrew, Cranage and Lee, 1990). Andrew, Cranage and Lee conducted a study to forecast hotel occupancy using time series models, Box-Jenkins and exponential smoothing. They collected 68 months of monthly occupancy rates and forecasted the following six months. The

predicted values were then compared with actual occupancy rates for accuracy.

Computer Models

The process of forecasting tourism demand by regression analysis may be summarized as follows:

1. Select those variables which are expected to influence the forecast variable (the demand determinants) and specify the relationship in mathematical form;
2. Assemble data relevant to the model;
3. Use the data to estimate the quantitative effects of the influencing variables on the forecast variable in the past;
4. Carry out tests on the estimated model to see if it is sufficiently realistic;
5. If the tests show that the model is satisfactory then it can be used for forecasting (Witt and Witt, 1992).

As an example of this approach, Borsenik (1992) used a curvilinear regression model for estimating future guestroom rates and occupancy. The model generated an equation which provided accurate forecasts.

Chang and Sullivan (1989) in "Quantitative Systems for Business Plus" developed ten time series forecasting models. Another possible forecasting technique is developed through PLAN. PLAN is a PC-based software product, for project

managers, schedulers and estimators who use such tools as Primavera and Lotus 1-2-3 to plan and control project performance. PLAN software can help management identify and control potential overruns. PLAN is a simple methodology that utilizes proven mathematical techniques. The user can assign a "low, most likely, and high" probabilities to specific events within the project plan. PLAN is also an early warning system that facilitates better cost/schedule estimates. Management can visualize how a specific risk mitigation decision cascades throughout the project to improve the cost/schedule outcome (Six, 1992).

Summary

Three basic areas of literature are applicable to the projection of future guestrooms for Las Vegas, Nevada. The subject of potential overbuilding of lodging guestrooms was addressed. The factors that lead to an oversupply of guestrooms were reviewed. Guestroom overbuilding could be minimized by accurately forecasting demand. Guestroom supply can be projected for a destination area by applying appropriate forecasting technique to the area. Various computer software forecasting programs were reviewed in an attempt to determine those that may be applicable to Las Vegas, Nevada.

METHODOLOGY

Introduction

The methodology used in this study compares three model projections of guestroom supply for 1991-2000. The methodology is similar to that used by Andrew, Cranage and Lee (1990) in their study of forecasting hotel occupancy rates with time series models. The models were applied to the most recent database to determine the validity of the predicting models. The primary data were developed by the Las Vegas Convention and Visitors Authority for Las Vegas, Nevada. Various computer software programs (identified below) were applied to the primary data to determine the most applicable software programs for the primary data base. These models and combination of models were then used to forecast future lodging guestroom demand for each year from 1991 to 2000. The final model and analysis should be applicable to any major lodging city that has a realistic database.

Analysis Strategy

Data analysis involved four steps. First, statistics, from 1972 to 1990 describing visitor counts and the Las Vegas lodging industry, were collected from the Las Vegas Convention and Visitors Authority. Second, the primary data were

analyzed to determine if any trends existed over the nineteen year period. Factors that did not show a trend were eliminated as possible variables from the study. Third, computer forecasting models were applied to the remaining variables. Fourth, the model results were evaluated to identify those having optimal forecasting capabilities.

Potential Variables

Data were collected from various yearly statistics (1972-1990) (Las Vegas Convention and Visitors Authority, 1991). The following factors may affect the demand/supply of lodging guestrooms:

* Number of guestrooms (supply),
* Visitor volume,
* Average number of nights stayed,
* Lodging revenue,
* Gaming income,
* Room tax revenue,
* Mode of transportation,
    * Airline,
    * Auto,
    * Bus,
    * Train,
* Number of conventions,
* Attendance at convention,
* Total lodging occupancy rates,
* Hotel occupancy rates, and
* Motel occupancy rates.

Reducing Factors to Variables

The factors (potential variables) listed above were analyzed to determine if any trend relationship existed during the nineteen year period. Factors with a trend showing a tendency to increase or decrease became variables for the study. The remaining factors that had no trend relationship were eliminated from the study.

Computer Models

The primary data were evaluated by several computer software programs. First, data were analyzed by using a curvilinear regression model using Lotus 1-2-3 software. This model formulates a predicting equation. The equation can be used to generate results, which in turn calculates forecasts of the actual data for 1972 to 1990 and future yearly forecasts. Second, ten time series forecasting models (software package QSB+) were used to generate similar results and forecasts. The model with the highest R-Squared (goodness of fit) was selected (Appendix L). Finally, PLAN was used to generate yearly forecasts for 1991 to 2000. Curvilinear regression and QSB+ models forecast one variable at a time. PLAN, depending on the version, is able to analyze one to 300 variables.

Comparing Models

The models were compared to determine which was the most valid forecaster. The primary test of a valid forecasting

model was based on the error between yearly data and model generated results for the base data period (1972-1990). In addition, a second validity test was used for 1991. Data for 1991 were recently available and was compared to a model's generated forecast for 1991. Knowing that Las Vegas guestroom inventory should increase by at least 11,000 in 1994/1995, this information was also used to select the most appropriate forecasting model.

DESCRIPTIVE ANALYSIS OF FINDINGS AND RESULTS

Introduction

The results of the four steps involved in the data analysis are examined in this chapter. Curvilinear regression and double exponential smoothing with linear trend analysis results are shown in Tables 1 - 6. Results generated by PLAN for 1991 are shown in Figures 1 - 11. The forecasts for 1992 to 2000 are summarized in Tables 7 - 24 and are also shown in the appendix.

Variables

Data were collected from various yearly statistics (1972-1990). The following variables were selected as having an increasing or decreasing trend during the study period:

* Number of guestrooms (supply),
* Visitor volume,
* Lodging revenue,
* Gaming revenue,
* Total revenue,
* Room tax revenue.

Trends

Factors that were not related to guestroom supply (where no trend relationship existed) were eliminated as possible

variables. Average number of nights visitors stayed in a hotel/motel guestroom was removed. This factor displayed an increasing trend from 1972 to 1983, but then had a decreasing trend to 1990. The statistics showed no trend relationship with guestroom supply, which had an increasing trend for the nineteen year period. Mode of transportation percentages were eliminated because these statistics remained constant and were reflected in visitor volume.

Although the number of conventions had an increasing trend over the nineteen years, this factor was not used because no direct correlation exists with the demand of rooms. A convention in Las Vegas can have an attendance range of 10 to 100,000. When comparing convention attendance and number of conventions, the author discovered that, although both had increasing trends over the nineteen years, the average attendance per convention had a decreasing trend. The attendance of conventions was eliminated because the attendees were already included in the visitor volume totals. Finally, the occupancy statistics were eliminated because they did not show any trend and were reflected in revenue. The variables used in the study were guestrooms, visitor volume, revenue, gaming revenue, total revenue, and room tax revenue.

Model Results

Curvilinear Regression Model

The curvilinear regression model was used to forecast the number of guestrooms for Las Vegas, Nevada for 1991 through

2000. Lodging guestrooms from 1972 to 1990 were the initial data base. The model generated guestroom counts from 1972 through 2000. For 1990, only 68,061 guestrooms were forecasted (actual guestrooms were 73,330, a difference of 5,669). In 1991, the prediction was 70,300 and in 1992 was 72,539 (see Table 1). Both predictions were less than the actual data of 1990. Hence, the guestroom forecasts for 1991 and beyond appear to be very conservative.

Guestroom data were converted to a logarithm base for the curvilinear regression model. The model generated estimated logarithms which were converted back via antilog. The 1990 error was only 1,935 guestrooms. The model generated 71,795 guestrooms for 1990. The forecasts for 1991 and 1992 were 77,880 and 85,573 respectively. The model appears to be a more accurate forecast of guestrooms. However, the forecasts eventually become extremely high (see Table 1). For example, for the year 2000, this analysis predicts 346,194 guestrooms in Las Vegas, while the non-logarithm forecast is 90,448 guestrooms.

"Quantitative Systems for Business Plus"

The third analysis was performed using the QSB+ package. "Double exponential smoothing with linear trend" was selected over nine other time series QSB+ forecasting programs because it generated the highest correlation coefficient (R^2) when projecting the guestrooms from 1972 to 1990 (see Appendix L). The forecast error for 1990 was 1,579 guestrooms (see Table

1). In comparison to the curvilinear regression models, the forecast for the year 2000 of 138,639 guestrooms appears more reliable.

TABLE 1: Guestrooms

Year	Actual	Forecasts		
		Curvilinear Regression	Curv. Reg. (Logarithm)*	QSB+**
1972	26,980	27,765	26,450	
1973	29,198	30,004	29,516	26,980
1974	32,826	32,242	32,464	30,303
1975	35,190	34,481	35,247	35,495
1976	36,245	36,720	37,833	38,196
1977	39,350	38,958	40,209	38,546
1978	42,620	41,197	42,377	42,102
1979	45,035	43,436	44,355	45,972
1980	45,815	45,675	46,178	48,295
1981	49,614	47,913	47,890	48,075
1982	50,270	50,152	49,551	52,639
1983	52,529	52,391	51,228	52,550
1984	54,129	54,629	52,998	54,809
1985	53,067	56,868	54,952	56,292
1986	56,494	59,107	57,191	53,775
1987	58,474	61,345	59,834	58,335
1988	61,394	63,584	63,025	60,809
1989	67,391	65,823	66,938	64,262
1990	73,730	68,061	71,795	72,151
1991		70,300	77,880	80,024
1992		72,539	85,573	86,537
1993		74,778	95,385	93,050
1994		77,016	108,022	99,563
1995		79,255	124,479	106,075
1996		81,494	146,180	112,588
1997		83,732	175,206	119,101
1998		85,971	214,652	125,614
1999		88,210	269,219	132,126
2000		90,448	346,194	138,639

* Curvilinear Logarithm Regression.

** "Double Exponential Smoothing with Linear Trend."

PLAN

The final guestroom forecasting analysis was generated by the software package PLAN. PLAN is used in conjunction with Lotus 1-2-3. Variable incremental yearly changes were calculated. PLAN develops a forecast that depends on a triangular distribution of low, most likely, and high assumptions. For example, guestroom totals had an incremental change in 1985 of -1,062 guestrooms. This was the lowest incremental change for the nineteen year period and was entered as the low assumption for the triangular distribution. The year 1990 generated the high assumption because the incremental guestroom change was 6,339. The most likely assumption is dependent upon the individual (the author) performing the forecast. In order to maintain consistency in this study, the mean of all the incremental changes for each individual variable was used as the most likely assumption. The most likely assumption for guestrooms was 2,597. Knowing that the inventory of guestrooms increased by 5,997 in 1989, 6,339 in 1990, and plans exist for adding approximately 11,000 additional guestrooms in the next two years, one may argue that 2,597 is a pessimistic total to enter as a most likely value. A benefit of PLAN is that any number can be entered in this section. An optimistic assumption would have been a total closer to the recent guestroom inventory increases. On the other hand, if an analyst foresees a recession in the next year a lower total can be entered.

Unlike the earlier models in this study, PLAN does not forecast guestroom counts from 1972 to 1990. Therefore, no error or goodness of fit can be examined between generated and actual data. PLAN generates a range of results for each forecast year. The range includes a low, most likely, and high forecasts based on the above assumptions. In addition, PLAN generates a probability forecast for each year.

Figures 1A and 1B show a S-curve and a Bell curve, respectively, of forecasted guestrooms for 1991. The range for 1991 includes a "low" of 75,265, a "most likely" of 78,965 and a "high" of 82,666 guestrooms. The S-curve shows a cumulative forecast for 1991. For example, PLAN indicates with a 50% probability exists that Las Vegas will have 78,965 guestrooms in 1991. The Bell curve shows the likelihood of each guestroom forecast for 1991. Therefore, the curve peak is the value that is most likely to occur. The peak, which is the 50% point on the S-curve for guestrooms, shows a 16.5% chance that this number of guestrooms will exist. Interestingly, the forecasted results of 1991 for curvilinear logarithm regression and "double exponential smoothing with linear trend" fit in the range produced by PLAN. However, for the year 2000, the curvilinear regression forecast falls close to PLAN's most likely results, while the QSB+ results just fits on PLAN's high forecast, and curvilinear logarithm regression results are outside of PLAN's forecast range.

PLAN can also combine two to 300 variables using a spreadsheet called "BigFZero" in "Planproj." For this study, the author concentrated on combining two variables. Before this procedure was performed the Pearson coefficient of correlation had to be calculated. Correlation measures the strength and direction of relationship between two variables. Correlation can range between -1.00 to +1.00. If a correlation of +1.00 exists, changes in one variable are matched by changes in the other. If a correlation of -1.00 exists, increases in one variable are matched by decreases in the other. A correlation of zero indicates little linear relationship between two variables (Stevenson, 1990).

Las Vegas visitor counts, lodging revenue, lodging gaming revenue, total lodging revenue, and room tax revenue were correlated (Pearson correlation coefficient) to guestroom data for 1972 to 1990. A "t-test" was also calculated to confirm the significance of these relationships. The results are shown below.

Variables	Correlation Coefficient	"t-values*"	Status
Visitor Counts	.97	16.68	Significant
Lodging Revenue	.96	13.54	"
Gaming Revenue	.99	23.96	"
Total Revenue	.97	18.63	"
Room Tax Revenue	.98	15.71	"

* Variable is significant if -2.898 > "t" > 2.898 for a 99.5% confidence level for 17 degrees of freedom.

Taking into consideration that the totals were large numbers and had an effect on the correlation, the correlation coefficients, as well as the "t-values," of the incremental yearly changes for each variable were also calculated. The results are shown below.

Variables(Increases)	Correlation Coefficient	"t-values*"	Status
Visitor Counts	.33	1.42	Significant
Lodging Revenue	.57	2.77	"
Gaming Revenue	.48	2.21	"
Total Revenue	.57	1.64	"
Room Tax Revenue	.38	2.75	"

* Variable is significant if -1.337 > "t" > 1.337 for a 90% confidence level with 16 degrees of freedom.

Hence, Las Vegas guestrooms significantly correlate to visitor counts, lodging revenue, gaming revenue, total revenue, and room tax revenue for each year and for the entire time period of 1972 through 1990. Each of the five variables were analyzed to generate their respective forecasts for the years 1991 through 2000 by curvilinear regression, curvilinear logarithm regression, and "double exponential smoothing with linear trend." (Similar to the guestroom count analysis). These forecast results for the years 1991 through 2000 were used to establish assumption ranges for PLAN guestroom forecasting. Tables 2 through 6 show the results for each variable from 1972 through 2000. The generated results from

1972 through 1990 show high correlations to the actual yearly variable data.

TABLE 2: Visitor Volume

	Actual	Forecasts		
Year		Curvilinear Regression	Curv. Reg. (Logarithm)*	QSB+**
1972	7,954,748	7,664,873	7,952,152	
1973	8,474,727	8,400,449	8,334,983	7,954,746
1974	8,664,751	9,016,370	8,736,245	8,733,676
1975	9,151,427	9,534,146	9,156,825	8,961,550
1976	9,769,354	9,975,288	9,597,652	9,565,668
1977	10,137,021	10,361,308	10,059,701	10,300,000
1978	11,178,111	10,713,718	10,543,994	10,700,000
1979	11,696,073	11,054,029	11,051,602	12,000,000
1980	11,941,524	11,403,751	11,583,647	12,500,000
1981	11,820,788	11,784,397	12,141,305	12,500,000
1982	11,633,728	12,217,477	12,725,811	12,100,000
1983	12,348,270	12,724,503	13,338,455	11,600,000
1984	12,843,433	13,326,987	13,980,594	12,700,000
1985	14,194,189	14,046,439	14,653,646	13,300,000
1986	15,196,284	14,904,371	15,359,100	15,200,000
1987	16,216,102	15,922,294	16,098,517	16,400,000
1988	17,199,808	17,121,720	16,873,530	17,400,000
1989	18,129,684	18,524,159	17,685,853	18,400,000
1990	20,297,382	20,151,124	18,537,284	19,300,000
1991		22,024,125	19,429,704	22,100,000
1992		24,164,674	20,365,086	23,900,000
1993		26,594,282	21,345,500	25,800,000
1994		29,334,461	22,373,113	27,600,000
1995		32,406,721	23,450,197	29,500,000
1996		35,832,575	24,579,134	31,400,000
1997		39,633,532	25,762,420	33,200,000
1998		43,831,106	27,002,672	35,100,000
1999		48,446,806	28,302,631	36,900,000
2000		53,502,145	29,665,174	38,800,000

* Curvilinear Logarithm Regression.

** "Double Exponential Smoothing with Linear Trend."

TABLE 3: Revenue

	Actual	Forecasts		
Year		Curvilinear Regression	Curv. Reg. (Logarithm)*	QSB+**
1972	1,029,534,098	1,165,838,981	1,015,628,820	
1973	1,185,989,509	1,046,591,035	1,148,500,964	1,030,000,000
1974	1,206,374,805	1,125,089,381	1,298,756,434	1,290,000,000
1975	1,412,228,560	1,338,133,369	1,468,669,446	1,290,000,000
1976	1,601,668,520	1,633,224,338	1,660,811,747	1,590,000,000
1977	1,906,575,615	1,968,565,619	1,878,091,537	1,840,000,000
1978	2,042,970,530	2,313,062,528	2,123,797,492	2,250,000,000
1979	2,713,060,852	2,646,322,376	2,401,648,535	2,340,000,000
1980	3,138,684,265	2,958,654,458	2,715,850,124	3,310,000,000
1981	3,121,878,667	3,251,070,063	3,071,157,911	3,800,000,000
1982	3,433,352,607	3,535,282,468	3,472,949,716	3,490,000,000
1983	4,047,598,663	3,833,706,938	3,927,306,923	3,800,000,000
1984	4,300,700,769	4,179,460,730	4,441,106,532	4,660,000,000
1985	4,668,380,294	4,616,363,089	5,022,125,242	4,850,000,000
1986	5,068,220,894	5,198,935,250	5,679,157,156	5,200,000,000
1987	5,865,170,287	5,992,400,437	6,422,146,890	5,630,000,000
1988	7,036,210,807	7,072,683,865	7,262,340,088	6,700,000,000
1989	8,623,353,206	8,526,412,738	8,212,453,632	3,320,000,000
1990	10,450,760,962	10,450,916,248	9,286,868,122	10,400,000,000
1991		12,954,225,578	10,501,845,537	12,700,000,000
1992		16,155,073,901	11,875,775,367	15,100,000,000
1993		20,182,896,378	13,429,452,953	17,500,000,000
1994		25,177,830,160	15,186,394,240	19,800,000,000
1995		31,290,714,389	17,173,191,701	22,200,000,000
1996		38,683,090,195	19,419,916,838	24,500,000,000
1997		47,527,200,698	21,960,575,329	26,900,000,000
1998		58,005,991,008	24,833,621,730	29,200,000,000
1999		70,313,108,223	28,082,541,508	31,600,000,000
2000		84,652,901,432	31,756,509,225	34,000,000,000

* Curvilinear Logarithm Regression.

** "Double Exponential Smoothing with Linear Trend."

TABLE 4: Gaming Revenue

	Actual	Forecasts		
Year		Curvilinear Regression	Curv. Reg. (Logarithm)*	QSB+**
1972	476,126,720	389,678,350	465,147,100	
1973	588,221,779	563,183,132	570,105,658	476,000,000
1974	684,828,388	717,423,364	684,294,074	660,000,000
1975	770,336,695	856,295,292	805,967,811	790,000,000
1976	845,975,652	983,695,158	933,351,640	879,000,000
1977	1,015,463,342	1,103,519,206	1,064,855,708	947,000,000
1978	1,236,235,456	1,219,663,681	1,199,276,408	1,170,000,000
1979	1,423,620,102	1,336,024,827	1,335,968,034	1,460,000,000
1980	1,617,194,799	1,456,498,887	1,474,980,510	1,660,000,000
1981	1,676,148,606	1,584,982,105	1,617,167,948	1,860,000,000
1982	1,751,421,394	1,725,370,726	1,764,281,119	1,830,000,000
1983	1,887,451,717	1,881,560,992	1,919,063,987	1,870,000,000
1984	2,008,117,102	2,057,449,149	2,085,380,565	2,030,000,000
1985	2,232,797,850	2,256,931,440	2,268,404,890	2,160,000,000
1986	2,393,154,550	2,483,904,108	2,474,915,665	2,450,000,000
1987	2,737,795,600	2,742,263,399	2,713,751,024	2,610,000,000
1988	3,003,237,429	3,035,905,555	2,996,501,863	3,060,000,000
1989	3,289,587,815	3,368,726,821	3,338,560,488	3,340,000,000
1990	3,869,984,638	3,744,623,440	3,760,705,121	3,640,000,000
1991		4,167,491,657	4,291,507,131	4,410,000,000
1992		4,641,227,715	4,971,026,862	4,970,000,000
1993		5,169,727,859	5,856,569,283	5,540,000,000
1994		5,756,888,331	7,031,800,721	6,100,000,000
1995		6,406,605,377	8,621,465,744	6,660,000,000
1996		7,122,775,240	10,815,637,736	7,220,000,000
1997		7,909,294,164	13,910,566,617	7,780,000,000
1998		8,770,058,393	18,379,105,077	8,350,000,000
1999		9,708,964,171	24,995,161,253	8,910,000,000
2000		10,729,907,741	35,059,422,380	9,470,000,000

* Curvilinear Logarithm Regression.

** "Double Exponential Smoothing with Linear Trend."

TABLE 5: Total Revenue

Year	Actual	Forecasts		
		Curvilinear Regression	Curv. Reg. (Logarithm)*	QSB+**
1972	1,505,660,818	1,668,120,847	1,584,886,501	
1973	1,774,211,288	1,597,262,665	1,783,206,843	1,510,000,000
1974	1,891,203,193	1,771,123,589	2,006,343,447	1,980,000,000
1975	2,182,565,255	2,111,079,981	2,257,401,627	2,090,000,000
1976	2,447,644,172	2,551,786,090	2,539,875,270	2,490,000,000
1977	2,922,038,957	3,041,174,056	2,857,695,463	2,790,000,000
1978	3,279,205,986	3,540,453,902	3,215,285,197	3,440,000,000
1979	4,136,680,954	4,024,113,539	3,617,620,923	3,780,000,000
1980	4,755,879,064	4,479,918,765	4,070,301,806	5,030,000,000
1981	4,798,027,273	4,908,913,266	4,579,627,646	5,630,000,000
1982	5,184,774,001	5,325,418,614	5,152,686,551	5,170,000,000
1983	5,935,050,380	5,757,034,267	5,797,453,581	5,610,000,000
1984	6,308,817,871	6,244,637,571	6,522,901,730	6,730,000,000
1985	6,901,178,144	6,842,383,760	7,339,126,807	6,940,000,000
1986	7,461,375,444	7,617,705,952	8,257,487,926	7,610,000,000
1987	8,602,965,887	8,651,315,156	9,290,765,598	8,200,000,000
1988	10,039,448,236	10,037,200,264	10,453,339,583	9,820,000,000
1989	11,912,941,021	11,882,628,057	11,761,389,014	11,700,000,000
1990	14,320,745,600	14,308,143,203	13,233,117,555	14,100,000,000
1991		17,447,568,255	14,889,006,733	17,100,000,000
1992		21,448,003,657	16,752,100,975	20,000,000,000
1993		26,469,827,735	18,848,328,308	22,900,000,000
1994		32,686,696,706	21,206,861,189	25,700,000,000
1995		40,285,544,671	23,860,522,490	28,600,000,000
1996		49,466,583,620	26,846,242,280	31,500,000,000
1997		60,443,303,429	30,205,571,772	34,300,000,000
1998		73,442,471,861	33,985,261,569	37,200,000,000
1999		88,704,134,566	38,237,912,286	40,100,000,000
2000		106,481,615,081	43,022,706,563	42,900,000,000

* Curvilinear Logarithm Regression

** "Double Exponential Smoothing with Linear Trend."

TABLE 6: Room Tax Revenue

	Actual	Forecasts		
Year		Curvilinear Regression	Curv. Reg. (Logarithm)*	QSB+**
1972	4,770,716	3,799,819	4,794,615	
1973	5,556,312	5,486,356	5,676,835	4,770,716
1974	6,559,315	7,049,239	6,685,884	5,568,657
1975	7,616,661	8,527,754	7,832,701	6,826,299
1976	8,890,463	9,961,186	9,127,764	8,226,633
1977	10,383,259	11,388,824	10,580,772	9,820,533
1978	13,113,511	12,849,953	12,200,298	11,600,000
1979	15,847,040	14,383,860	13,993,412	14,700,000
1980	18,231,548	16,029,830	15,965,295	18,100,000
1981	18,179,761	17,827,151	18,118,840	21,100,000
1982	19,070,664	19,815,108	20,454,269	21,400,000
1983	21,731,353	22,032,989	22,968,765	21,700,000
1984	23,921,313	24,520,079	25,656,148	24,000,000
1985	26,956,881	27,315,665	28,506,597	26,400,000
1986	30,564,624	30,459,034	31,506,446	29,800,000
1987	34,561,412	33,989,471	34,638,062	33,900,000
1988	37,968,339	37,946,263	37,879,817	38,500,000
1989	40,093,788	42,368,697	41,206,173	42,600,000
1990	49,030,375	47,296,058	44,587,879	45,000,000
1991		52,767,634	47,992,288	53,800,000
1992		58,822,711	51,383,801	60,400,000
1993		65,500,574	54,724,414	66,900,000
1994		72,840,511	57,974,383	73,500,000
1995		80,881,808	61,092,974	80,000,000
1996		89,663,752	64,039,292	86,600,000
1997		99,225,627	66,773,155	93,100,000
1998		109,606,722	69,255,998	99,600,000
1999		120,846,323	71,451,773	106,000,000
2000		132,983,715	73,327,816	113,000,000

* Curvilinear Logarithm Regression.

** "Double Exponential Smoothing with Linear Trend."

1991 PLAN Forecast

Figures 1A and 1B show a S-curve and a Bell curve, respectively, of guestroom forecasts for 1991. The range includes a "low" of 75,265, a "most likely" of 78,965, and a "high" of 82,666 guestrooms. The S-curve shows a 50% probability that either more or less than 78,965 guestrooms should exist. The peak of the Bell curve, which is also the 50% point on the S-curve for guestrooms, shows a 16.5% chance that this exact amount will exist.

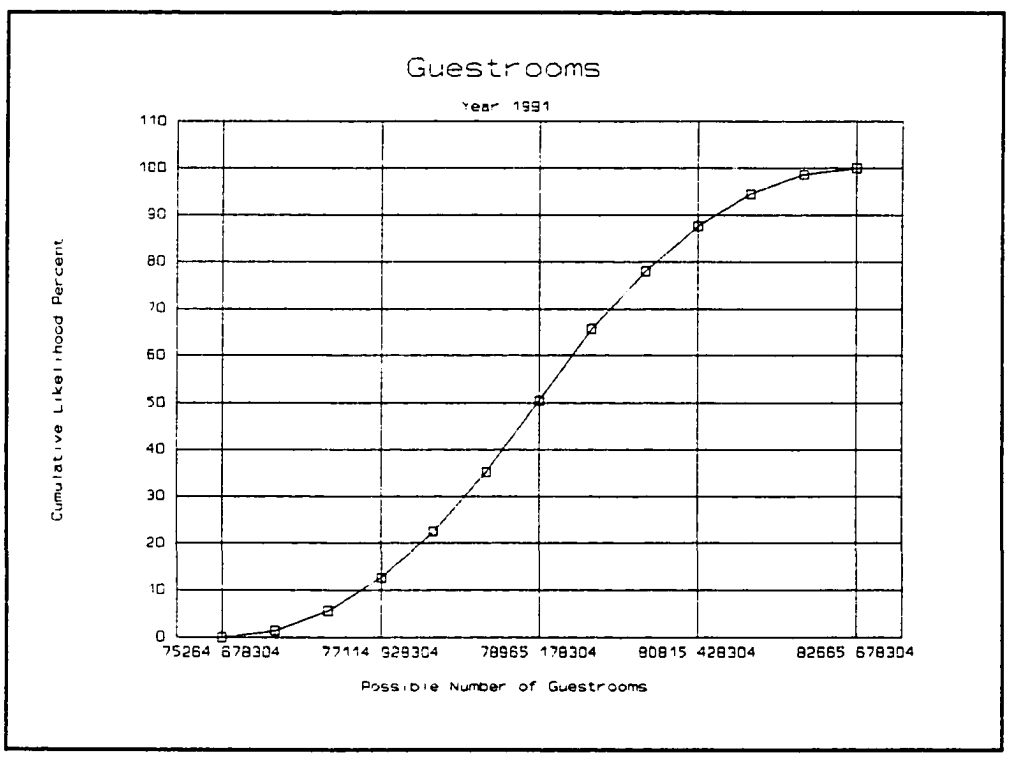


Figure 1A: 1991 Guestrooms

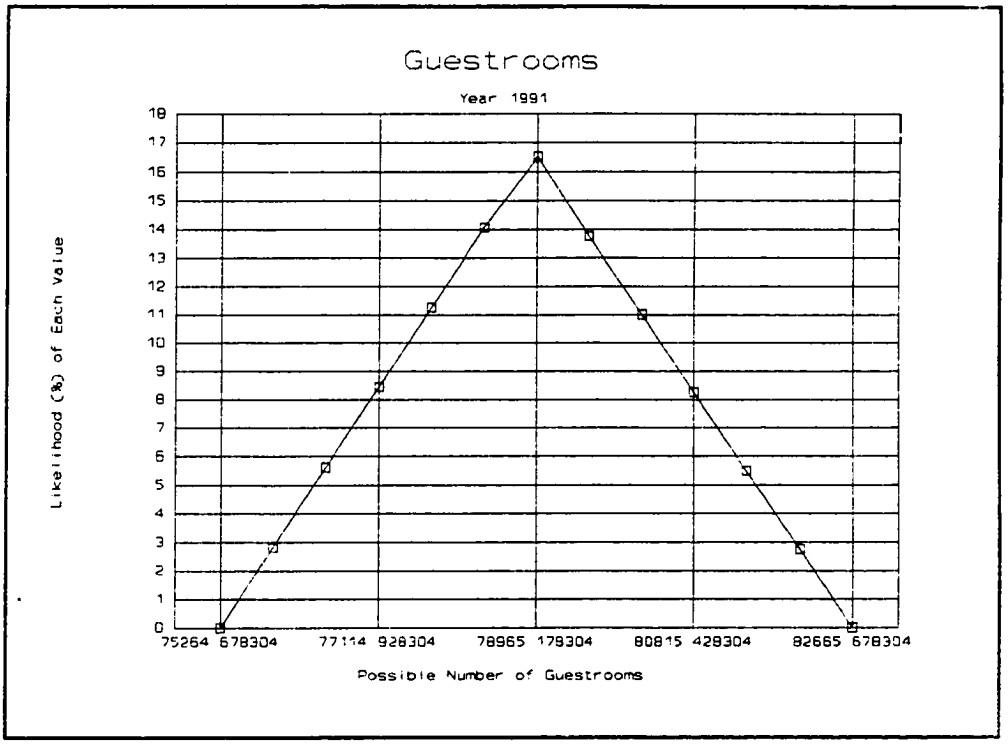


Figure 1B: 1991 Guestrooms

Figures 2A and 2B display the forecast of visitor counts for 1991. The range of visitors had a "low" of 20,794,715, a "most likely" of 21,775,864, and a "high" of 23,149,473. The most likely value, which has a 15.5% likelihood on the Bell curve, shows approximately a 46% cumulative likelihood on the S-curve. In other words, 46% of the forecasted values for 1991 are less than or equal to 21,775,864.

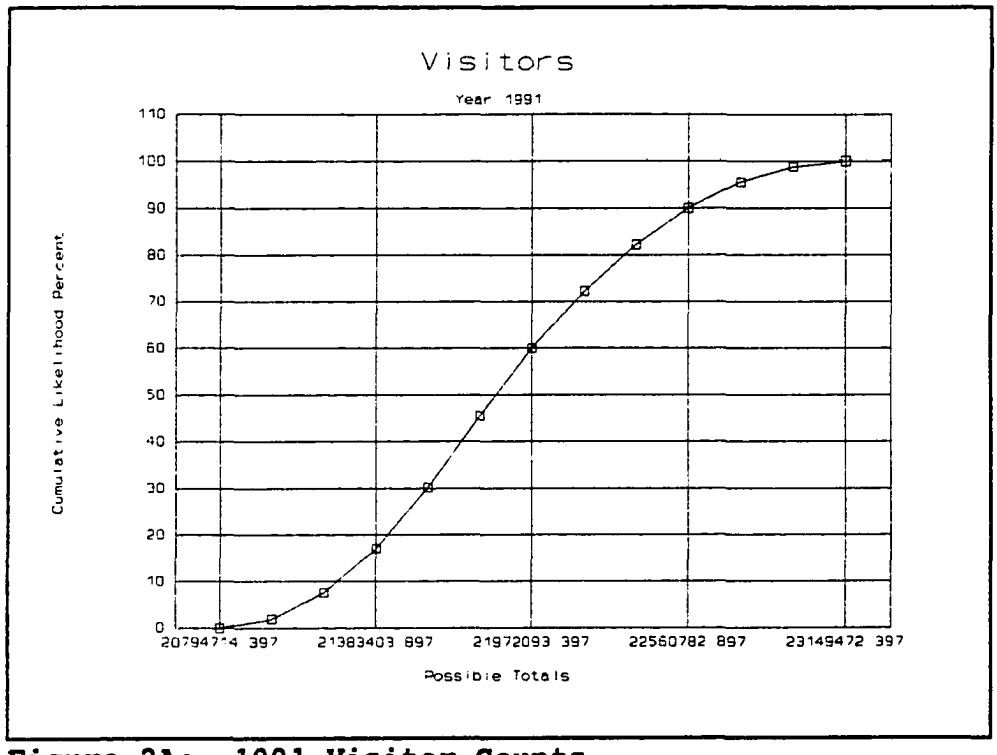


Figure 2A: 1991 Visitor Counts

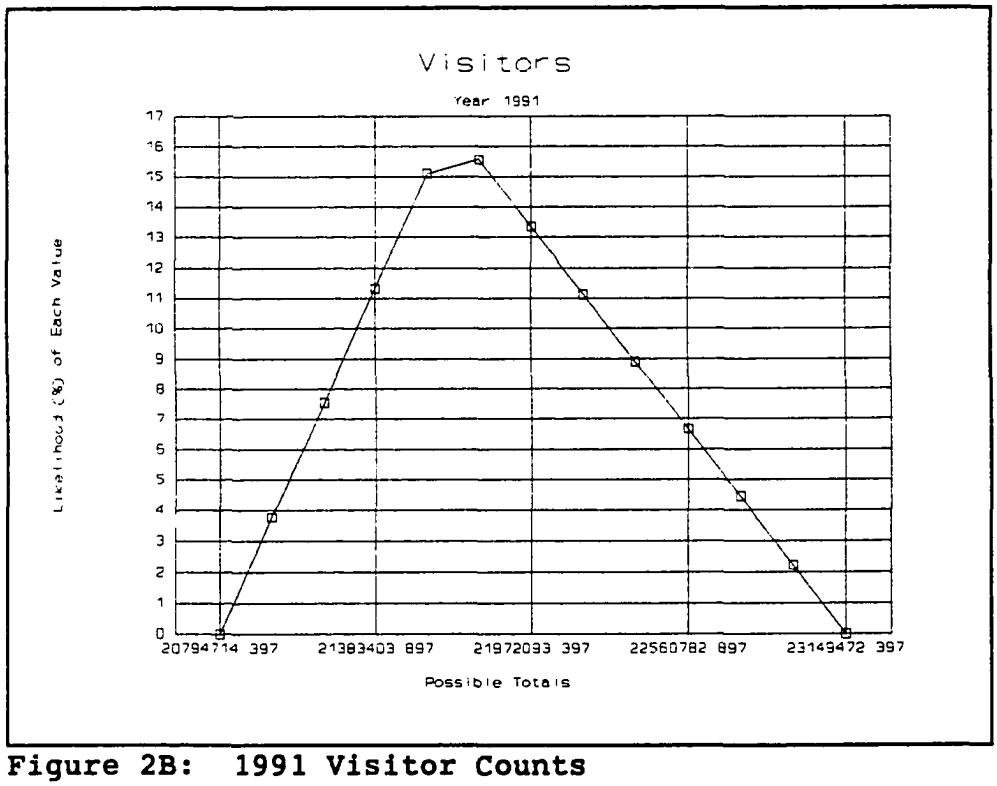


Figure 2B: 1991 Visitor Counts

Figure 3A shows the forecast of guestrooms versus visitor counts for 1991. In order for PLAN to graph the shown relationship, a correlation coefficient was calculated of total visitor volume to total guestrooms had to be determined. Visitor totals had a correlation of +0.97 for the nineteen years to total guestrooms. The next step was to assume a contour value for the graph. For the sake of consistency, a contour of 5 percent was selected for each graph when two variables were combined. A contour of 5 means 5 percent is removed from both sides of the Bell curve of each variable, leaving 90%. Therefore, the combining graphs display a 90% probability that the actual result will be within. The most likely result from the S- and Bell curves are always the center of the combining graphs. According to Figure 3A, approximately 20.98 million to 22.6 million visitors will arrive in Las Vegas in 1991. Approximately 76,300 to 81,200 guestrooms are required to accommodate these visitors.

Figure 3B shows a similar combining graph with a contour of 25%. The graph reflects a 50% probability of visitor counts and guestroom requirements. Approximately 21.43 million to 22.15 million visitors will arrive in Las Vegas in 1991. Approximately 77,700 to 79,850 guestrooms will be required to accommodate the range of visitors.

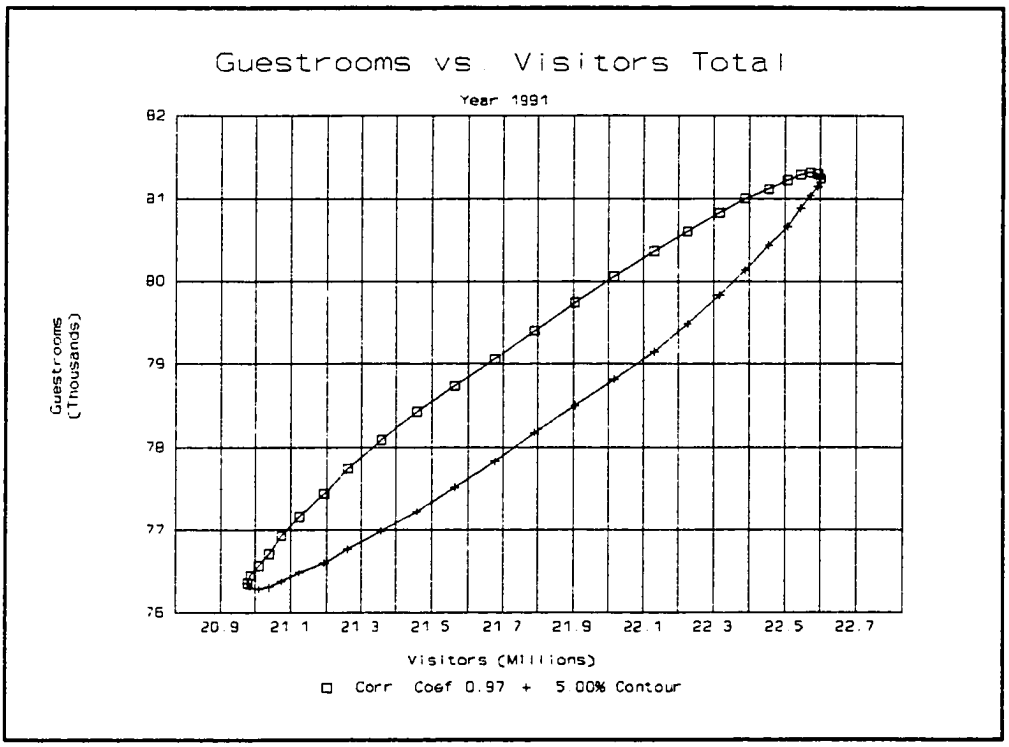


Figure 3A: 1991 Guestrooms versus Visitor Counts

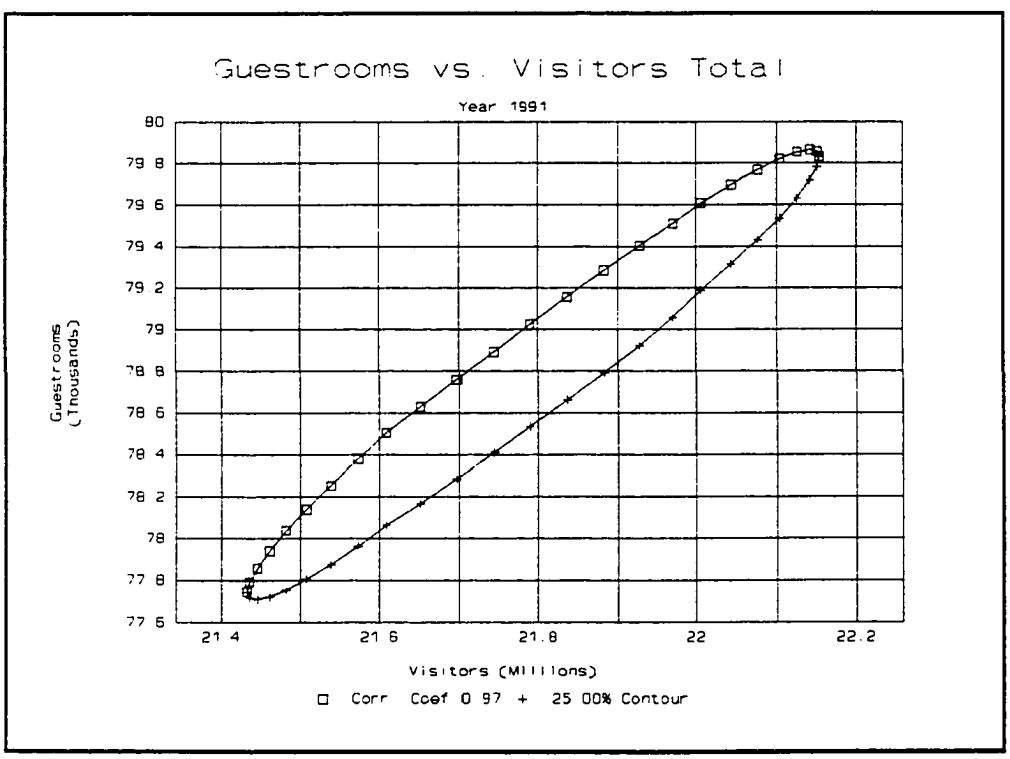


Figure 3B: 1991 Guestrooms versus Visitor Counts

Figure 3C displays the forecast of guestroom increment changes versus visitor increment changes for 1991. This graph is more disperse than the previous one (Figure 3A) because of the lower correlation of +0.33 between the two variables. A 90% chance exists that approximately 0 to 1.61 million more visitors will arrive in Las Vegas in 1991, as opposed to 1990, and guestrooms should increase by 0 to 5,000.

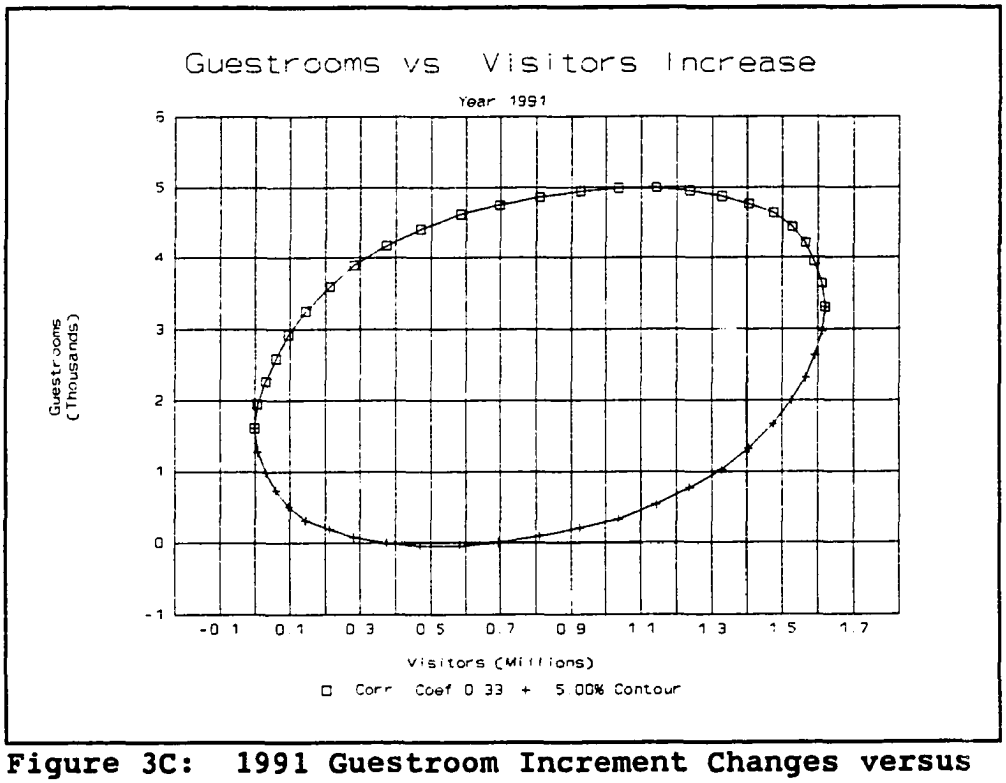


Figure 3C: 1991 Guestroom Increment Changes versus Visitor Increment Changes

Figures 4A and 4B show the forecast of lodging revenue for 1991. The range has a "low" of $10,955,410,159, a "most likely" of $11,570,147,920 and a "high" of $12,799,623,449.

The "most likely" revenue has a 37% cumulative likelihood on the S-curve (Figure 4A), and indicates a 15.9% likelihood of that total occurring on the Bell curve (Figure 4B). The difference between the "high" revenue and the "most likely" revenue is far greater than the difference between the "most likely" and the "low" forecasts.

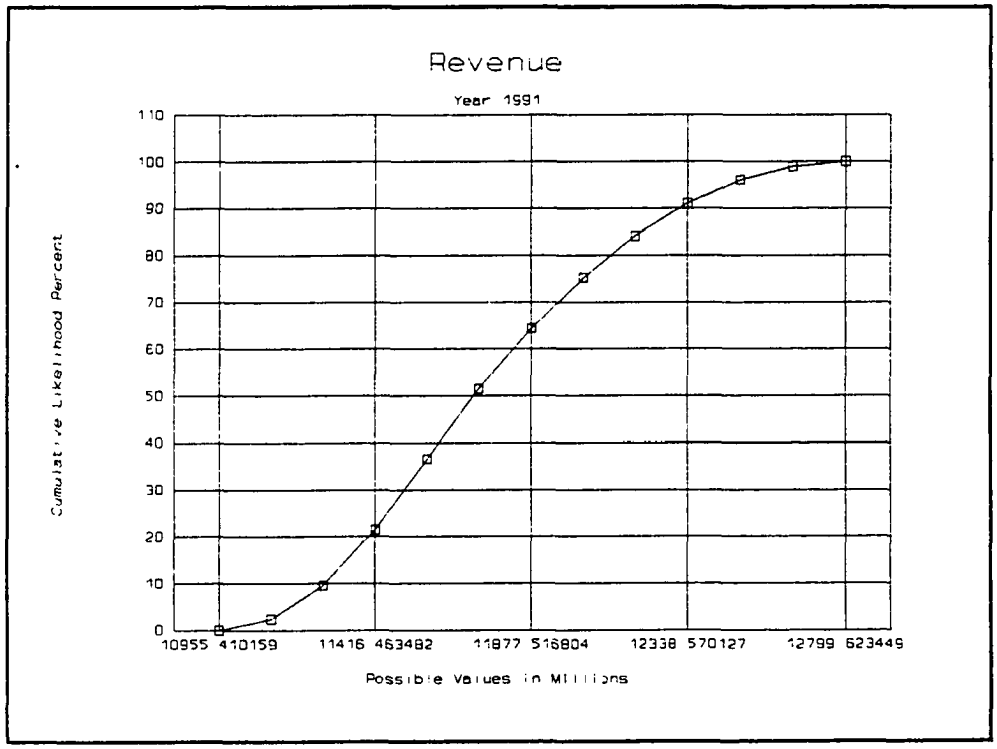


Figure 4A: 1991 Revenue

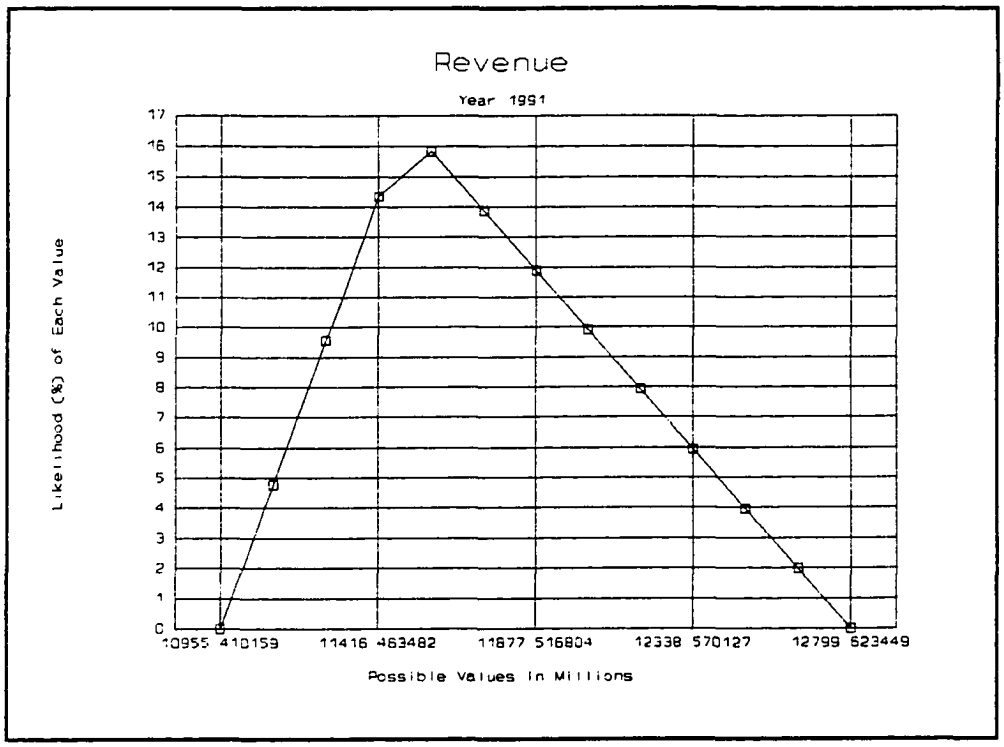


Figure 4B: 1991 Revenue

Figure 5A shows the forecast of guestrooms versus lodging revenue for 1991 with a +0.96 correlation. Approximately $11.03 billion to $12.33 billion in lodging revenue is forecasted for 1991. Approximately 76,300 to 81,200 guestrooms will exist to generate the revenue.

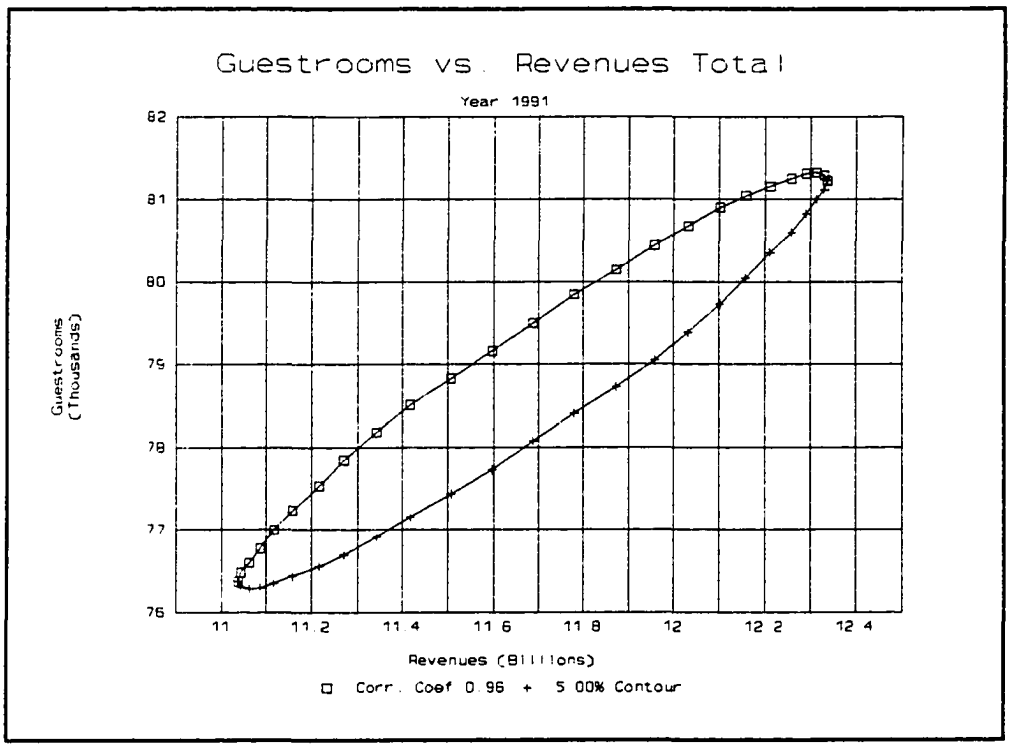


Figure 5A: 1991 Guestrooms versus Lodging Revenue

Figure 5B shows the forecast of guestroom increment changes versus revenue increment changes. The graph is wider than the previous one because of the lower correlation of +0.57 between the two variables in this situation. According to the graph, approximately $70,000,000 to $1.35 billion more revenue will be made in 1991, as opposed to 1990, and guestrooms will increase by 0 to 5,000.

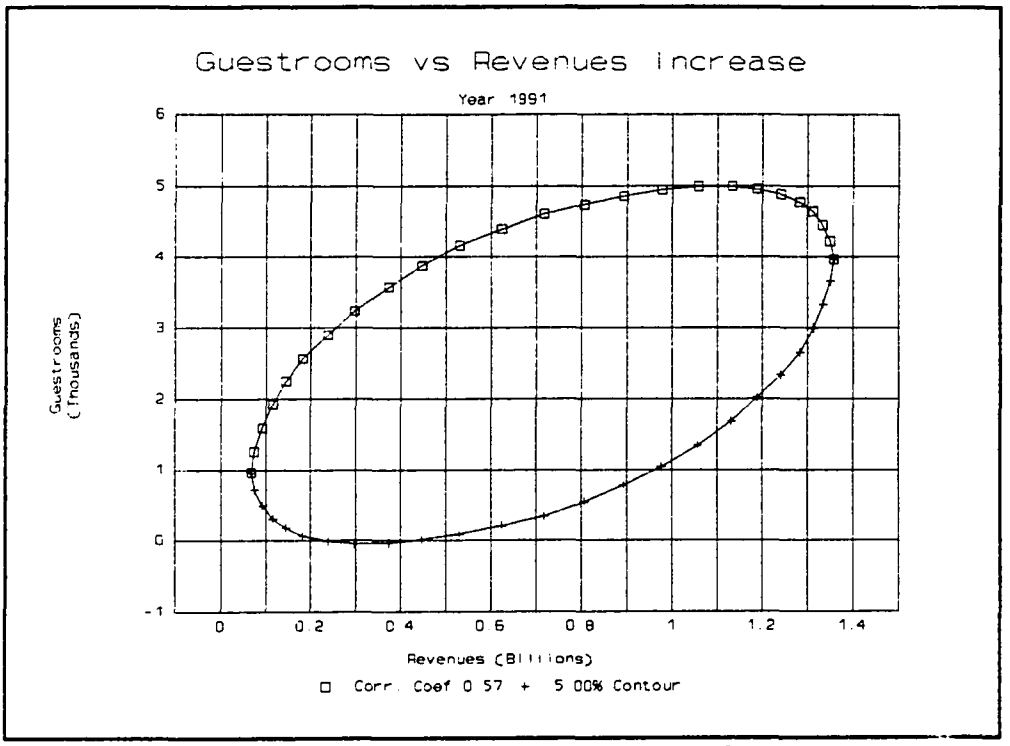


Figure 5B: 1991 Guestroom Increment Changes versus Revenue Increment Changes

Figures 6A and 6B show the forecast of gaming revenue for 1991. The forecast has a "low" of $4,117,427,254, a "most likely" of $4,247,788,007, and a "high" of $4,638,870,267. The"most likely" gaming revenue has a 25% cumulative likelihood on the S-curve (Figure 6A) and indicates a 16.6% likelihood on the Bell curve (Figure 6B). The difference between the "high" gaming revenue and the "most likely" gaming revenue is far greater than the difference between the "most likely" and the "low" forecasts.

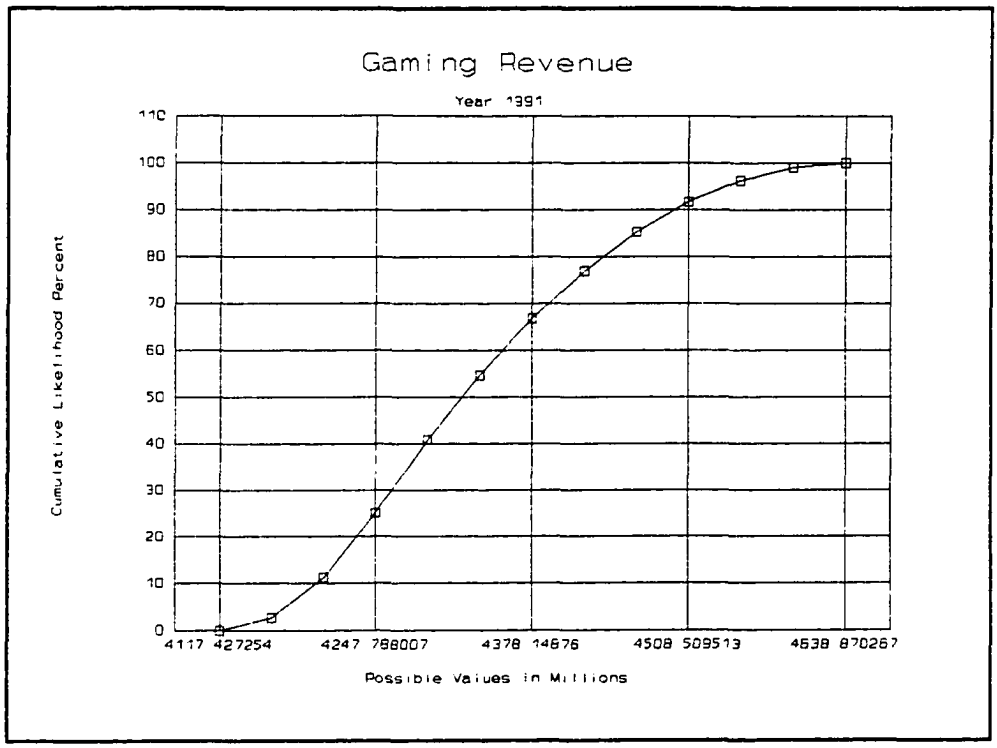


Figure 6A: 1991 Gaming Revenue

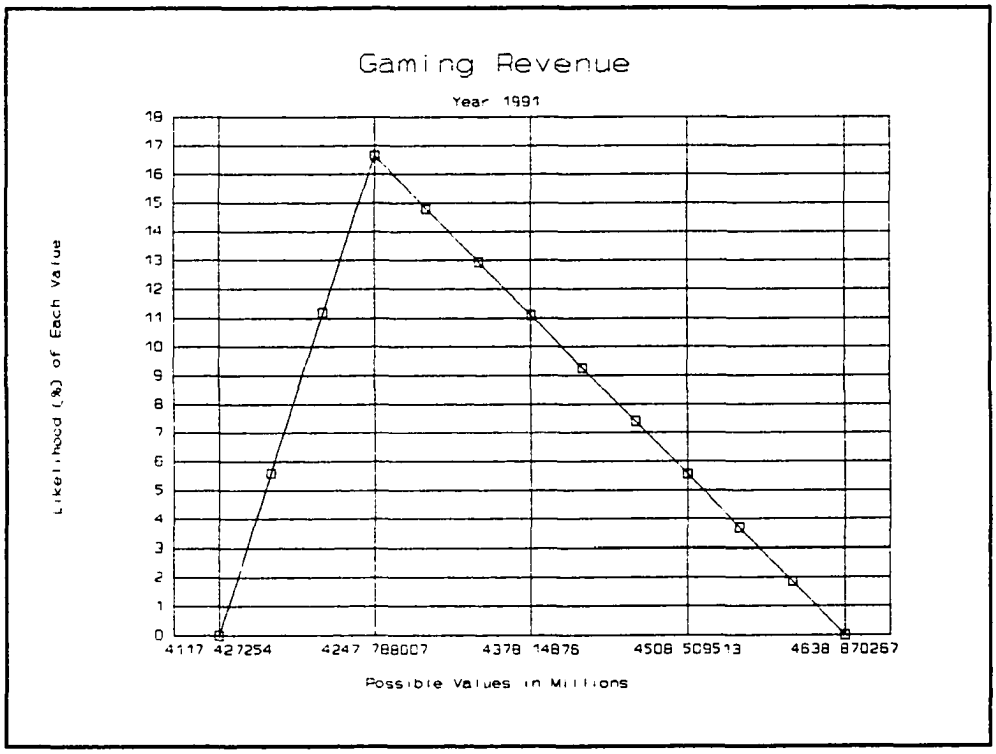


Figure 6B: 1991 Gaming Revenue

Figure 7A shows the forecast of guestrooms versus gaming revenue for 1991. The correlation coefficient between guestrooms and gaming revenue was +0.99. Approximately $4.13 billion to $4.51 billion in gaming revenue is forecasted for 1991. Approximately 76,300 to 81,200 guestrooms are forecasted for 1991.

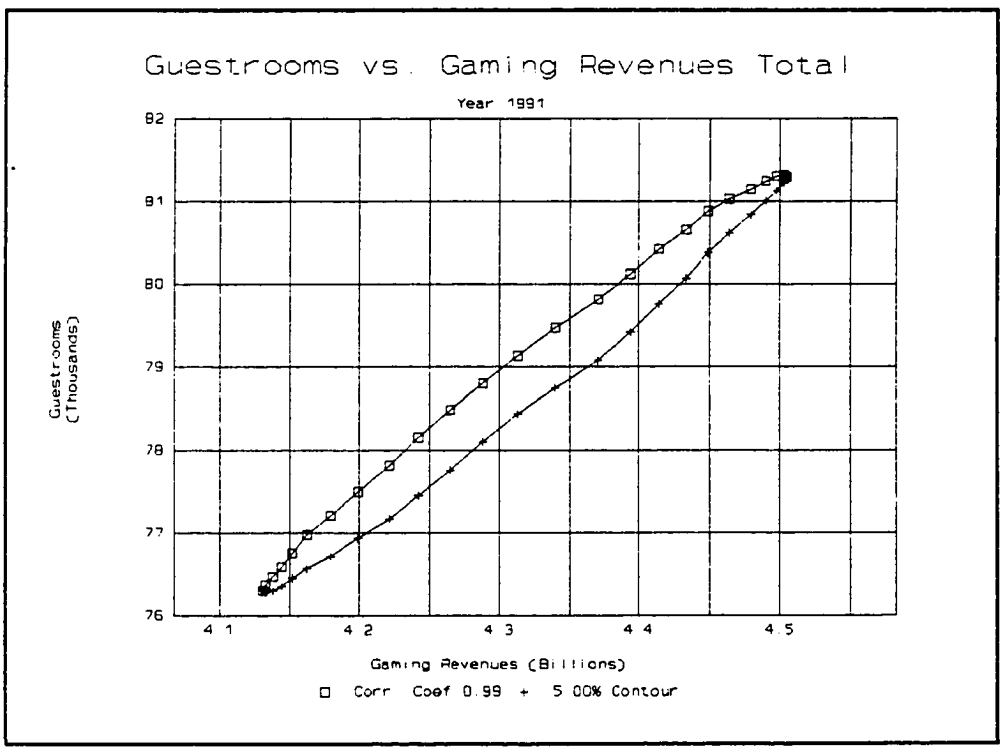


Figure 7A: 1991 Guestrooms versus Gaming Revenue

Figure 7B shows the forecast of guestroom increment changes versus gaming revenue increment changes for 1991. The graph is more dispersed than the previous one (Figure 7A) because the correlation coefficient is +0.48 between guestroom increment changes and gaming revenue increment changes. Approximately $75,000,000 to $449,000,000 of additional gaming revenue is forecasted for 1991, (compared to 1990), and the forecast indicates that guestrooms should increase from 0 to 5,000.

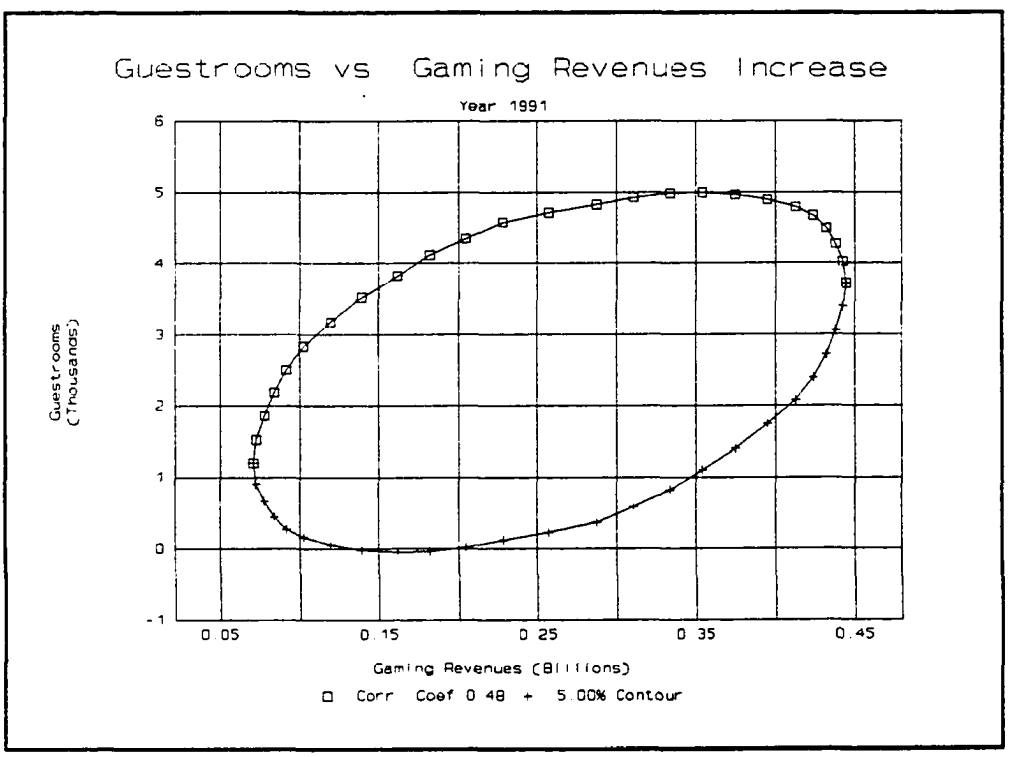


Figure 7B: 1991 Guestroom Increment Changes versus Gaming Revenue Increment Changes

Figures 8A and 8B show the forecast of total revenue for 1991. The forecast has a "low" value of $15,072,399,228, a "most likely" value of $15,860,951,321, and a "high" value of $17,438,055,519. The "most likely" total revenue has a 35.5% cumulative likelihood on the S-curve (Figure 8A) and indicates a 15.6% likelihood of that total occurring on the Bell curve (Figure 8B). The difference between the "high" total revenue and the "most likely" total revenue is far greater than the difference between the "most likely" and the "low" forecasts.

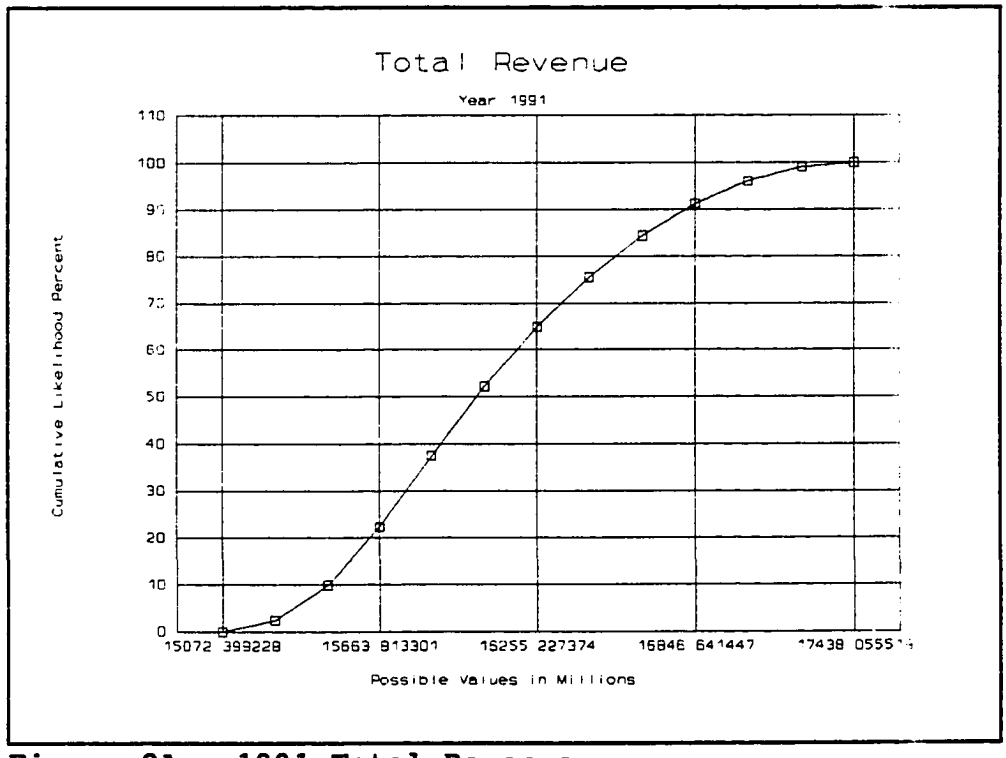


Figure 8A: 1991 Total Revenue

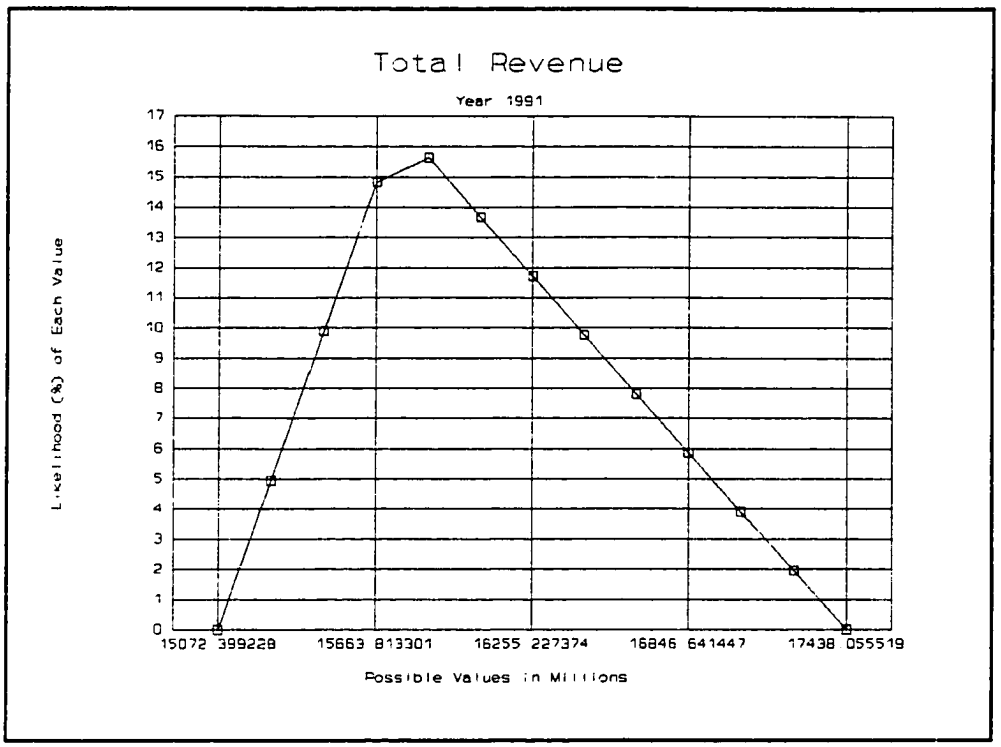


Figure 8B: 1991 Total Revenue

Figure 9A shows the forecast of guestrooms versus total revenue for 1991. The correlation coefficient between guestrooms and total revenue was +0.97. Approximately $15.18 billion to $16.83 billion in total revenue is forecasted for 1991. Approximately 76,300 to 81,200 guestrooms are forecasted for 1991.

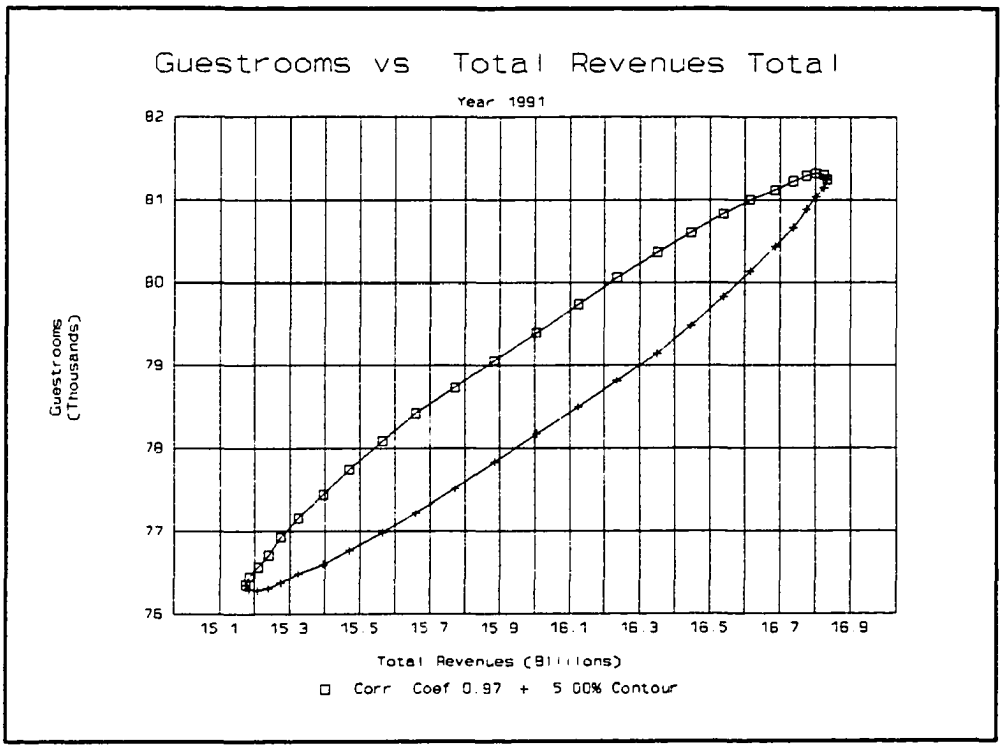


Figure 9A: 1991 Guestrooms versus Total Revenue

Figure 9B shows the forecast of guestroom increment changes versus total revenue increment changes for 1991. The graph is more dispersed than the previous one (Figure 9A) because the correlation coefficient is +0.57 between guestroom increment changes and total revenue increment changes. Approximately $140,000,000 to $1.8 billion additional total revenue is forecasted for 1991, (compared to 1990), and the forecast indicates that guestrooms should increase by 0 to 5,000.

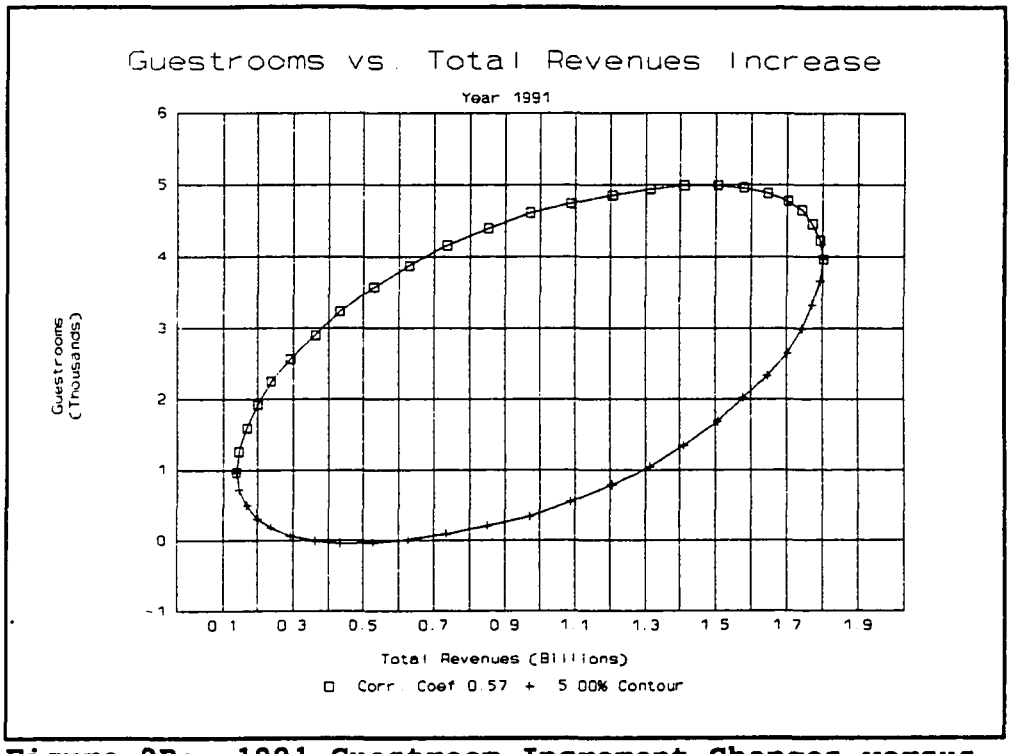


Figure 9B: 1991 Guestroom Increment Changes versus Total Revenue Increment Changes

Figures 10A and 10B shows the forecast of room tax revenue for 1991. The range has a "low" of $51,428,549, a "most likely" of $54,424,673, and a "high" of $60,416,923. The "most likely" room tax revenue has a 38% cumulative likelihood on the S-curve (Figure 10A) and indicates a 15.5% likelihood on the Bell curve (Figure 10B). The difference between "high" room tax revenue and the "most likely" room tax revenue is far greater than the difference between the "most likely" and the "low" forecasts.

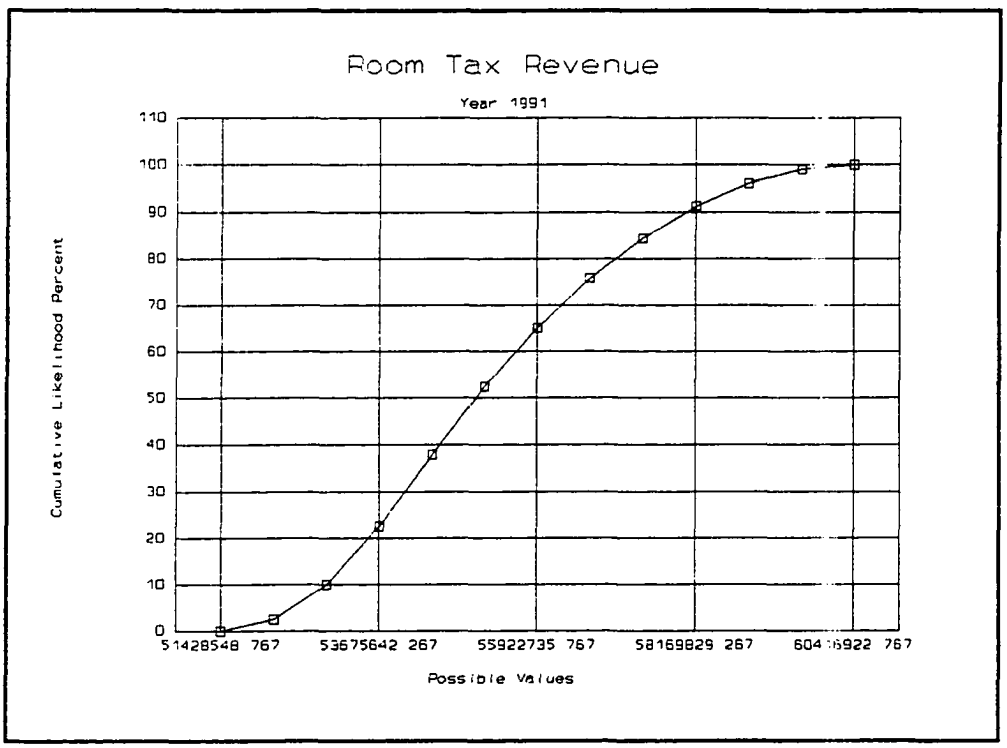


Figure 10A: 1991 Room Tax Revenue

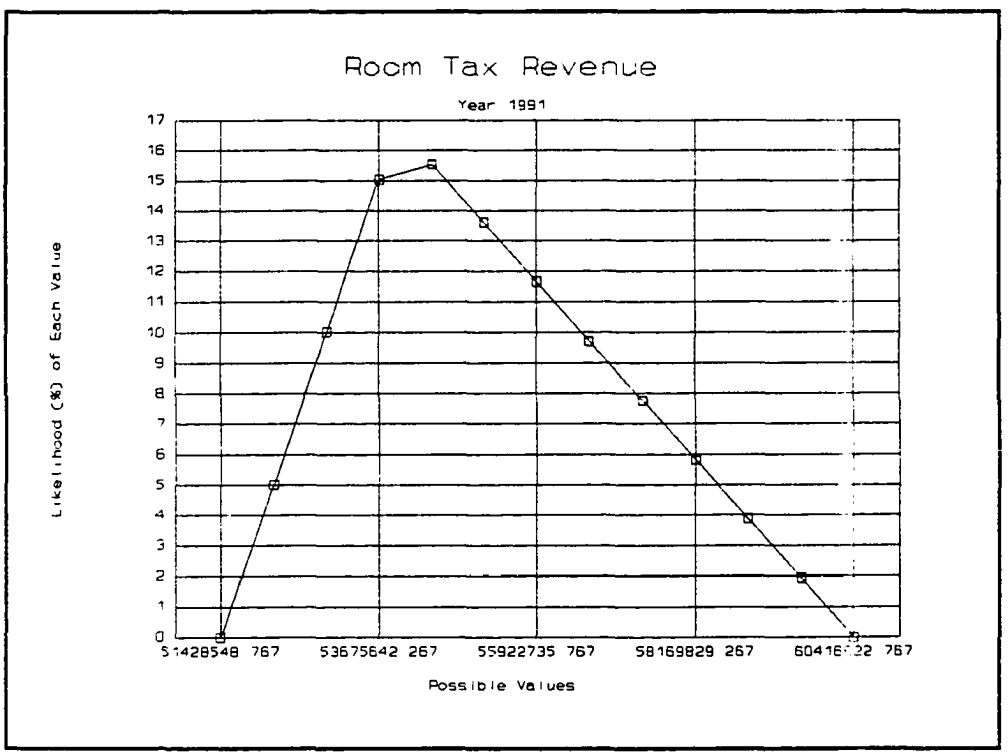


Figure 10B: 1991 Room Tax Revenue

Figure 11A shows the forecast of guestrooms versus room tax revenue for 1991. The correlation coefficient between guestrooms and room tax revenue was +0.98. Approximately $51.8 million to $58.1 million in room tax revenue is forecasted for 1991. Approximately 76,300 to 81,200 guestrooms are forecasted for 1991.

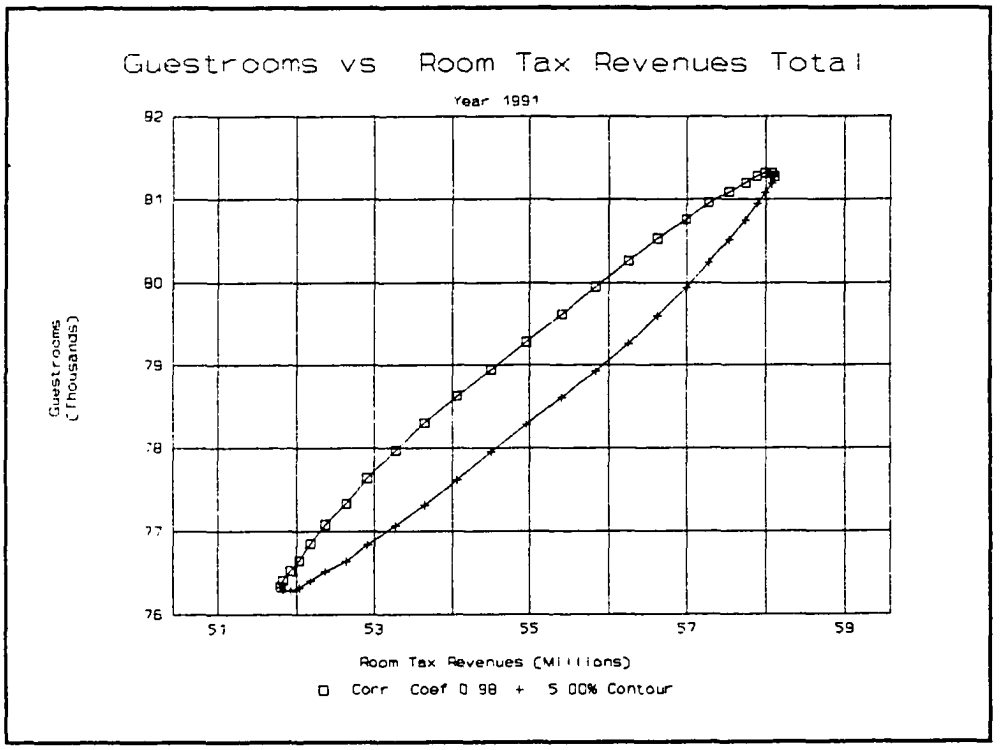


Figure 11A: 1991 Guestrooms versus Room Tax Revenue

Figure 11B shows the forecast of guestroom increment changes versus room tax revenue increment changes for 1991. The graph is more dispersed than the previous one (Figure 11A) because the correlation coefficient is +0.38 between guestroom increment changes and room tax revenue increment changes. Approximately $400,000 to $6.6 million additional room tax revenue is forecasted for 1991, (compared to 1990), and the forecast indicates that guestrooms will increase by 0 to 5,000.

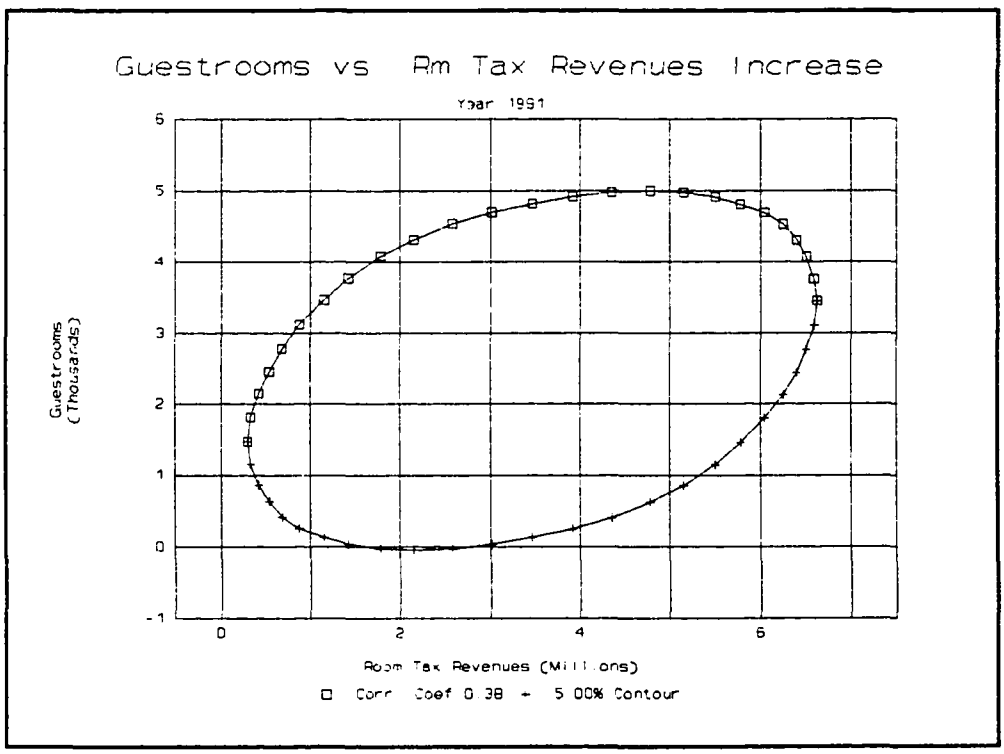


Figure 11B: 1991 Guestroom Increment Changes versus Room Tax Revenue Increment Changes

1992 PLAN Forecast

The 1992 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 7 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1992. The appendix graph reference for each forecast is also shown.

Table 8 shows the forecast range for each variable and the projected incremental change for 1992. Incremental change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 7: 1992 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	74,202	81,603	89,004	A1
Visitors	20,606,345	22,568,643	25,315,861	A2
Revenue(million)	$10,937	12,166	14,625	A4
Gaming Revenue(mil)	$4,176	4,437	5,219	A6
Total Revenue(mil)	$15,112	16,689	19,843	A8
Room Tax Revenue(mil)	$51	57	69	A10

TABLE 8: 1992 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,300 - 86,200	0 - 10,000	A3,5,7,9,11
Visitors(million)	21 - 24.2	0 - 3.21	A3
Revenue(mil)	$11,150 - 13,700	150 - 2,700	A5
Gaming Revenue(mil)	$4,200 - 4,950	140 - 880	A7
Total Revenue(mil)	$15,300 - 18,620	300 - 3,600	A9
Room Tax Revenue(mil)	$52 - 64.7	0.7 - 13.2	A11

1993 PLAN Forecast

The 1993 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 9 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1993. The appendix graph reference for each forecast is also shown.

Table 10 shows the forecast range for each variable and the projected increment change for 1993. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 9: 1993 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	73,140	84,242	95,343	B1
Visitors	20,417,975	23,361,423	27,482,249	B2
Revenue(million)	$10,918	12,762	16,451	B4
Gaming Revenue(mil)	$4,235	4,626	5,800	B6
Total Revenue(mil)	$15,152	17,517	22,249	B8
Room Tax Revenue(mil)	$51	60	78	B10

TABLE 10: 1993 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,300 - 91,300	(100) - 15,000	B3,5,7,9,11
Visitors(million)	21 - 25.8	0 - 4.8	B3
Revenue(mil)	$11,200 - 15,050	250 - 4,100	B5
Gaming Revenue(mil)	$4,280 - 5,390	220 - 1,320	B7
Total Revenue(mil)	$15,500 - 20,400	450 - 5,400	B9
Room Tax Revenue(mil)	$52 - 71.3	.99 - 19.9	B11

1994 PLAN Forecast

The 1994 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 11 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1994. The appendix graph reference for each forecast is also shown.

Table 12 shows the forecast range for each variable and the projected incremental change for 1994. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 11: 1994 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	72,078	86,880	101,682	C1
Visitors	20,229,606	24,154,202	29,648,638	C2
Revenue(million)	$10,899	13,358	18,276	C4
Gaming Revenue(mil)	$4,294	4,815	6,379	C6
Total Revenue(mil)	$15,191	18,345	24,654	C8
Room Tax Revenue(mil)	$51	63	87	C10

TABLE 12: 1994 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,200 - 96,200	(100) - 20,000	C3,5,7,9,11
Visitors(million)	21 - 26.4	0 - 6.5	C3
Revenue(mil)	$11,300 - 16,300	250 - 5,400	C5
Gaming Revenue(mil)	$4,350 - 5,820	290 - 1,770	C7
Total Revenue(mil)	$15,600 - 22,300	600 - 7,200	C9
Room Tax Revenue(mil)	$53 - 78	1.2 - 26.5	C11

1995 PLAN Forecast

The 1995 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 13 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1995. The appendix graph reference for each forecast is also shown.

Table 14 shows the forecast range for each variable and the projected increment change for 1995. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 13: 1995 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	71,015	89,518	108,020	D1
Visitors	20,041,236	24,946,982	31,815,026	D2
Revenue(million)	$10,880	13,954	20,101	D4
Gaming Revenue(mil)	$4,353	5,005	6,960	D6
Total Revenue(mil)	$15,231	19,173	27,059	D8
Room Tax Revenue(mil)	$51	66	96	D10

TABLE 14: 1995 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,200 - 101,200	(100) - 25,000	D3,5,7,9,11
Visitors(million)	21 - 29.1	0 - 8.1	D3
Revenue(mil)	$11,250 - 17,800	400 - 6,750	D5
Gaming Revenue(mil)	$4,420 - 6,270	360 - 2,210	D7
Total Revenue(mil)	$15,750 - 24,000	700 - 9,000	D9
Room Tax Revenue(mil)	$53 - 84.9	1.6 - 33	D11

1996 PLAN Forecast

The 1996 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 15 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1996. The appendix graph reference for each forecast is also shown.

Table 16 shows the forecast range for each variable and the projected increment change for 1996. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 15: 1996 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	69,953	92,156	114,359	E1
Visitors	19,852,866	25,739,761	33,981,414	E2
Revenue(million)	$10,862	14,550	21,927	E4
Gaming Revenue(mil)	$4,412	5,194	7,540	E6
Total Revenue(mil)	$15,270	20,002	29,464	E8
Room Tax Revenue(mil)	$51	69	105	E10

TABLE 16: 1996 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,200 - 106,200	(100) - 30,000	E3,5,7,9,11
Visitors(million)	21 - 30.6	0 - 9.7	E3
Revenue(mil)	$11,350 - 19,200	450 - 8,200	E5
Gaming Revenue(mil)	$4,500 - 6,700	440 - 2,650	E7
Total Revenue(mil)	$15,900 - 25,800	800 - 10,800	E9
Room Tax Revenue(mil)	$53 - 91.5	2 - 39	E11

1997 PLAN Forecast

The 1997 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 17 shows the "low, most likely and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1997. The appendix graph reference for each forecast is also shown.

Table 18 show the forecast range for each variable and the projected incremental change for 1997. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 17: 1997 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	68,891	94,794	120,698	F1
Visitors	19,664,497	26,532,541	36,147,803	F2
Revenue(million)	$10,843	15,146	23,752	F4
Gaming Revenue(mil)	$4,471	5,383	8,121	F6
Total Revenue(mil)	$15,311	20,830	31,870	F8
Room Tax Revenue(mil)	$51	72	114	F10

TABLE 18: 1997 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,000 - 111,500	(100) - 35,000	F3,5,7,9,11
Visitors(million)	21 - 32.25	0 - 11.3	F3
Revenue(mil)	$11,450 - 20,500	500 - 9,500	F5
Gaming Revenue(mil)	$4,550 - 7,150	500 - 3,100	F7
Total Revenue(mil)	$16,000 - 27,600	1,000 - 12,600	F9
Room Tax Revenue(mil)	$54 - 97.5	2.2 - 41.7	F11

1998 PLAN Forecast

The 1998 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 19 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1998. The appendix graph reference for each forecast is also shown.

Table 20 shows the forecast range for each variable and the projected increment change for 1998. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 19: 1998 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	67,828	97,432	127,036	G1
Visitors	19,664,497	26,532,541	36,147,803	G2
Revenue(million)	$10,824	15,742	25,578	G4
Gaming Revenue(mil)	$4,530	5,573	8,701	G6
Total Revenue(mil)	$15,350	21,659	34,276	G8
Room Tax Revenue(mil)	$51	78	132	G10

TABLE 20: 1998 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,000 - 116,000	(100) - 40,000	G3,5,7,9,11
Visitors(million)	21 - 34	0 - 13	G3
Revenue(mil)	$11,500 - 21,850	500 - 10,900	G5
Gaming Revenue(mil)	$4,640 - 7,600	600 - 3,530	G7
Total Revenue(mil)	$16,150 - 29,500	1,150 - 14,500	G9
Room Tax Revenue(mil)	$54 - 104.5	2.5 - 52.5	G11

1999 PLAN Forecast

The 1999 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 21 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 1999. The appendix graph reference for each forecast is also shown.

Table 22 shows the forecast range for each variable and the projected increment change for 1999. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 21: 1999 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	66,766	100,071	133,375	H1
Visitors	19,287,758	28,118,100	40,480,580	H2
Revenue(million)	$10,805	16,338	27,403	H4
Gaming Revenue(mil)	$4,589	5,762	9,282	H6
Total Revenue(mil)	$15,390	22,487	36,681	H8
Room Tax Revenue(mil)	$51	78	132	H10

TABLE 22: 1999 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	76,000 - 121,500	(100) - 45,000	H3,5,7,9,11
Visitors(million)	21 - 35.5	0 - 14.5	H3
Revenue(mil)	$11,550 - 23,200	600 - 12,200	H5
Gaming Revenue(mil)	$4,700 - 8,050	650 - 3,990	H7
Total Revenue(mil)	$16,300 - 31,200	1,250 - 16,250	H9
Room Tax Revenue(mil)	$55 - 110.05	3 - 59	H11

2000 PLAN Forecast

The 2000 forecasts generated by PLAN are summarized below and the graphs are in the appendix. Table 23 shows the "low, most likely, and high" forecasts of each variable (guestrooms, visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue) for Las Vegas, Nevada for 2000. The appendix graph reference for each forecast is also shown.

Table 24 shows the forecast range for each variable and the projected increment change for 2000. Increment change refers to the change from 1990. The appendix graph reference for each projection is also shown.

TABLE 23: 2000 S- and Bell Curve Forecasts

Variables	Low	Most Likely	High	Appendix
Guestrooms	62,047	102,752	143,458	I1
Visitors	18,243,719	29,036,360	44,146,057	I2
Revenue(million)	$10,270	17,032	30,557	I4
Gaming Revenue(mil)	$4,528	6,440	10,264	I6
Total Revenue(mil)	$14,793	23,467	40,815	I8
Room Tax Revenue(mil)	$49	$81	$147	I10

TABLE 24: 2000 Correlated Projections

Variables	Totals	Changes	Appendix
Guestrooms	75,000 - 127,500	(100) - 50,000	I3,5,7,9,11
Visitors(million)	21 - 37.5	0 - 16.2	I3
Revenue(mil)	$11,800 - 24,900	700 - 13,500	I5
Gaming Revenue(mil)	$4,800 - 8,600	750 - 4,400	I7
Total Revenue(mil)	$16,600 - 33,500	1,400 - 18,000	I9
Room Tax Revenue(mil)	$56 - 114.5	3 - 66.5	I11

Comparison of Models

The primary test of a valid forecasting model is based on the error between the yearly data and model generated data. R - squared (goodness of fit) was calculated for curvilinear regression, curvilinear logarithm regression, and double exponential smoothing with linear trend for the guestroom data from 1972 and to 1990. Goodness of fit for the guestroom data from 1972 to 1990 was not calculated for PLAN because the model does not forecast the input data. Curvilinear logarithm regression had the best fit of the actual guestroom data with a R - squared of 0.99 (see Appendix K). Curvilinear regression (Appendix J) and double exponential smoothing with linear trend (Appendix L) both had resulting R - squares of 0.97. Although goodness of fit is a valid test, Andrew, Cranage, and Lee (1990) stated that hoteliers are more interested in how accurately models can predict the future than how well a model can be fitted to historical data.

Therefore, a second validity test was used for 1991. Data for 1991 were recently available and were compared to forecasts generated by the models for 1991. Curvilinear logarithm regression generated an error of only 1,001 guestrooms, compared to -6,579 and 3,145 by curvilinear regression and double exponential smoothing with linear trend respectively. PLAN generated a forecast range with a "low" of 75,265, a "most likely" of 78,965, and a "high" of 82,666. The actual guestroom total of 76,879 fell between the "low"

and "most likely" estimates. PLAN's "low" forecast had an error of -1,614 guestrooms and the "most likely" projection had an error of 2,086 guestrooms.

The third test was to determine which model best predicted the increase of aproximately 11,000 guestrooms in 1994/1995. Hence, the total number of guestrooms for 1994/1995 is estimated to be 87,879. The 1994 curvilinear logarithm regression model forecast included approximately 32,000 additional guestrooms (see Appendix K). In 1995, this model predicts another increase of 16,000 guestrooms. The 1994 curvilinear regression model forecast is only 137 guestrooms higher than the actual total guestrooms in 1991 (see Appendix J). The 1994 double exponential smoothing projection includes an additional 22,684 guestrooms. This same model predicts another increase of 6,512 guestrooms for 1995. The 1994 PLAN forecast range has a "low" of 72,078, a "most likely" of 86,880, and a "high" of 101,682. The 1994 "most likely" value generated by PLAN is only 499 guestrooms short of the estimated total for that year.

During the nineteen year period of the actual data collected, the correlation of guestrooms and visitor counts was +0.97. The validity tests showed the curvilinear regression model forecasts to be conservative. The projections for 1990 and 1991 were lower than the actual guestroom totals. Also the estimated growth of 11,000 rooms in 1994/1995 was not included in the forecast of those years.

The curvilinear regression guestroom forecasts were lower than the curvilinear logarithm regression and the double exponential smoothing with linear trend results from 1991 to 2000 (Table 1). On the other hand, the curvilinear regression visitor forecasts were higher, which indicated that more visitors were forecasted per room from 1991 to 2000. In this situation, total guestrooms in Las Vegas, Nevada would be underbuilt.

Curvilinear logarithm regression forecasts were fairly accurate when estimating the actual guestroom data. However, curvilinear logarithm regression visitor forecasts in 1990 and 1991 were lower than the actual visitor counts for 1990. In 1990 the visitor to guestroom ratio was 258 and by the year 2000 the forecasted ratio dropped to 86 visitors per guestroom. The ratios were calculated by dividing the forecasted visitor counts by the forecasted guestrooms. This model, which generated the highest total guestrooms in 2000, generated the lowest visitor forecasts for that same year. In this situation, total guestrooms in Las Vegas, Nevada would be overbuilt.

Double exponential smoothing with linear trend appeared to over forecast guestrooms in 1991 and 1994 (see Table 1). However, the visitor forecast to guestroom forecast ratios were fairly stable. Similar to this model, PLAN also had stable visitor to guestrooms ratio. However, the guestroom

forecasts of PLAN project the actual data of 1991 and estimated total of 1994 with a smaller error.

CONCLUSION

"Comparison of Computer Models in Forecasting of Hotel and Motel Guestroom Supply" was an exploratory study that compared several traditional forecasting models as well as the software package PLAN which was applied to the hospitality industry for the first time. The purpose of the research was to develop a methodology and model for estimating the future number of guestrooms for a destination area. If an appropriate methodology and model for forecasting guestroom demand can be developed and if these guestroom demands are publicized, this information should assist in reducing guestroom overbuilding for a destination area. The could be applied to another destination area, such as Orlando or San Diego, that has a reliable travel and tourism data base.

The forecasts of curvilinear regression, curvilinear logarithm regression, and double exponential smoothing with linear trend were generated only with historical data from 1972 to 1990. Andrew, Cranage, and Lee (1990) stated that any additional information a manager possesses probably could make forecasts even more accurate. A model, such as PLAN, gives a forecaster more control of his/her projections because "low, most likely, and high" assumptions can be based on how pessimistic or optimistic that person is about the future.

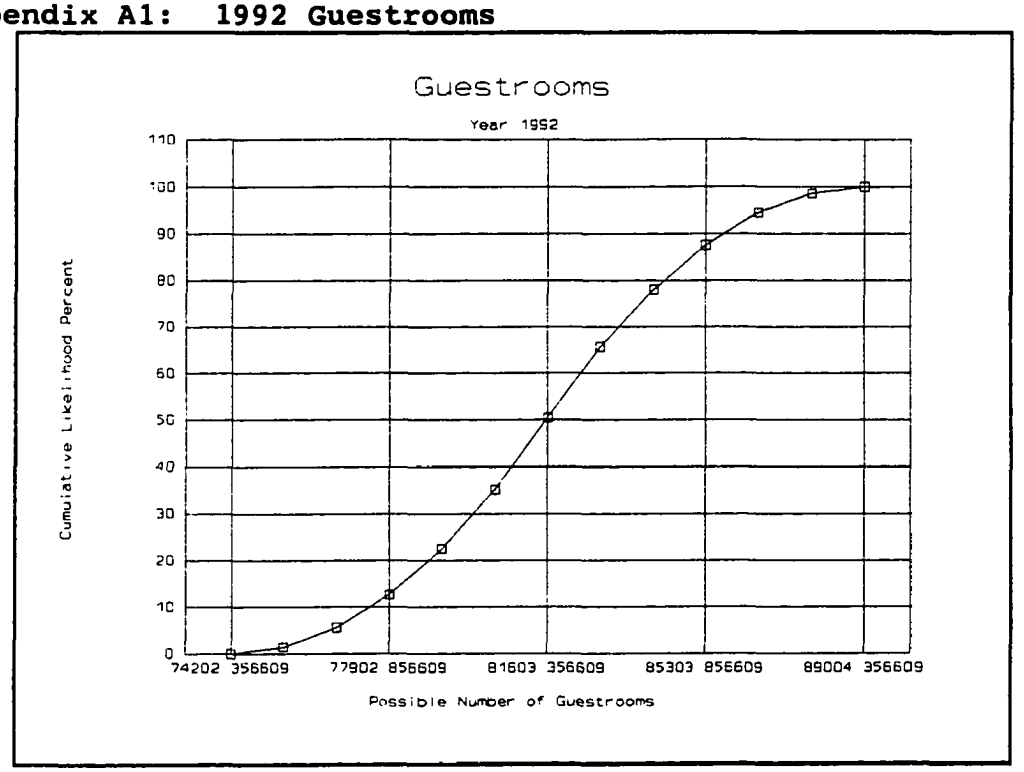
PLAN involved finding variables that were correlated to guestrooms, such as visitor volume, lodging revenue, gaming revenue, total revenue, and room tax revenue. The author did not reject the PLAN model because the forecasts maintained stable visitor to guestroom ratios. The ratio was 278 visitors per guestroom in 1994 and 279 in 1995. In 2000, the ratio increases to 283. As the visitor per guestroom ratio increases, this means the demand on existing rooms is increasing. In other words, if visitor counts continue to increase, total guestrooms in Las Vegas, Nevada will not be overbuilt with the projected guestrooms from this study for 1991 to 2000.

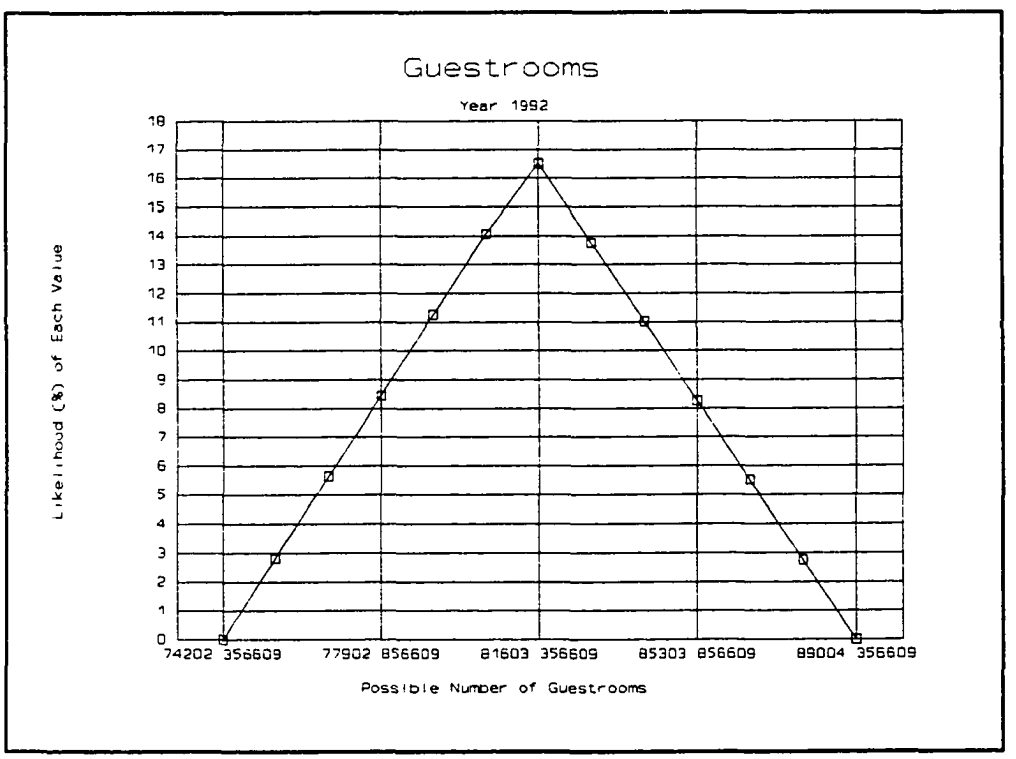
The following is the projected 'best estimate' guestroom supply for Las Vegas, Nevada for 1991 to 2000, as generated by PLAN.

Year	'Best estimate' guestroom supply
1991	78,965
1992	81,603
1993	84,242
1994	86,880
1995	89,518
1996	92,156
1997	94,794
1998	97,432
1999	100,071
2000	102,752

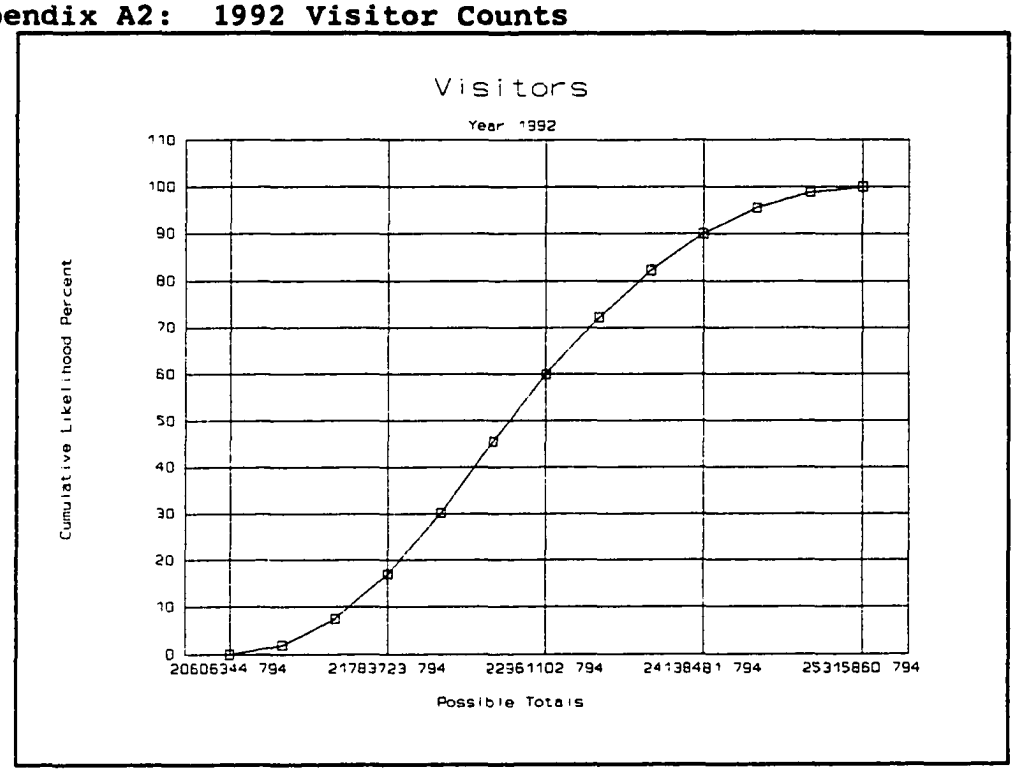
PLAN was a successful forecasting model in this study. The software gives managers more responsibilty for their projected results and requires more research. Managers can not just input historical guestroom data, like with curvilinear regression, curvilinear logarithm regression, and "double exponential smoothing with linear trend." Unfortunately, the cost of PLAN, which has a price tag of $13,500, may be dissuading and may impel developers and regional planners to utilize the other inexpensive models.

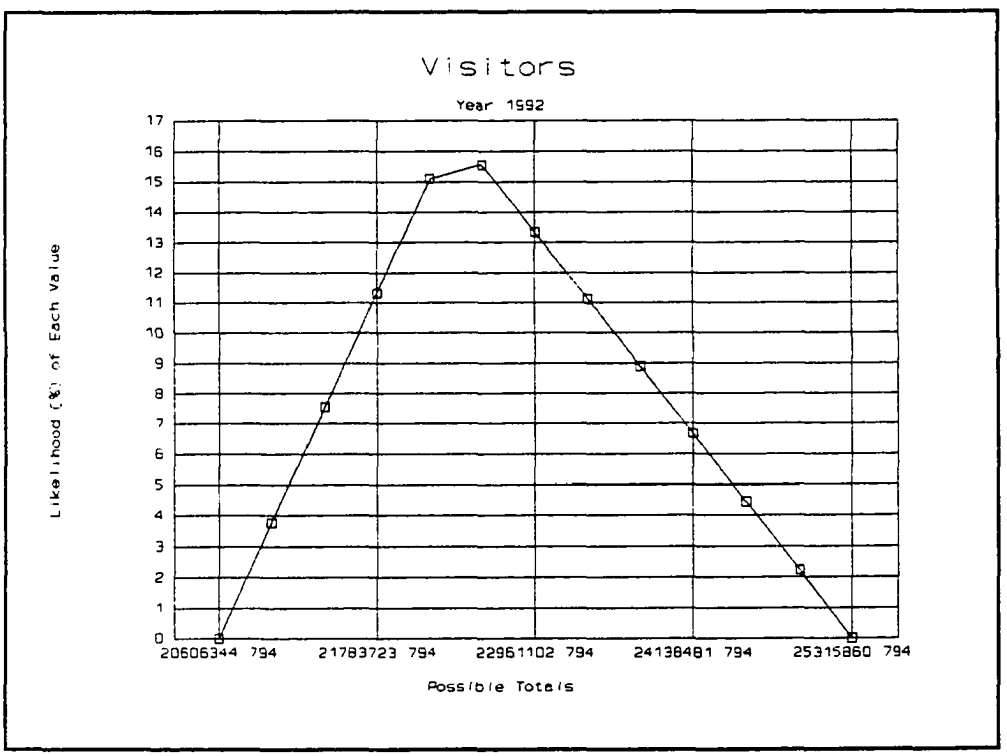
Appendix A1: 1992 Guestrooms



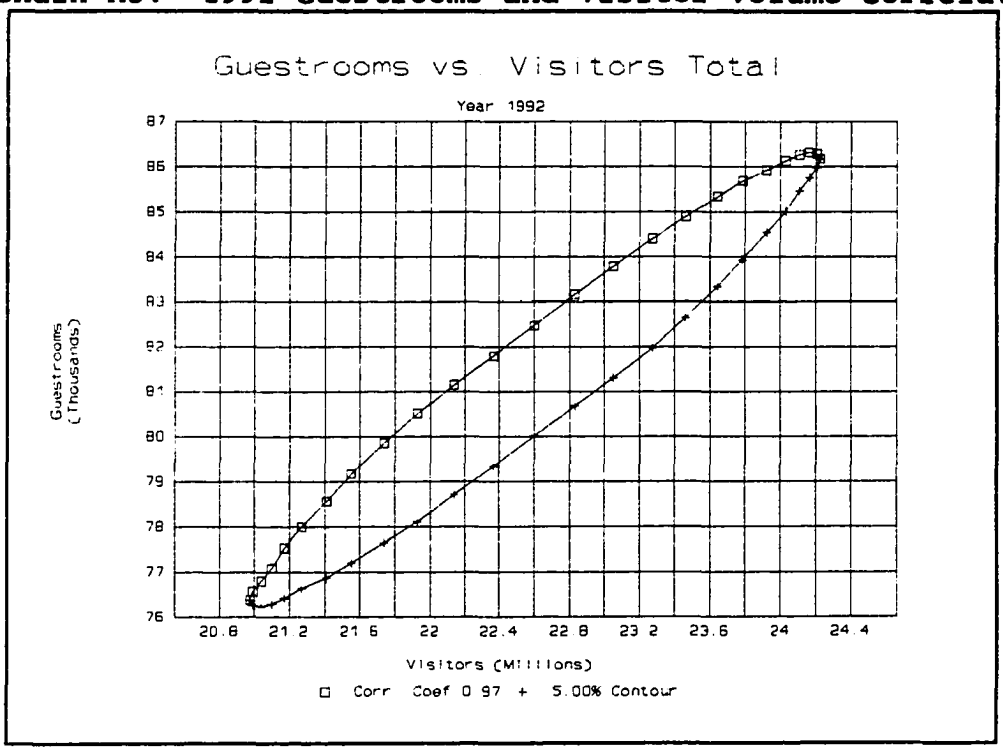


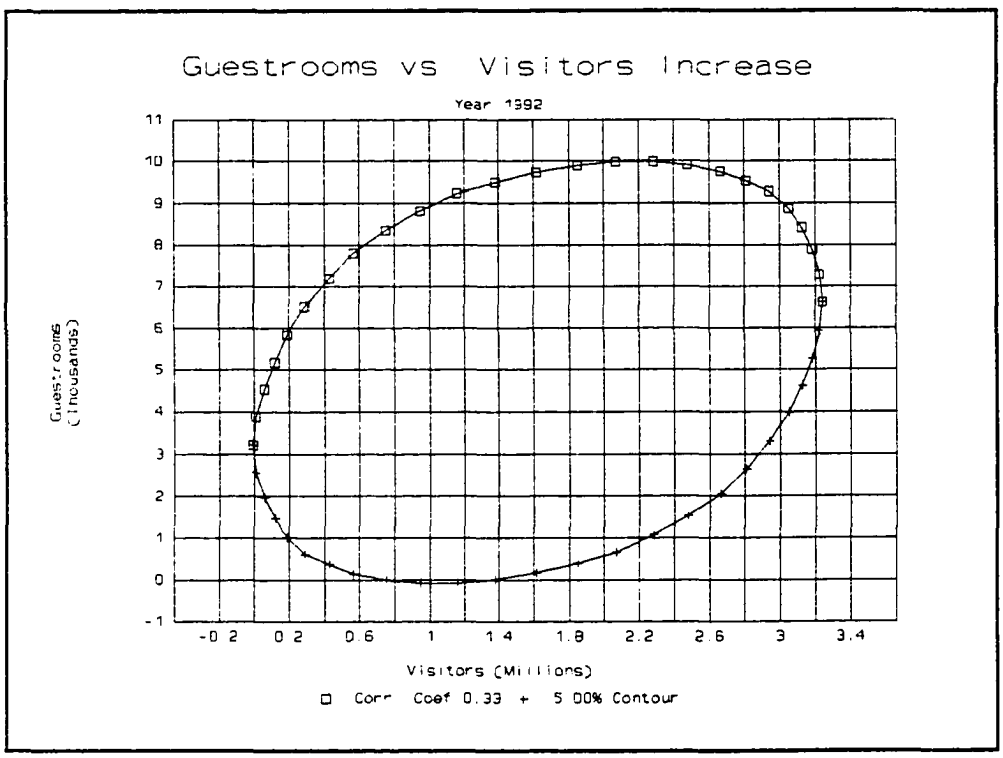
Appendix A2: 1992 Visitor Counts



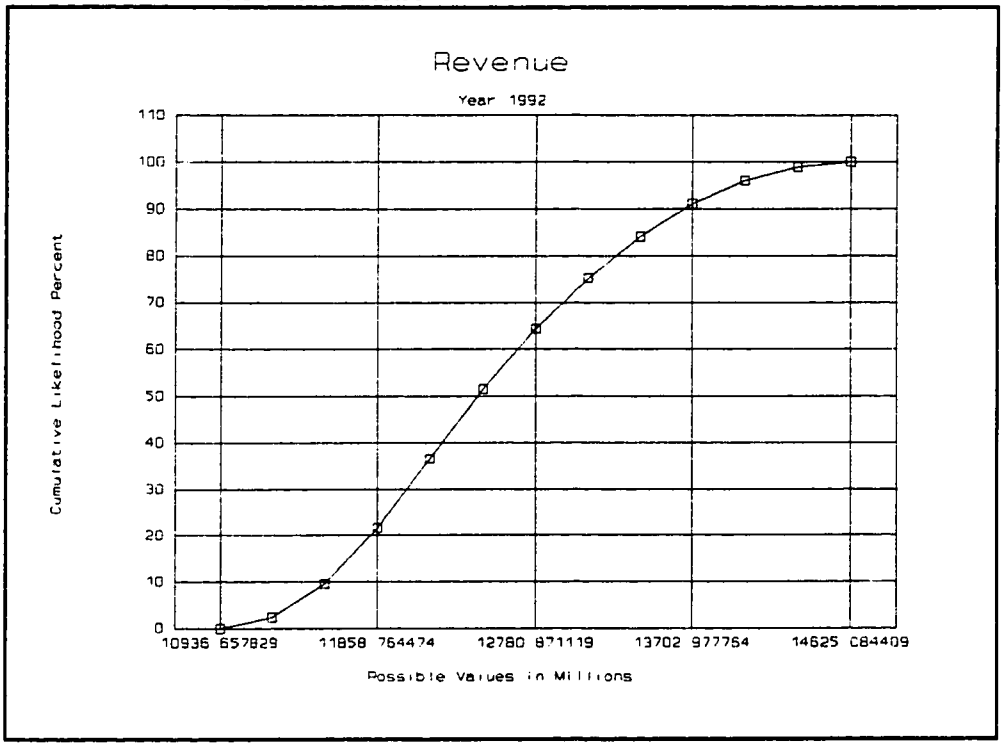


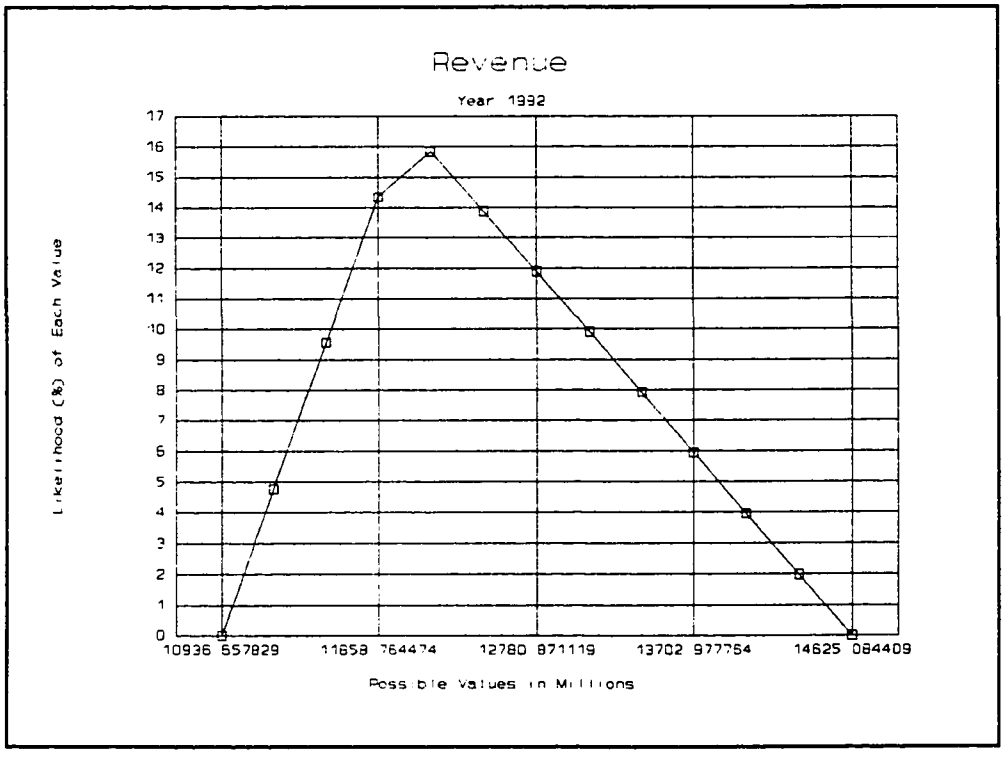
Appendix A3: 1992 Guestrooms and Visitor Volume Correlation



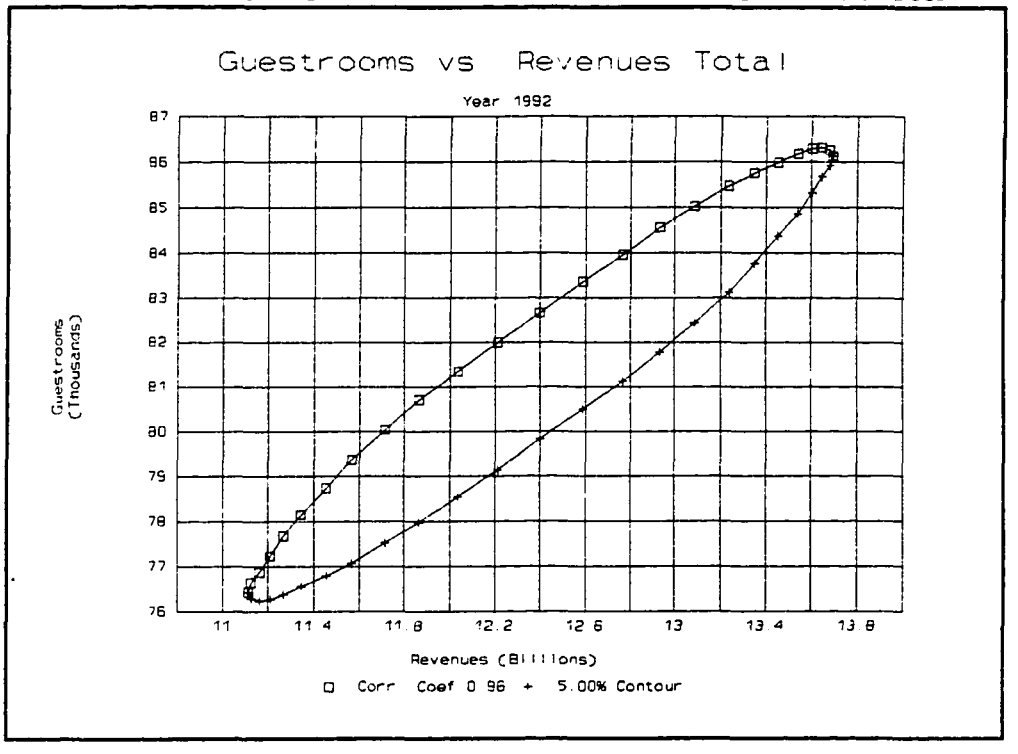


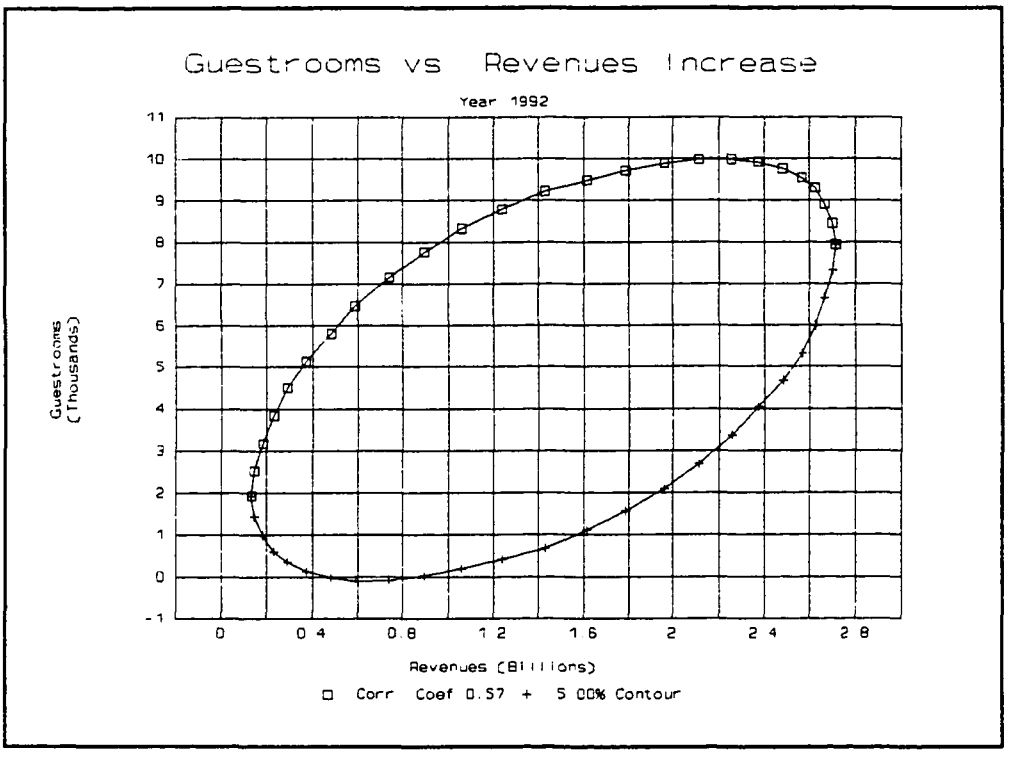
Appendix A4: 1992 Revenue



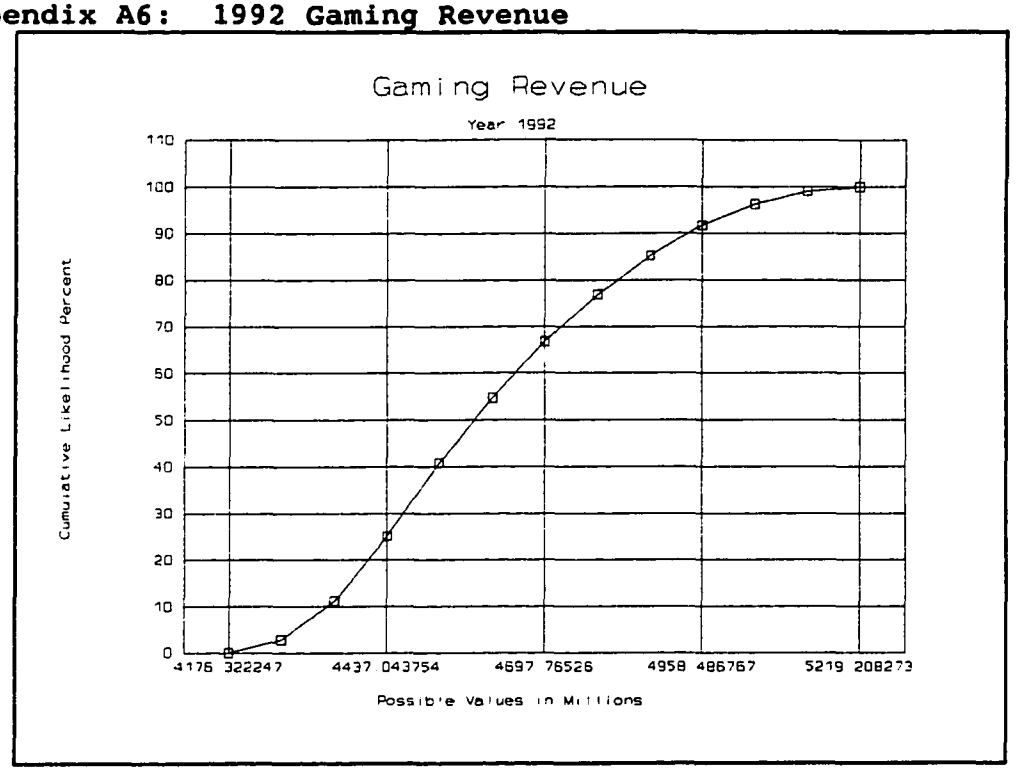


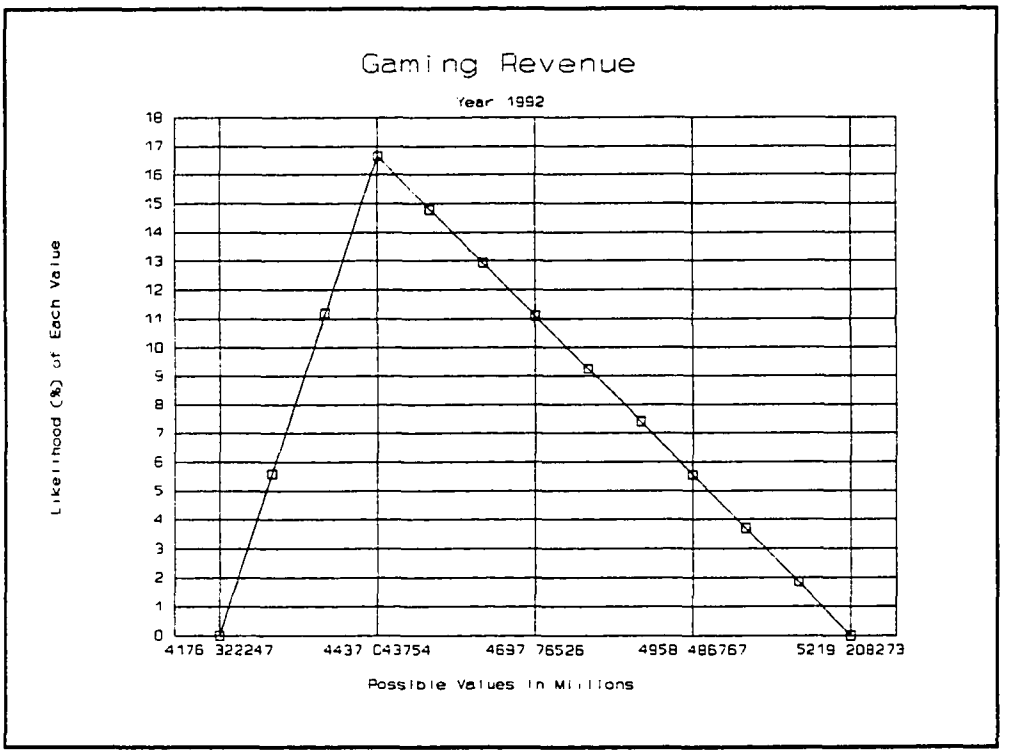
Appendix A5: 1992 Guestrooms and Revenue Correlation



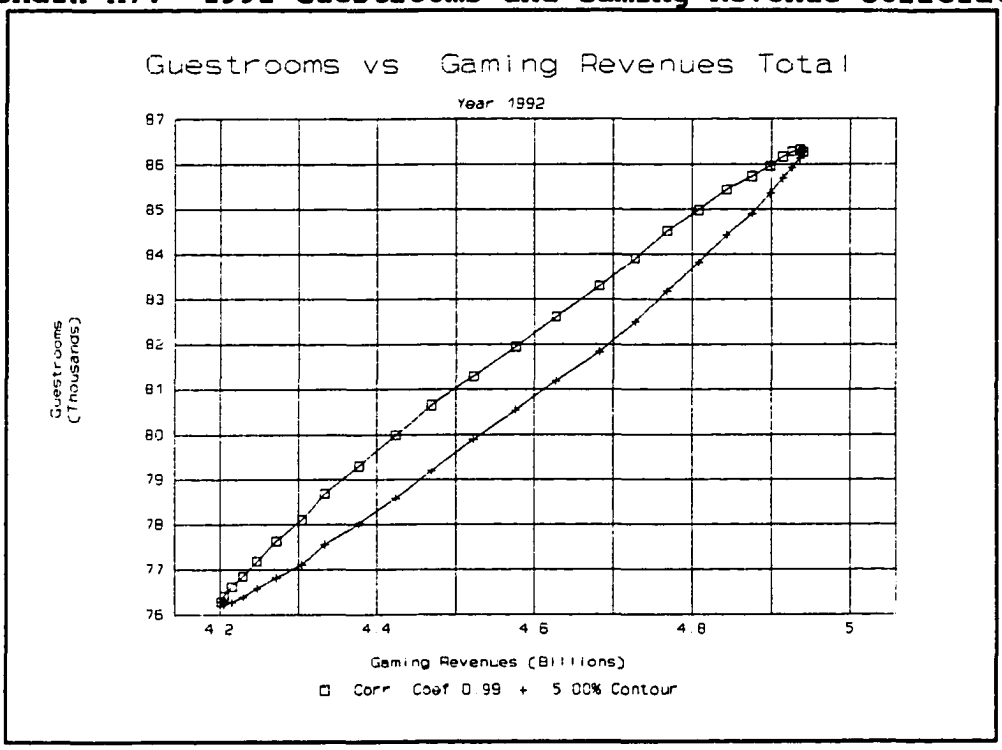


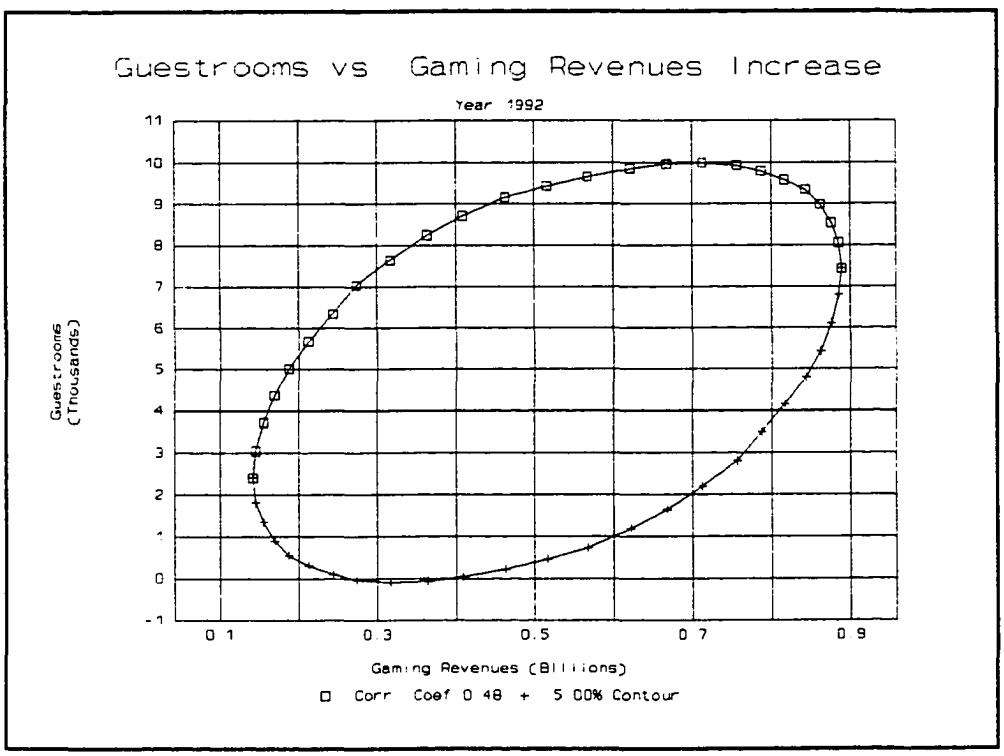
Appendix A6: 1992 Gaming Revenue



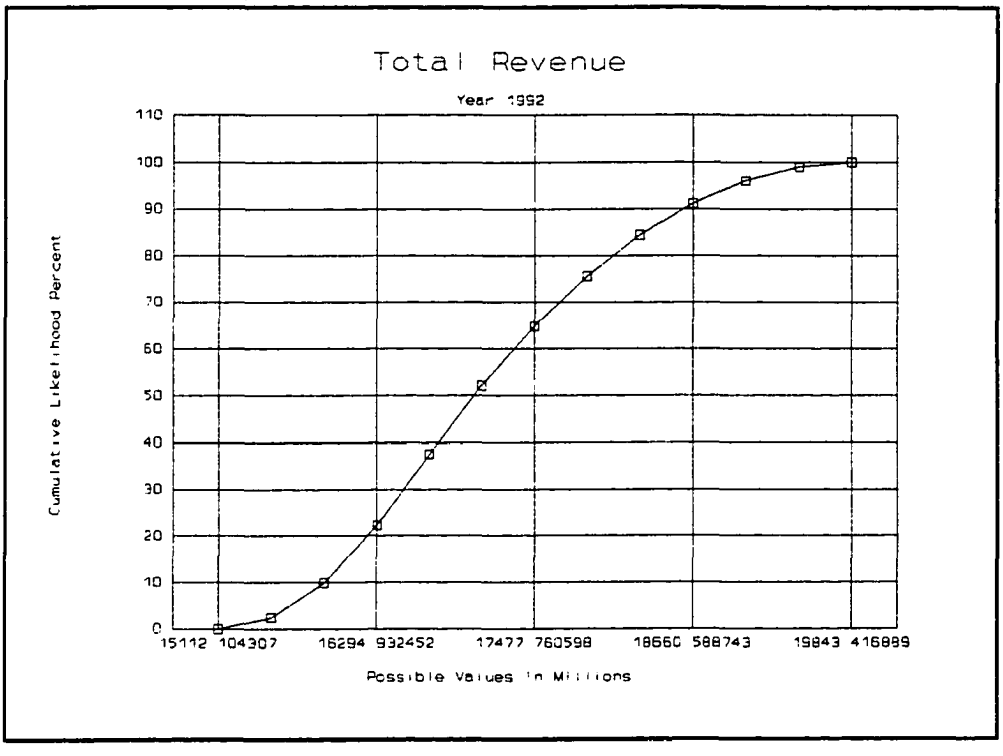


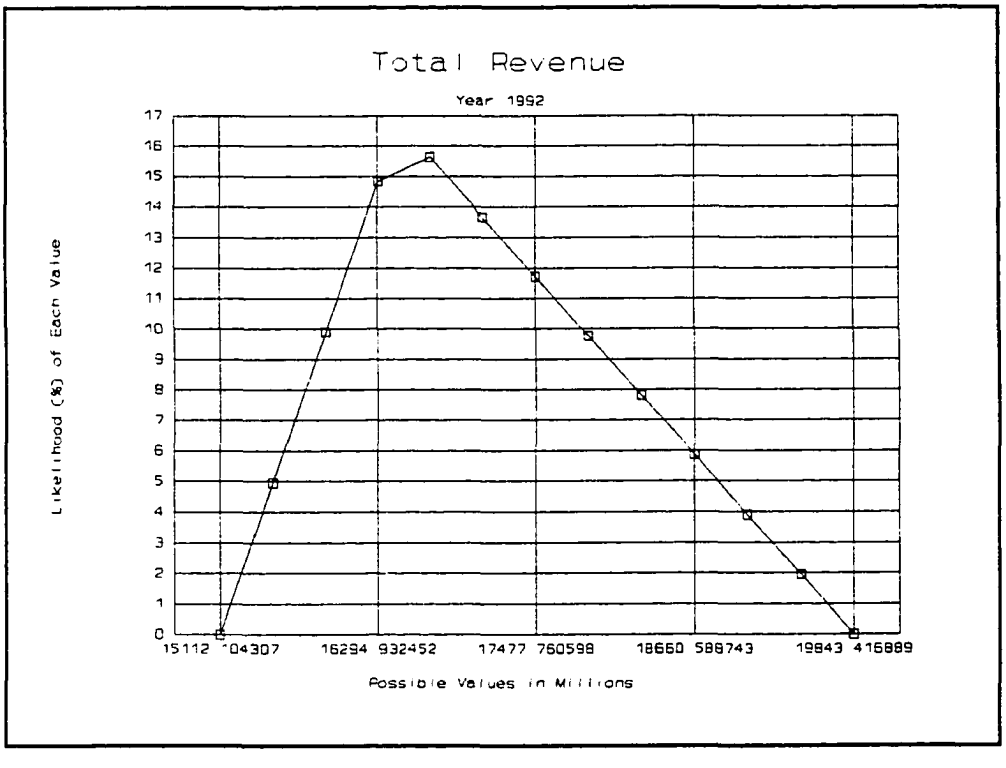
Appendix A7: 1992 Guestrooms and Gaming Revenue Correlation



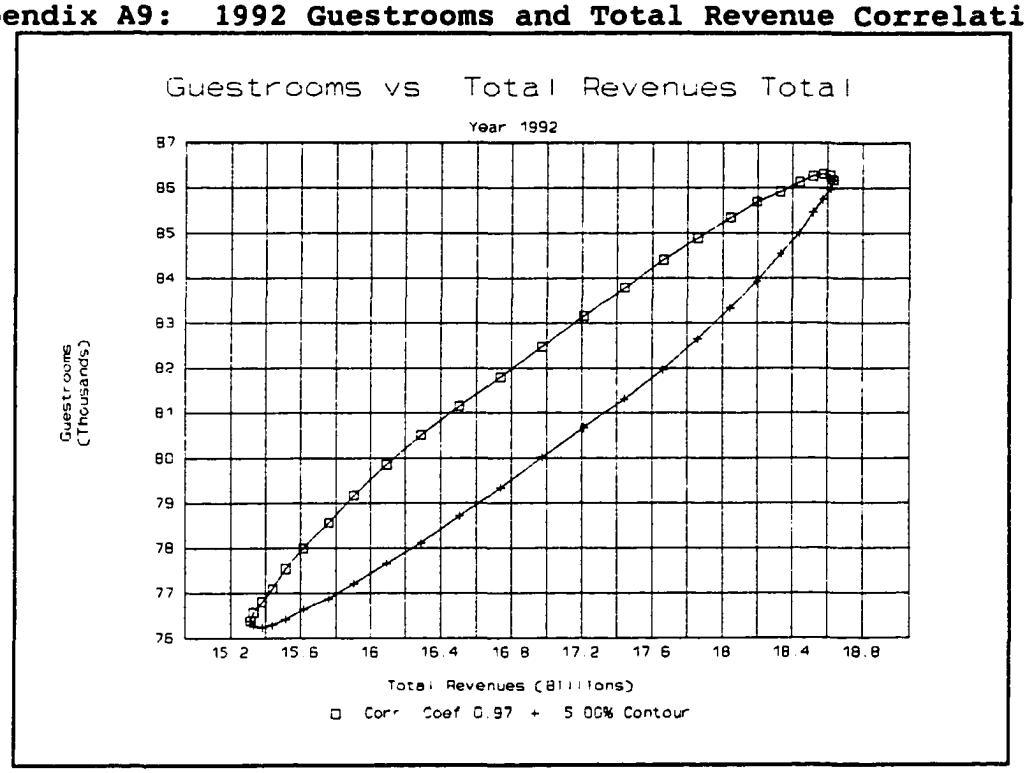


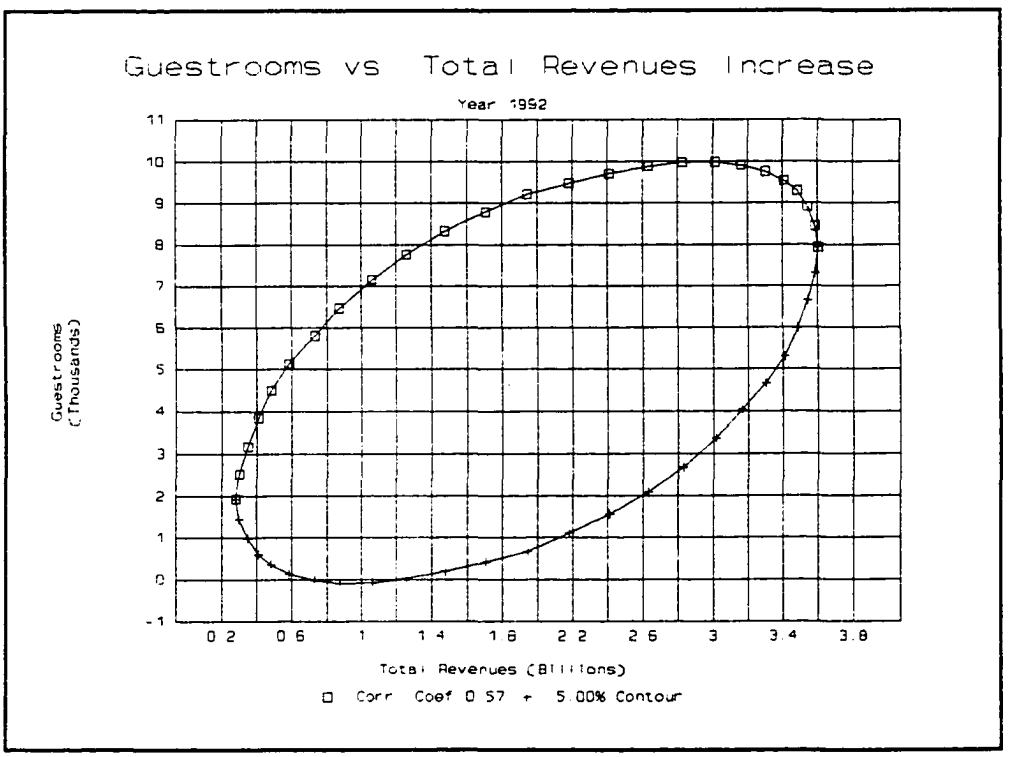
Appendix A8: 1992 Total Revenue



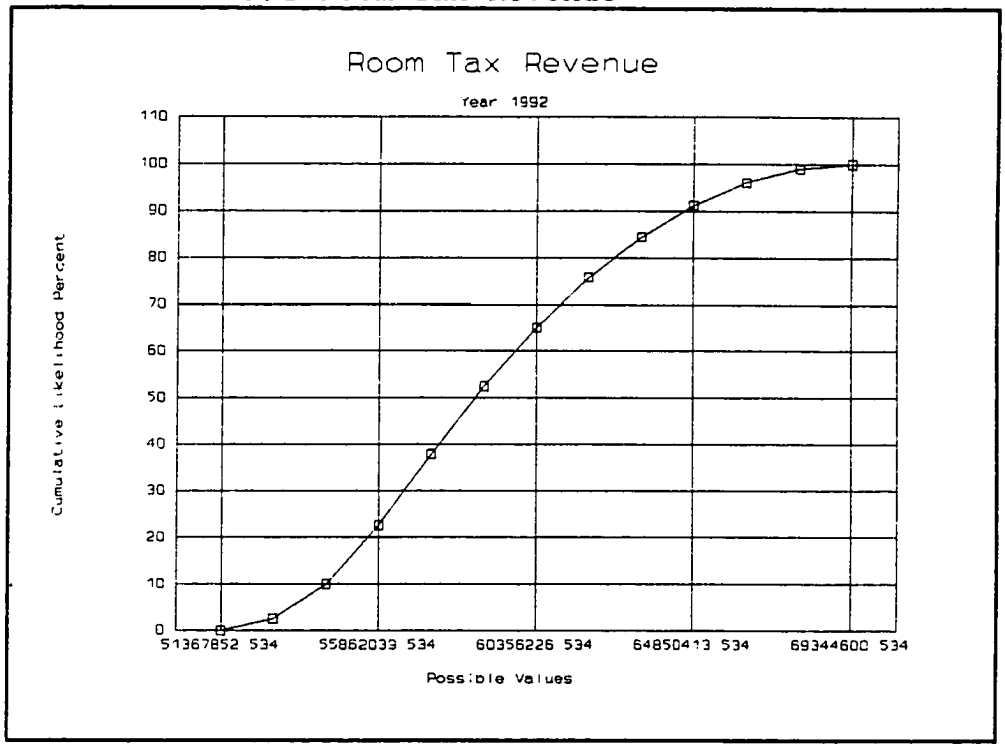


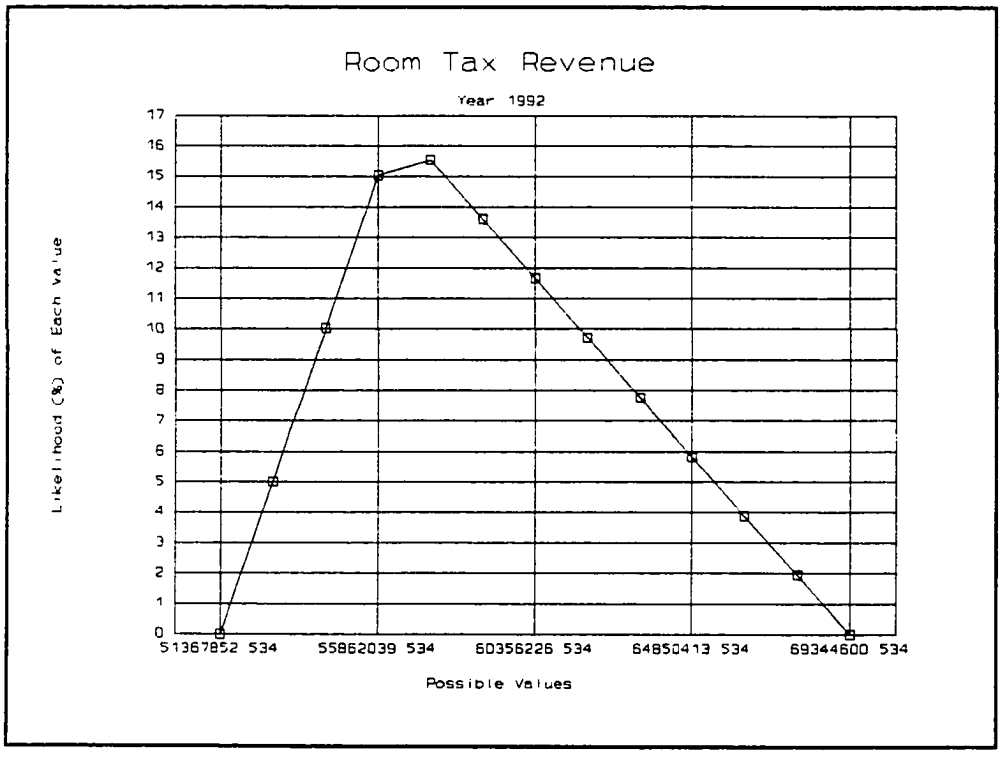
Appendix A9: 1992 Guestrooms and Total Revenue Correlation



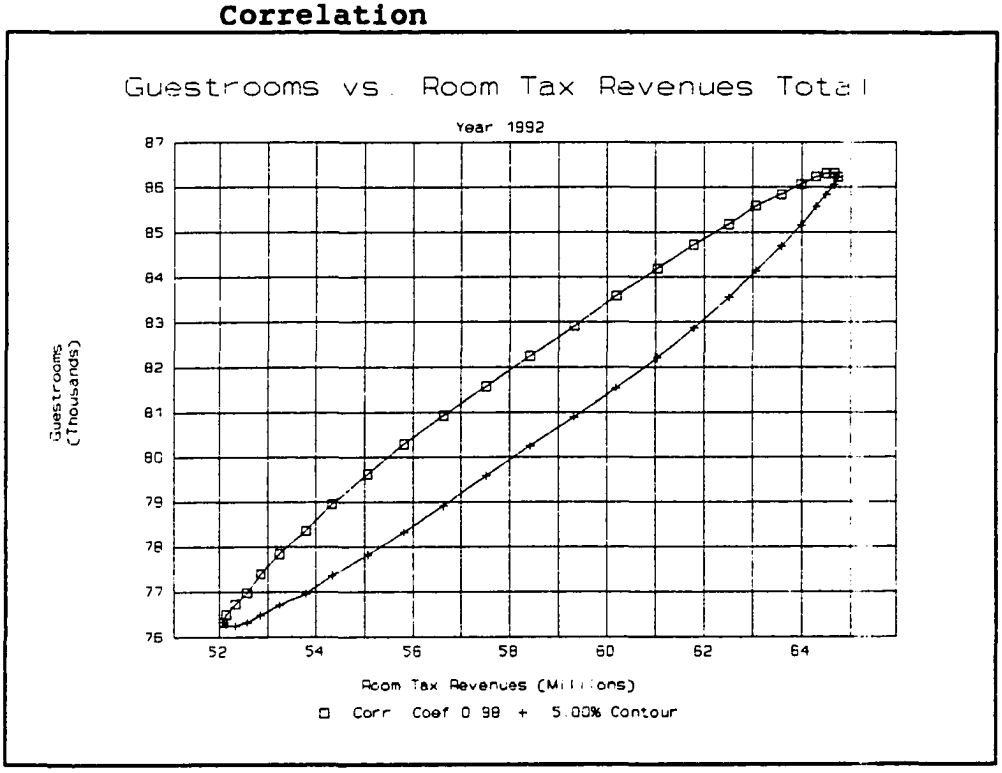


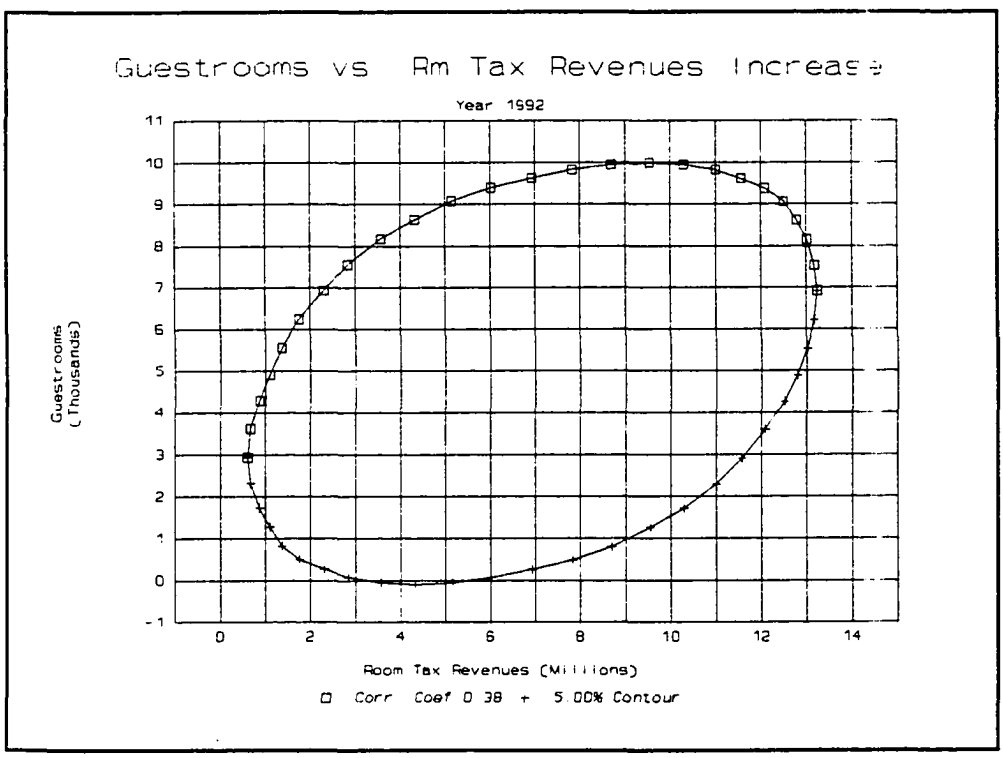
Appendix A10: 1992 Room Tax Revenue



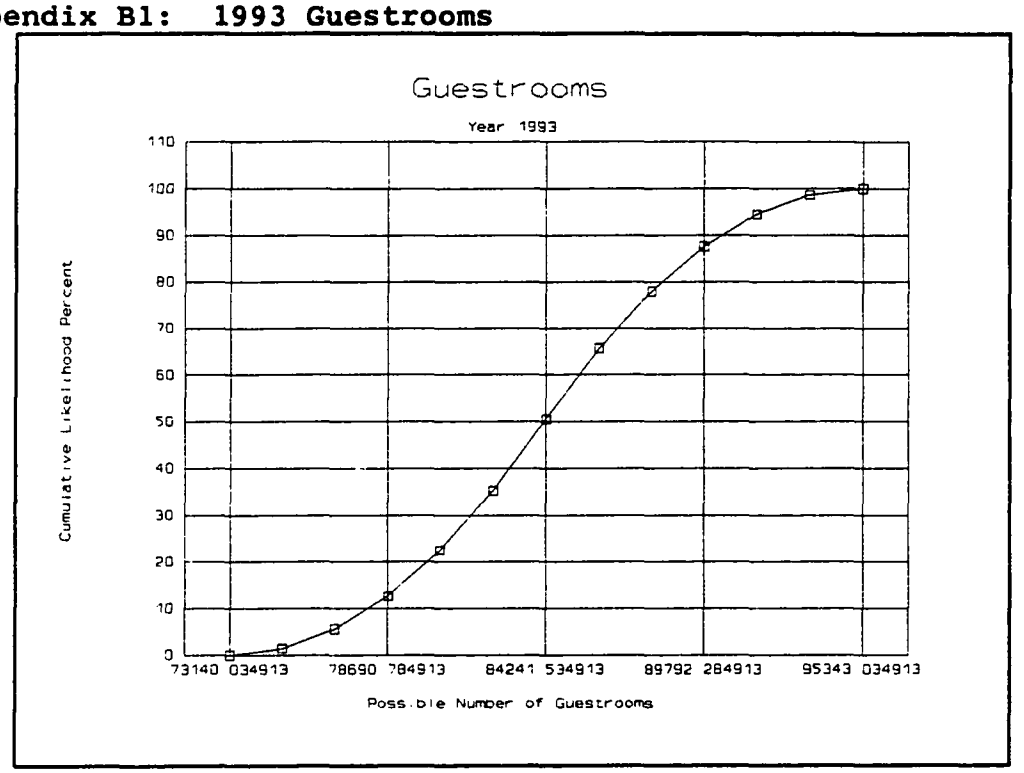


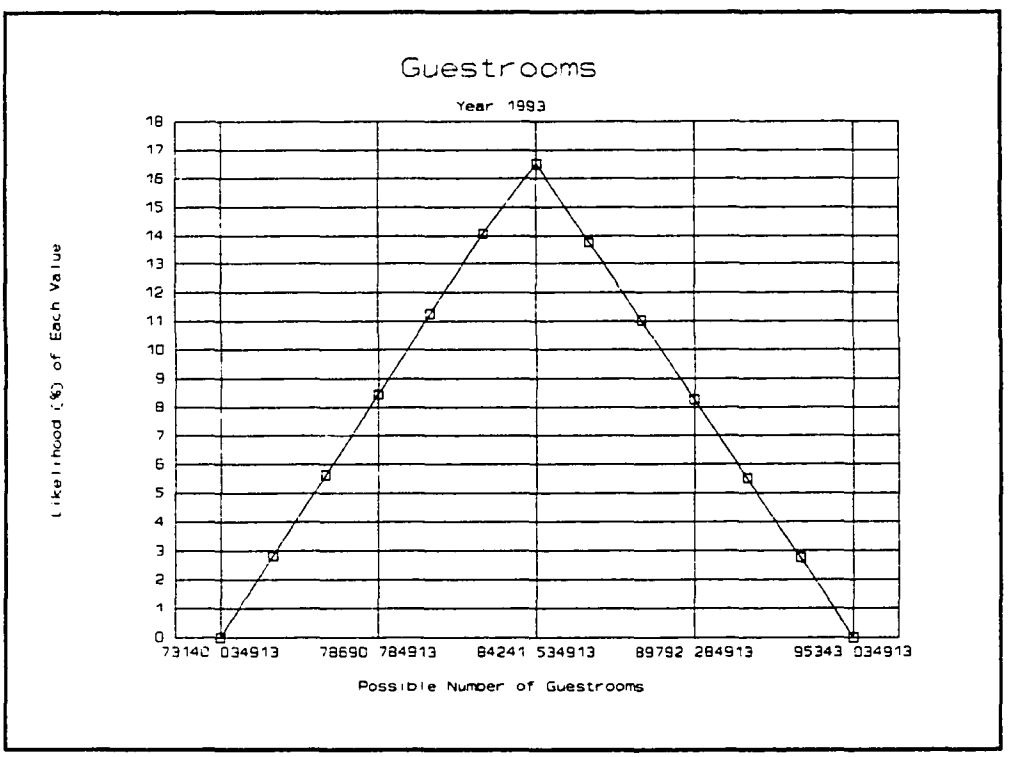
Appendix A11: 1992 Guestrooms and Room Tax Revenue Correlation



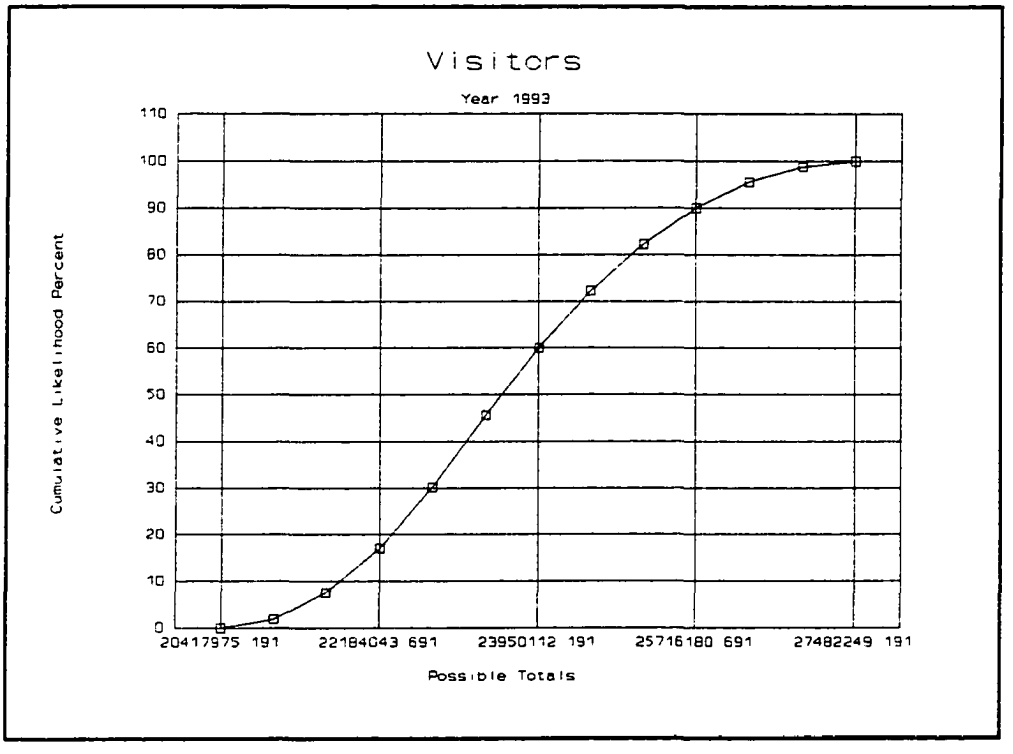


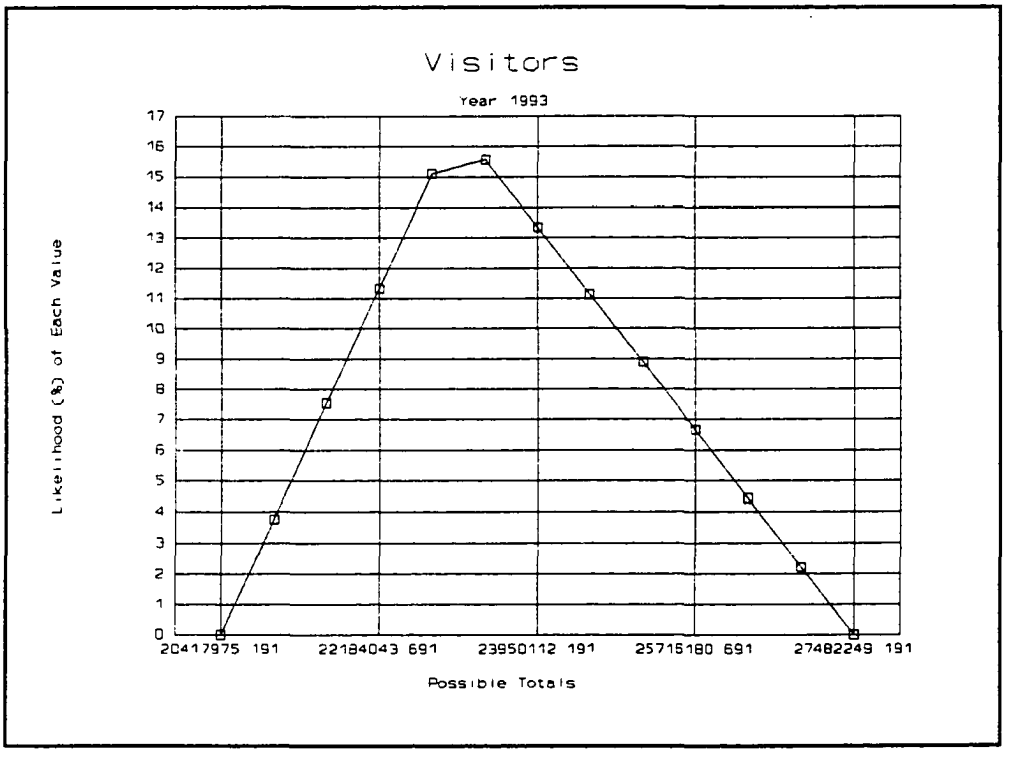
Appendix B1: 1993 Guestrooms



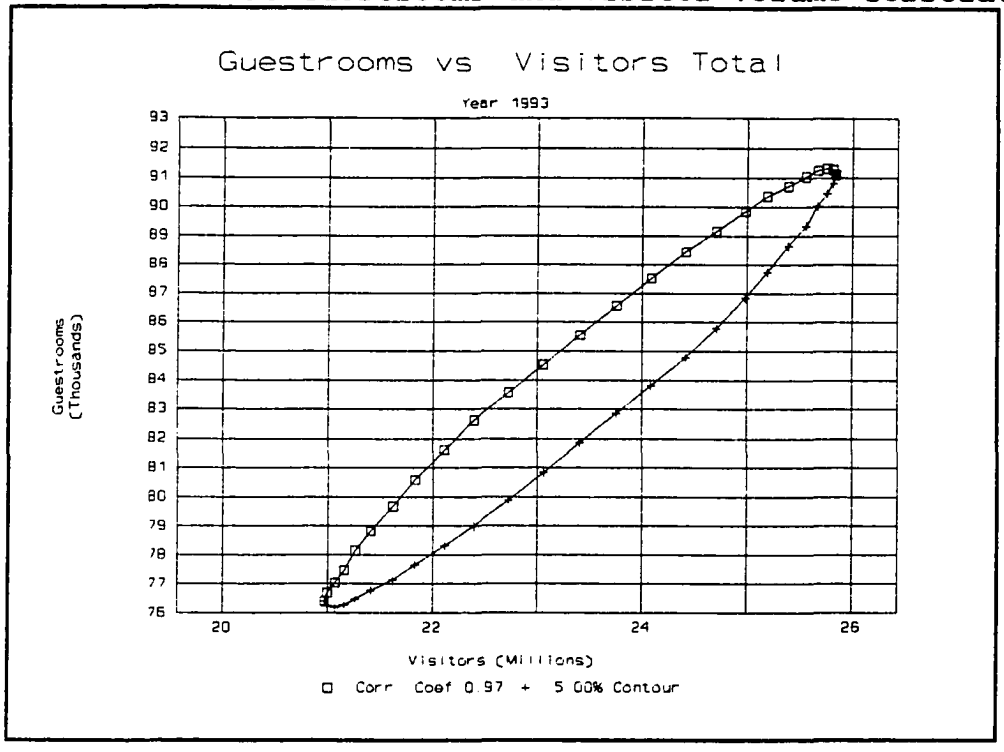


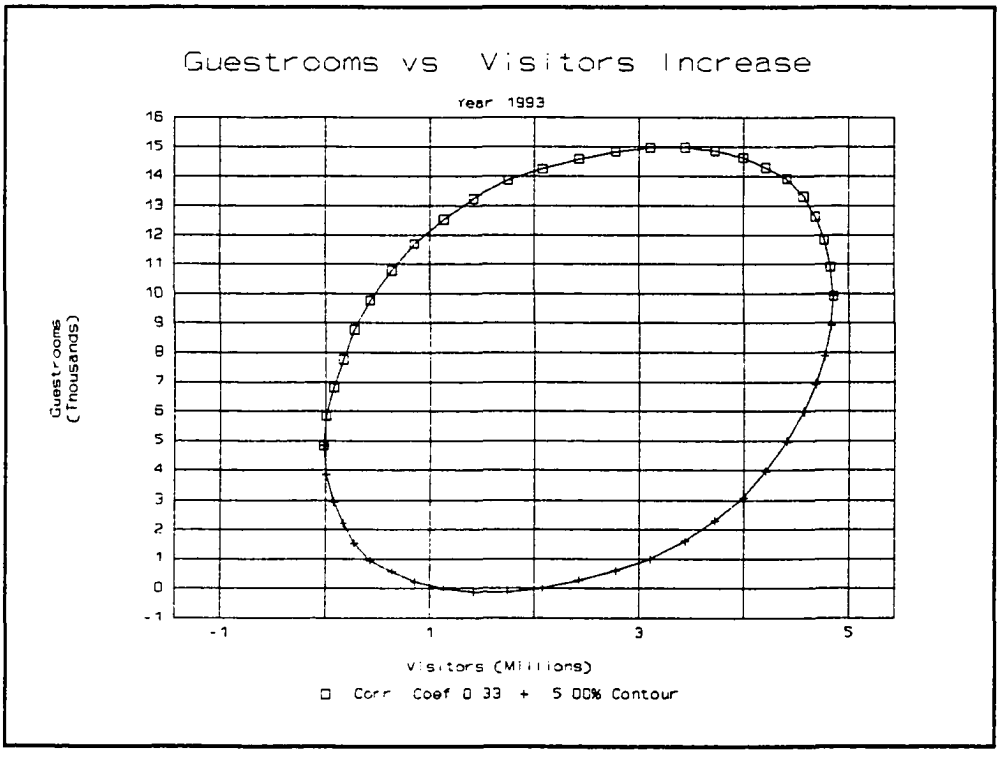
Appendix B2: 1993 Visitor Counts



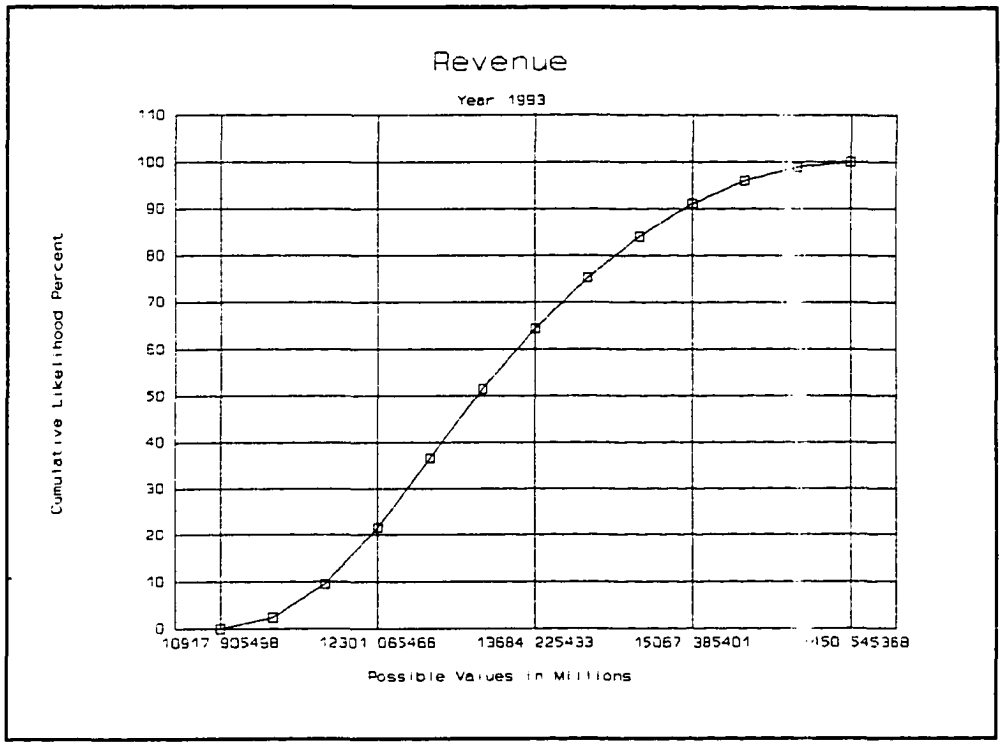


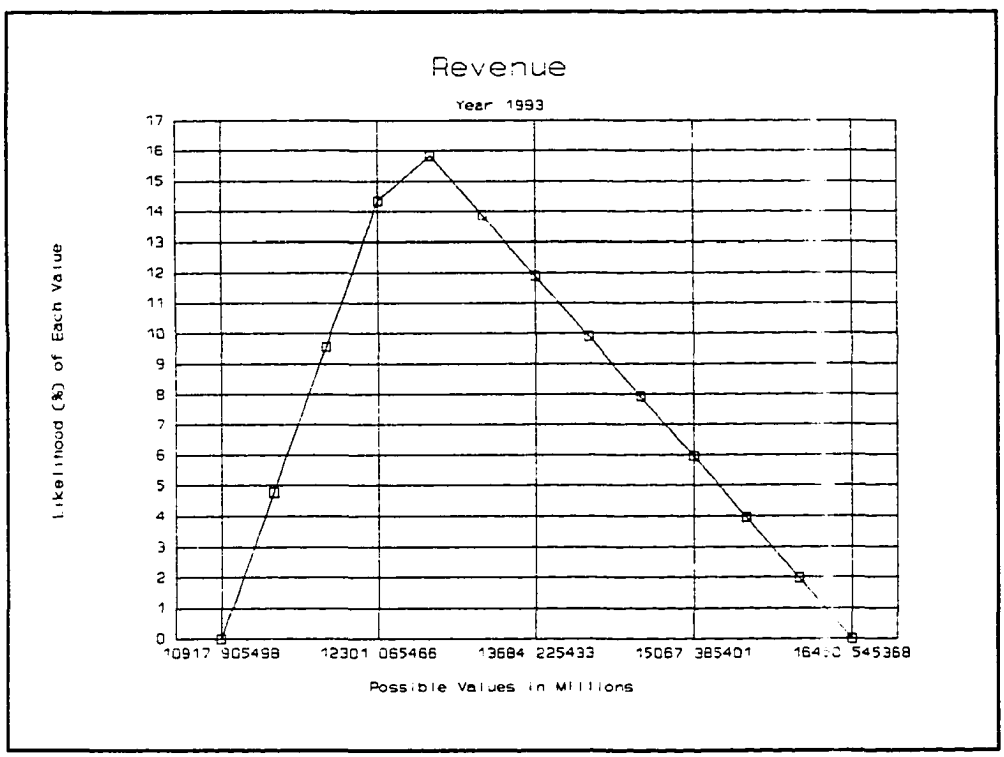
Appendix B3: 1993 Guestrooms and Visitor Volume Correlation



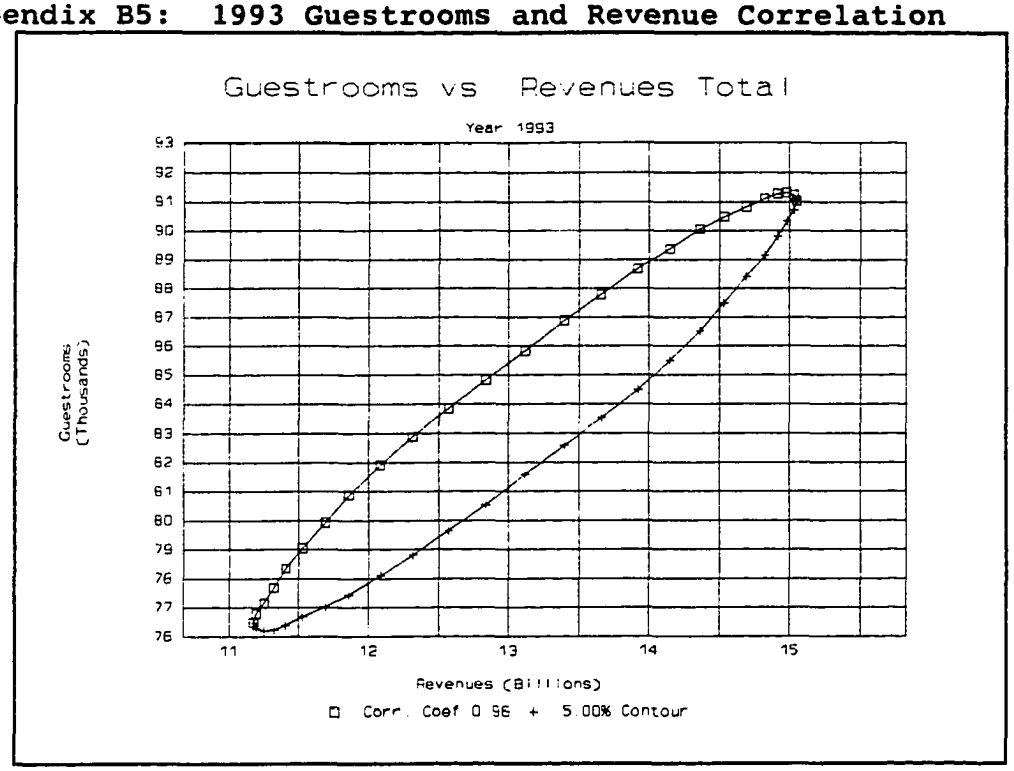


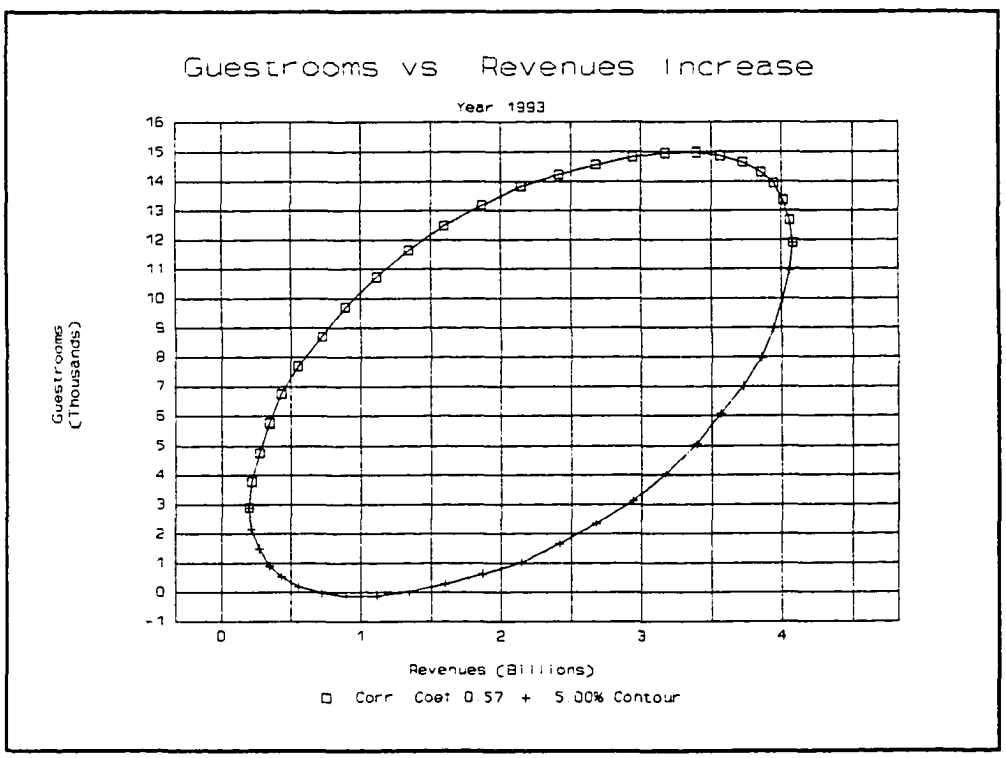
Appendix B4: 1993 Revenue



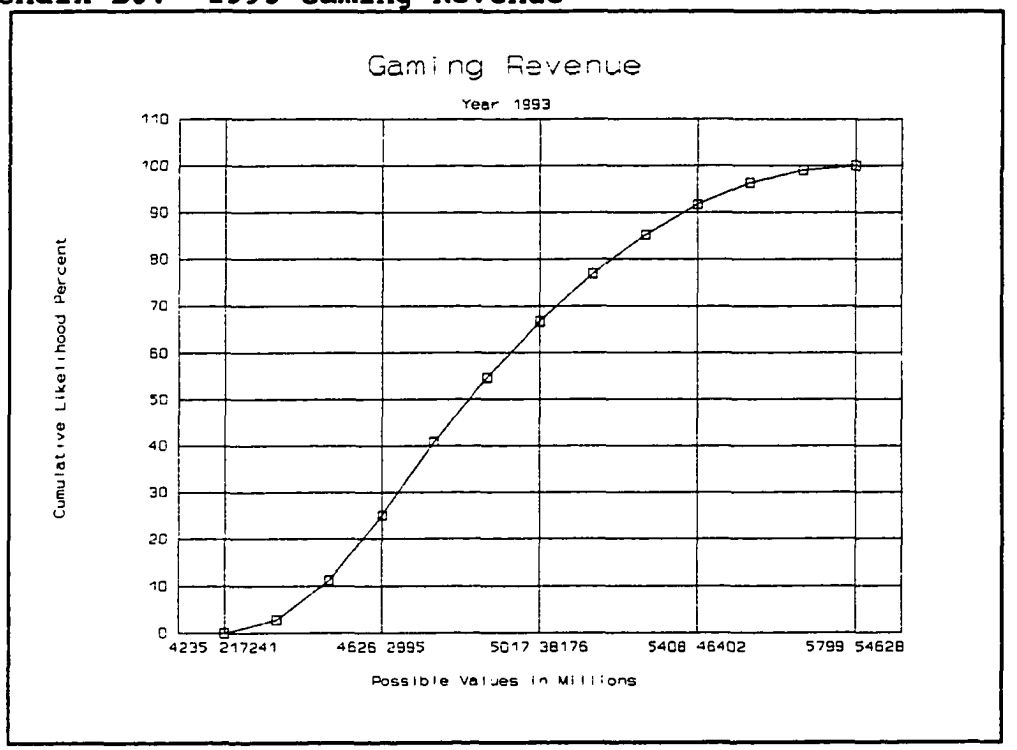


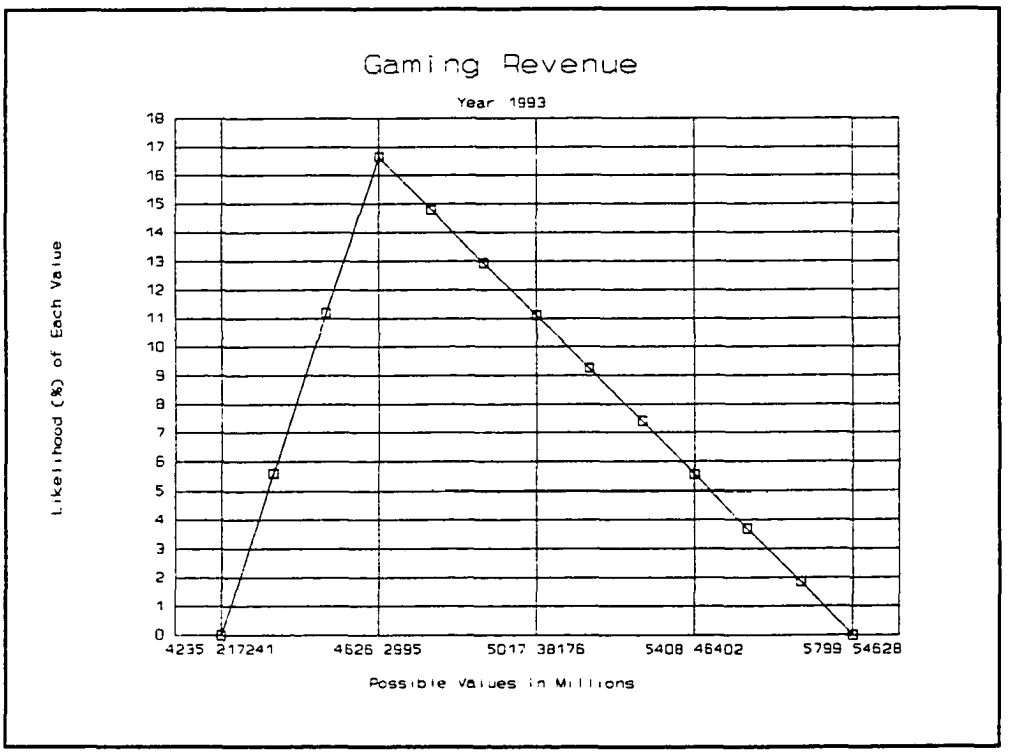
Appendix B5: 1993 Guestrooms and Revenue Correlation



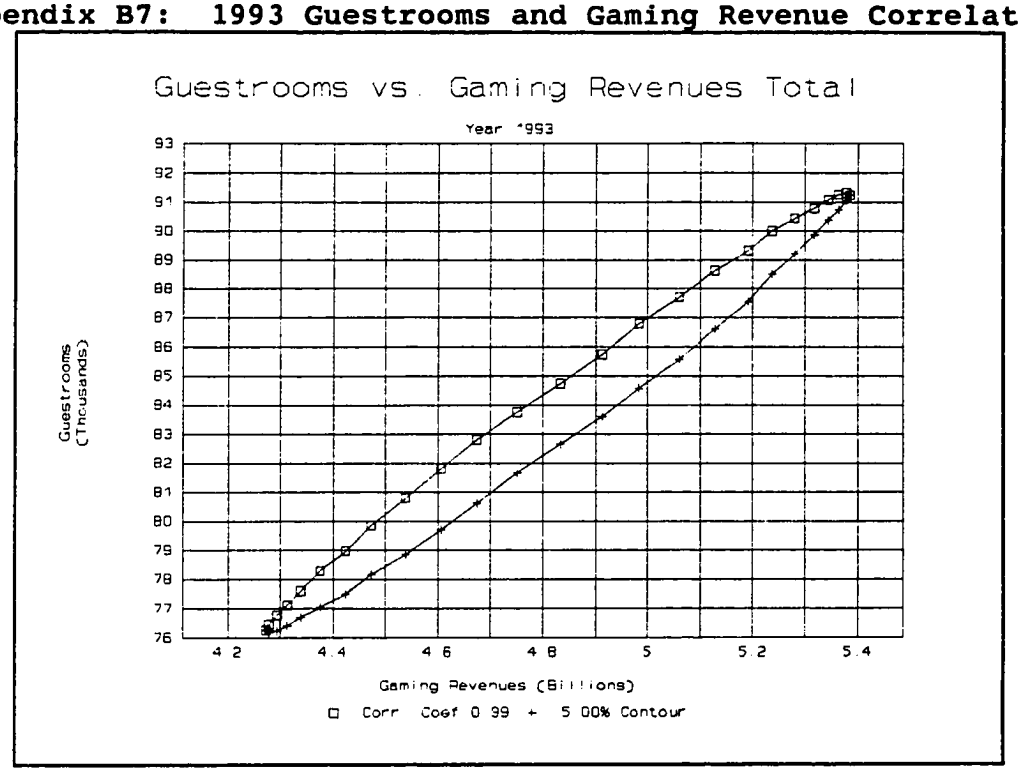


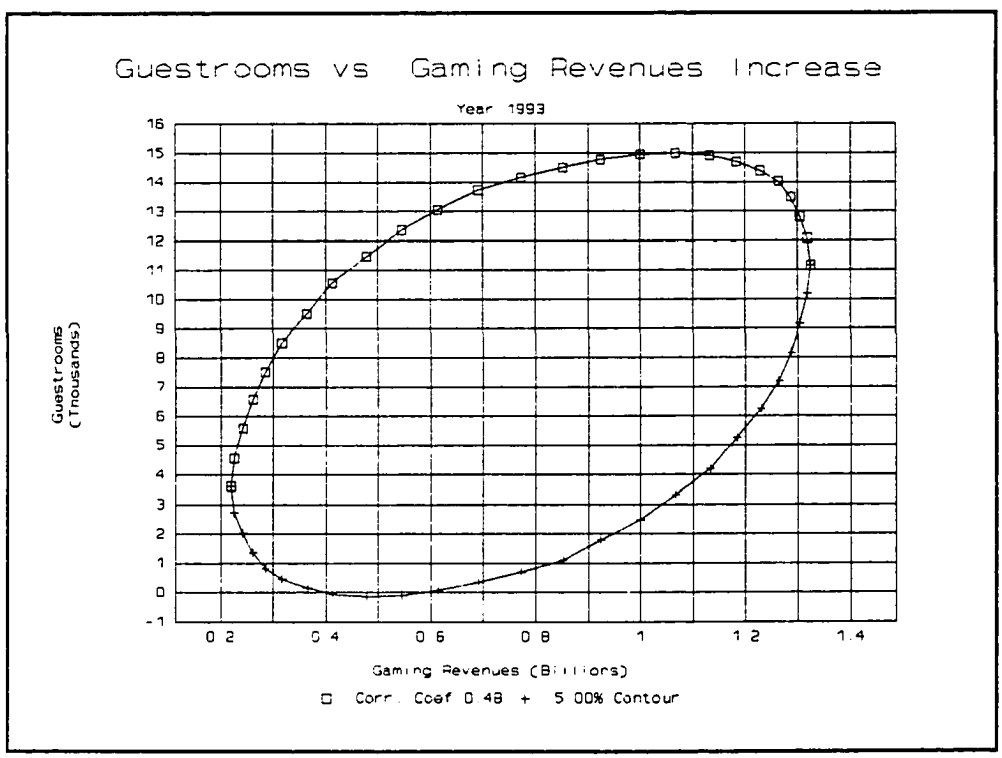
Appendix B6: 1993 Gaming Revenue



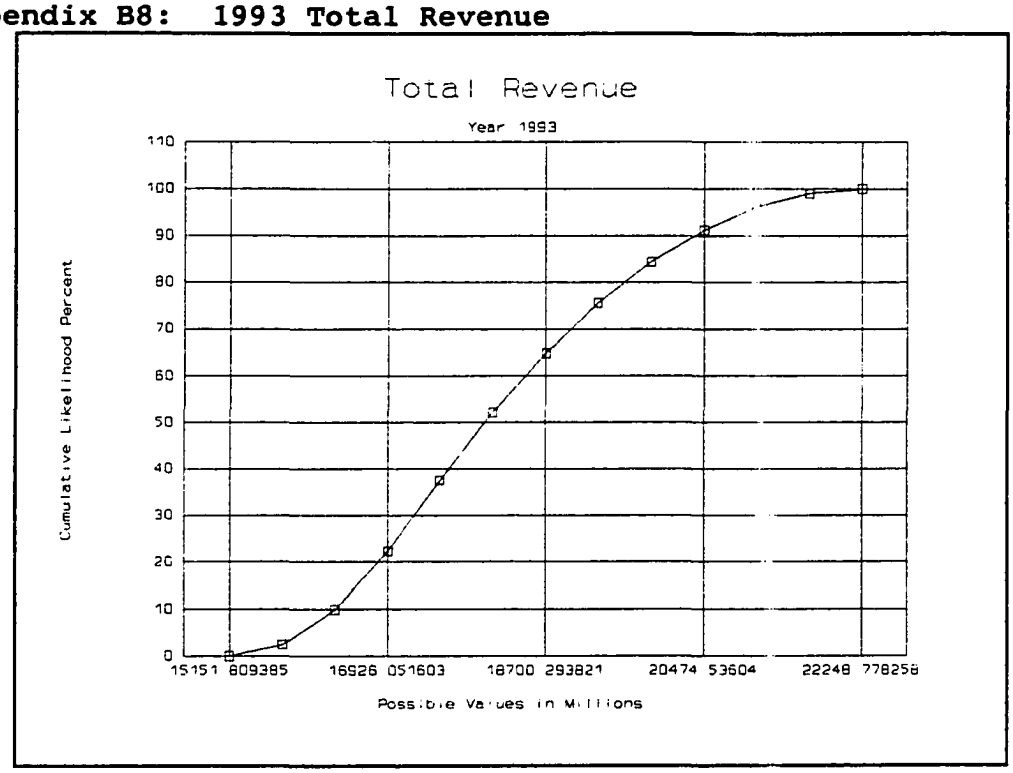


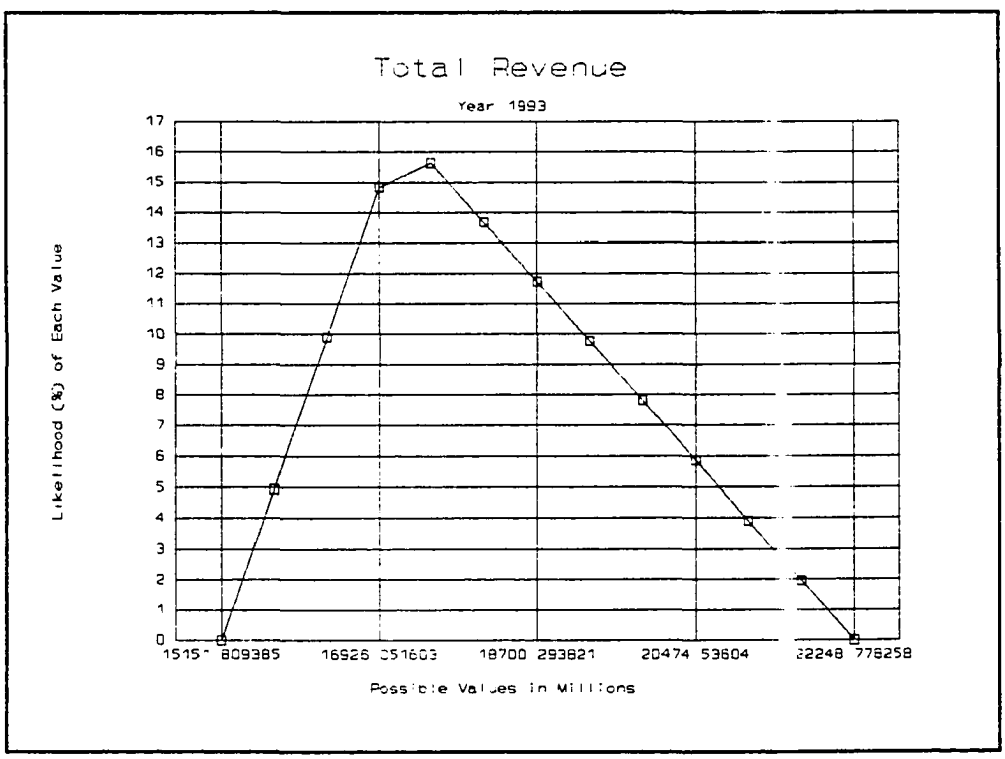
Appendix B7: 1993 Guestrooms and Gaming Revenue Correlation



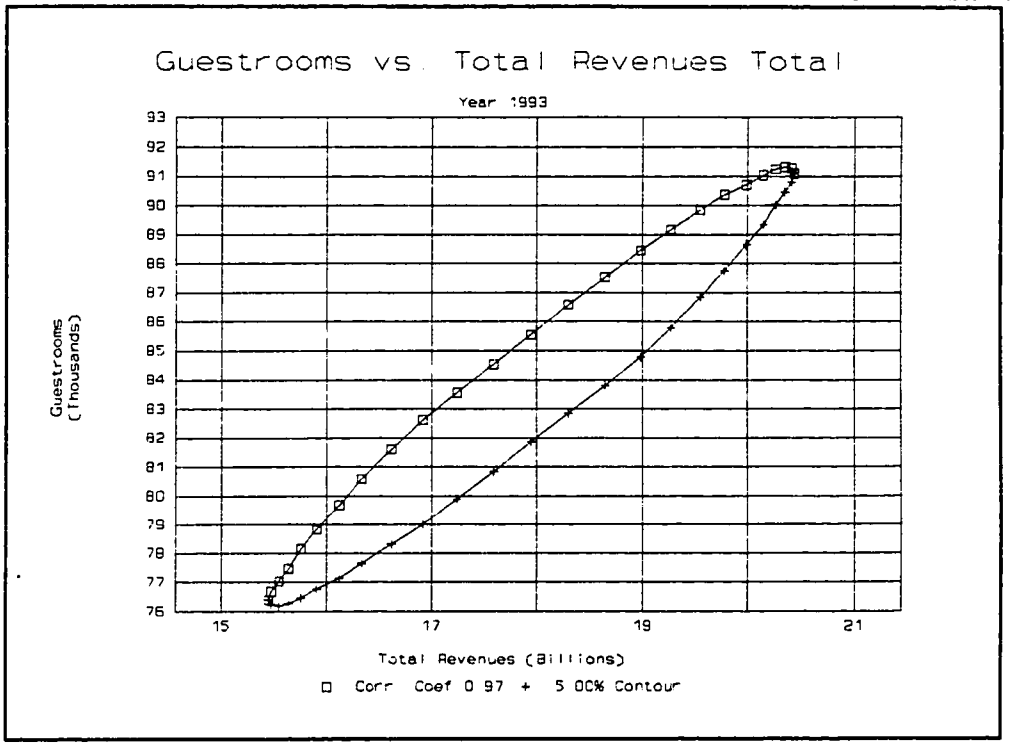


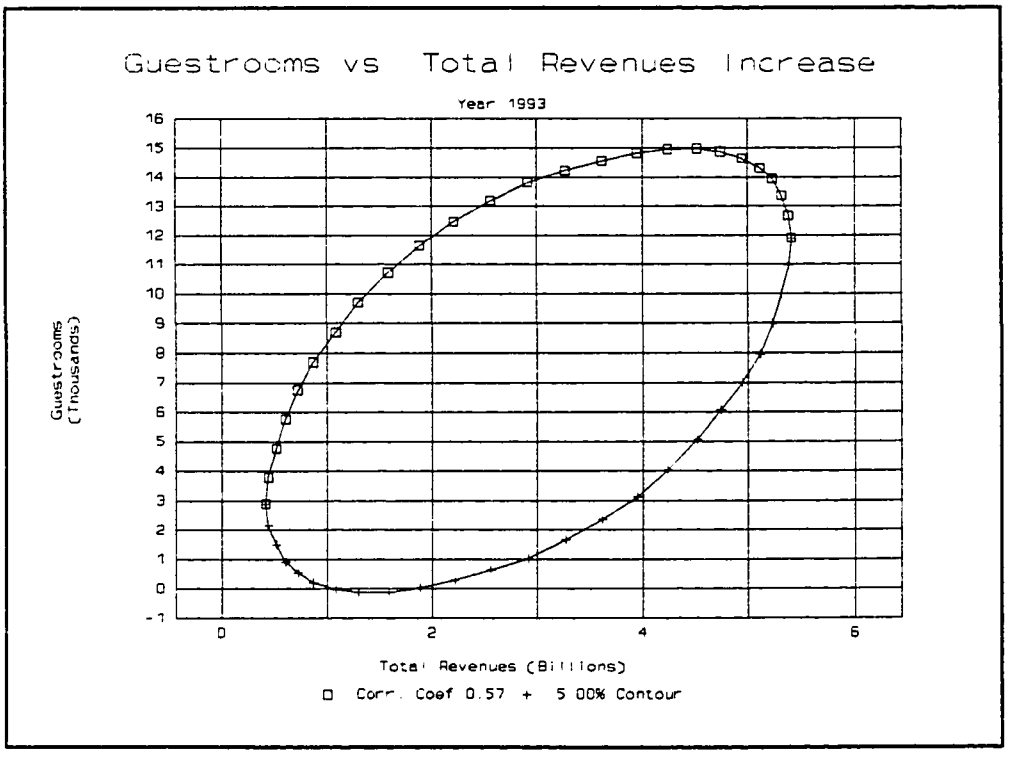
Appendix B8: 1993 Total Revenue



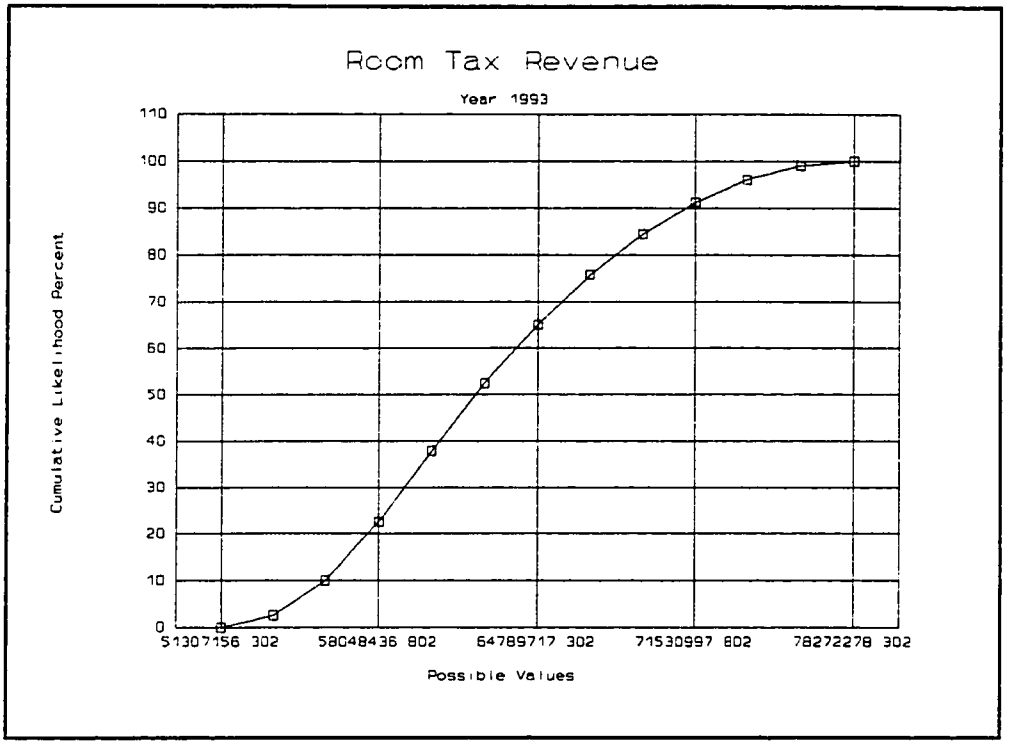


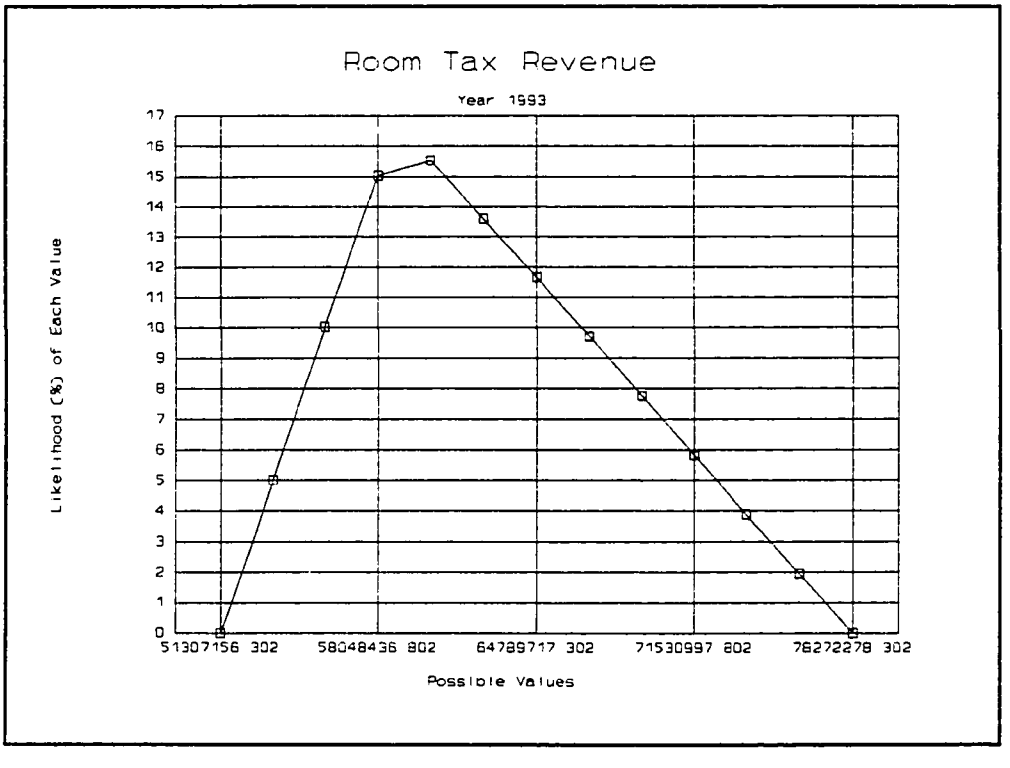
Appendix B9: 1993 Guestrooms and Total Revenue Correlation



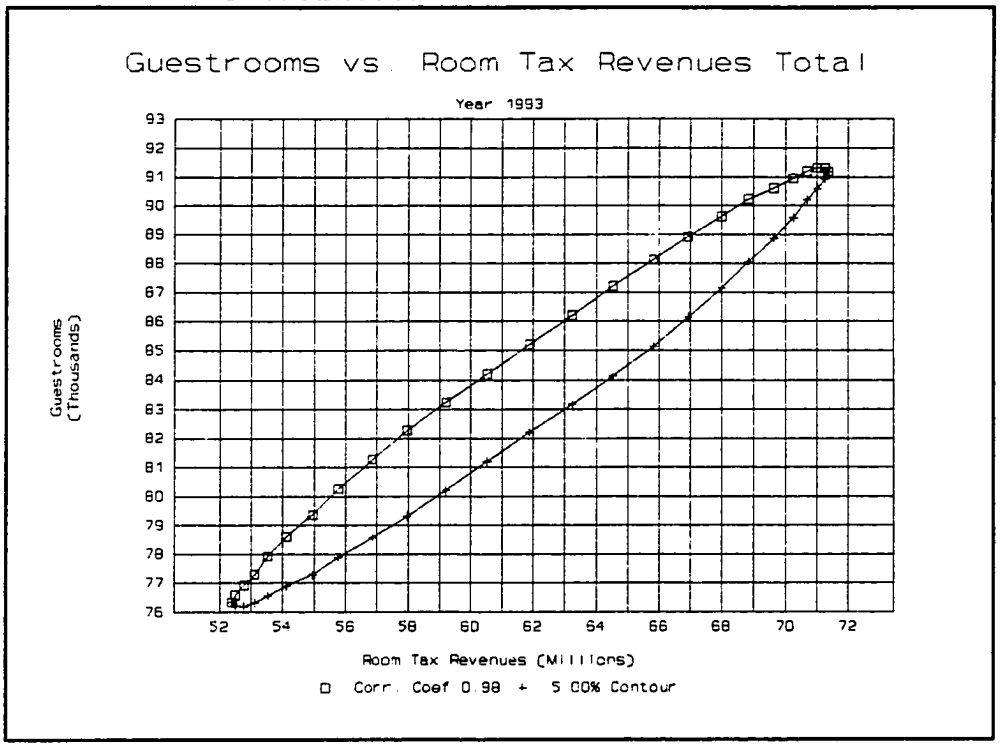


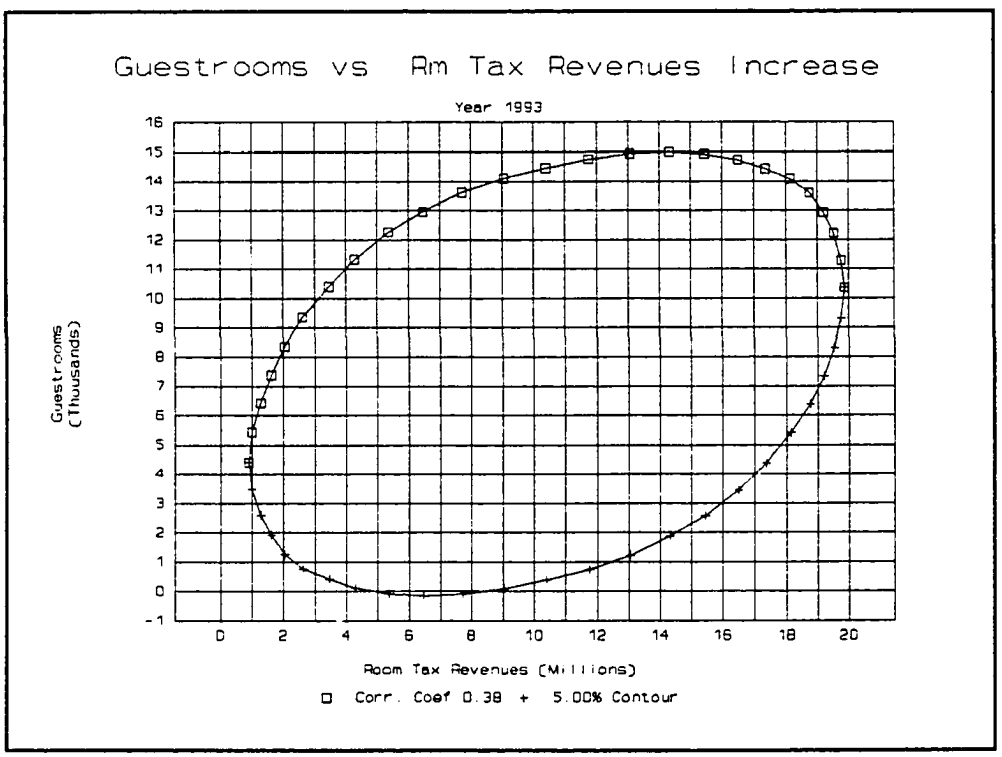
Appendix B10: 1993 Room Tax Revenue



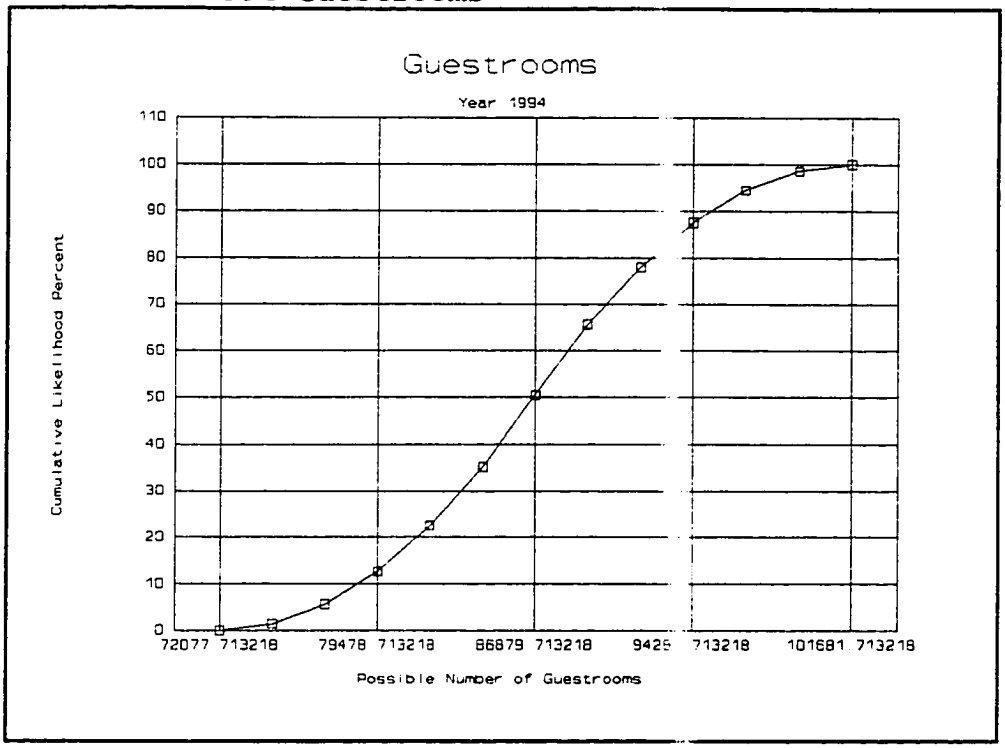


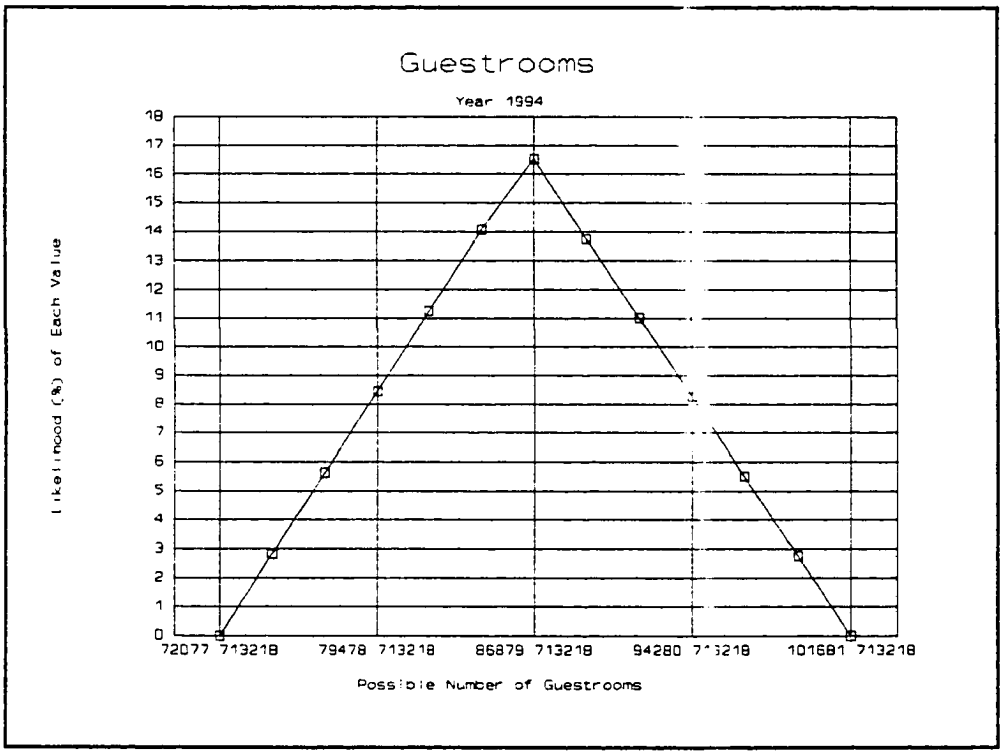
Appendix B11: 1993 Guestrooms and Room Tax Revenue Correlation



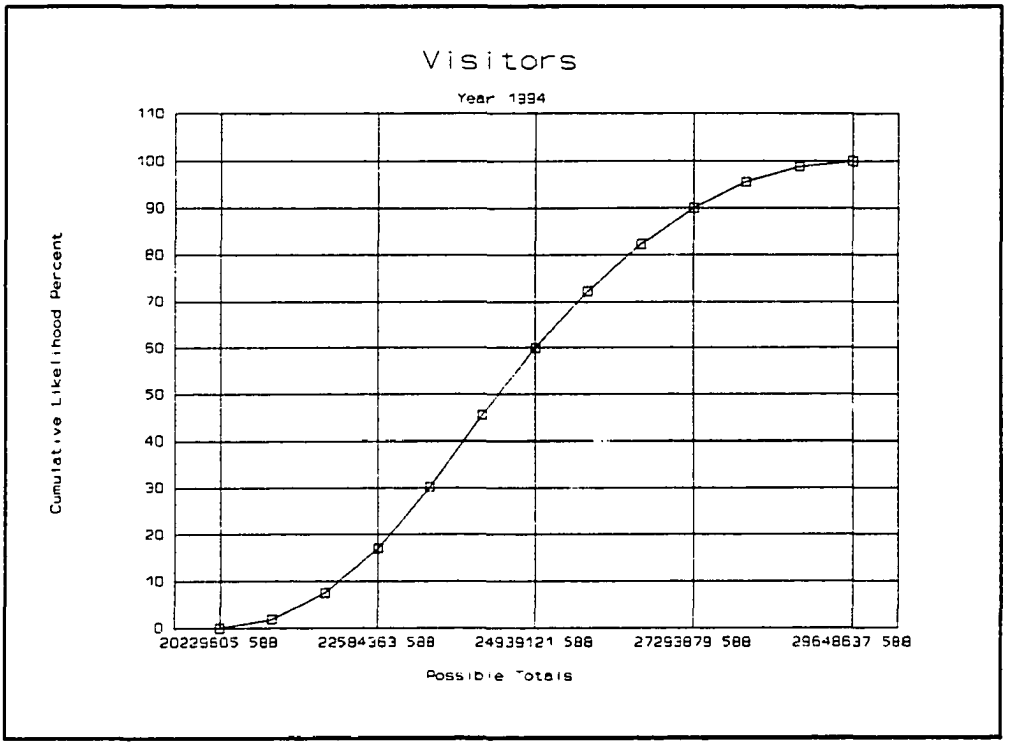


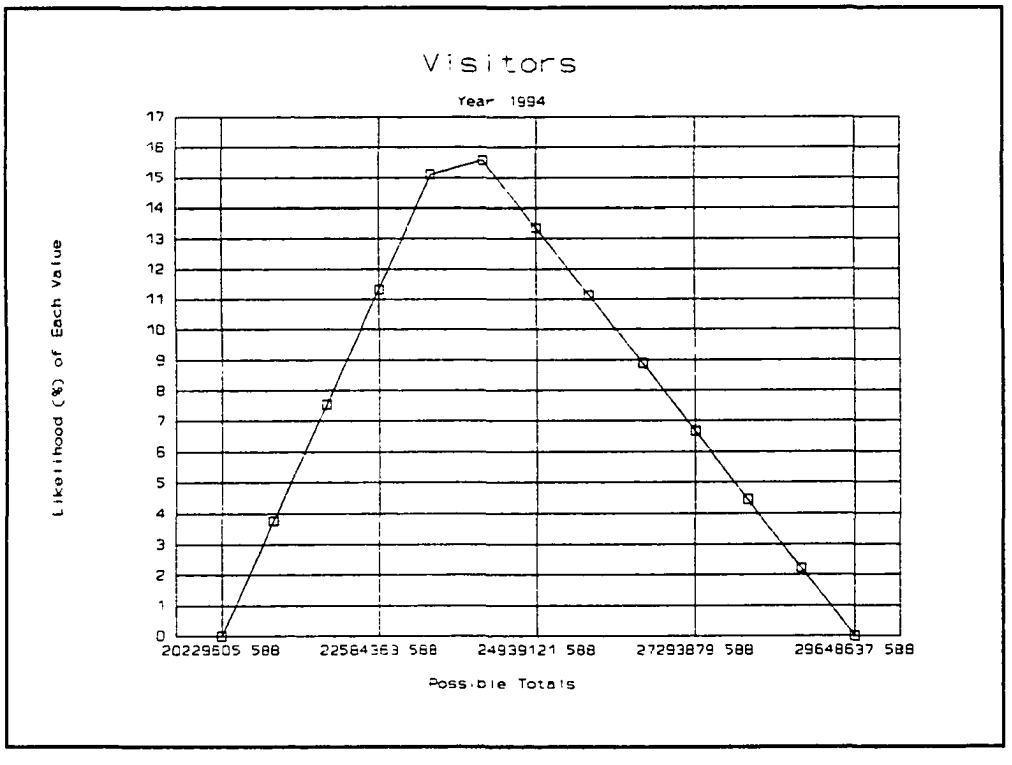
Appendix C1: 1994 Guestrooms



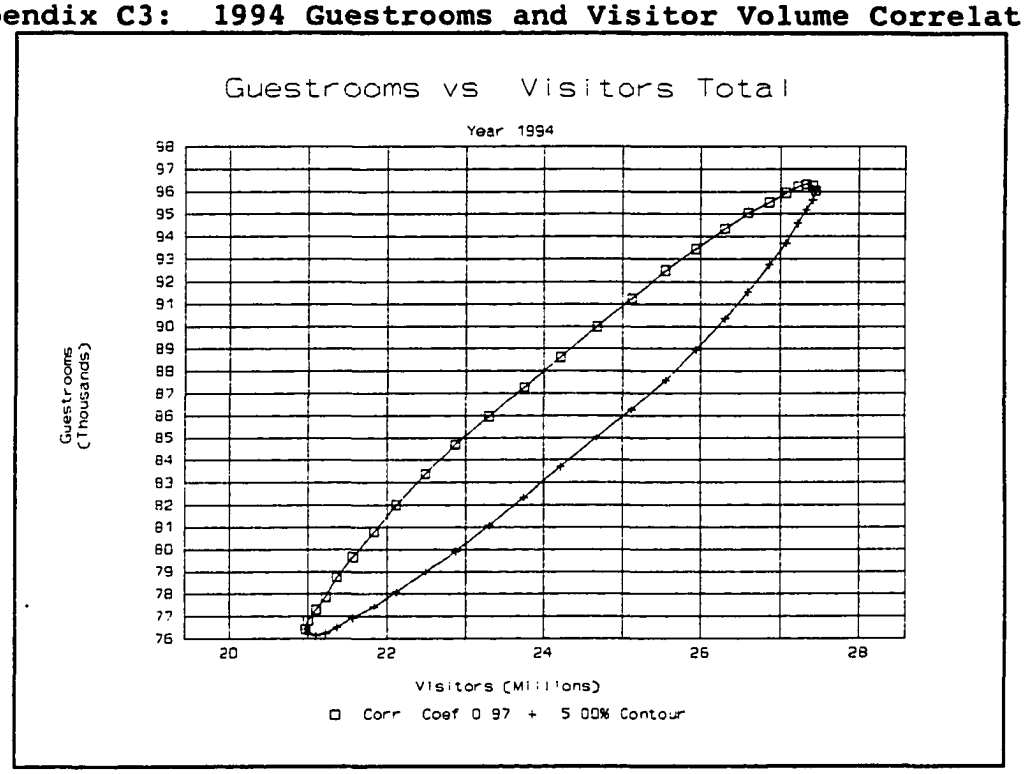


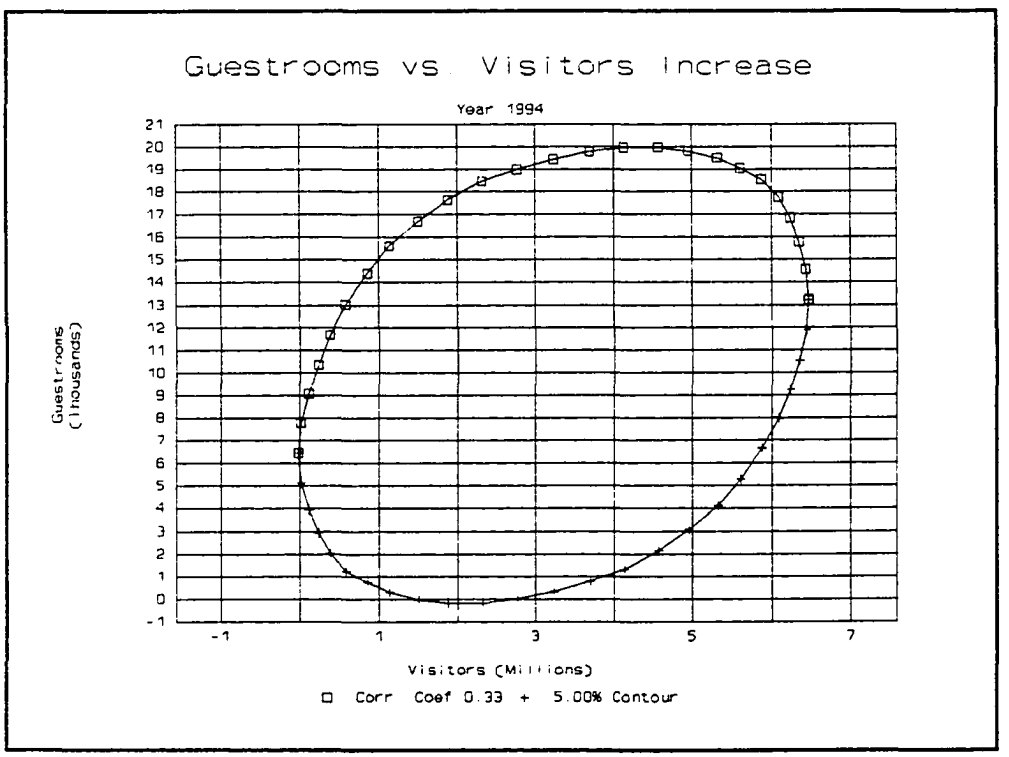
Appendix C2: 1994 Visitor Counts



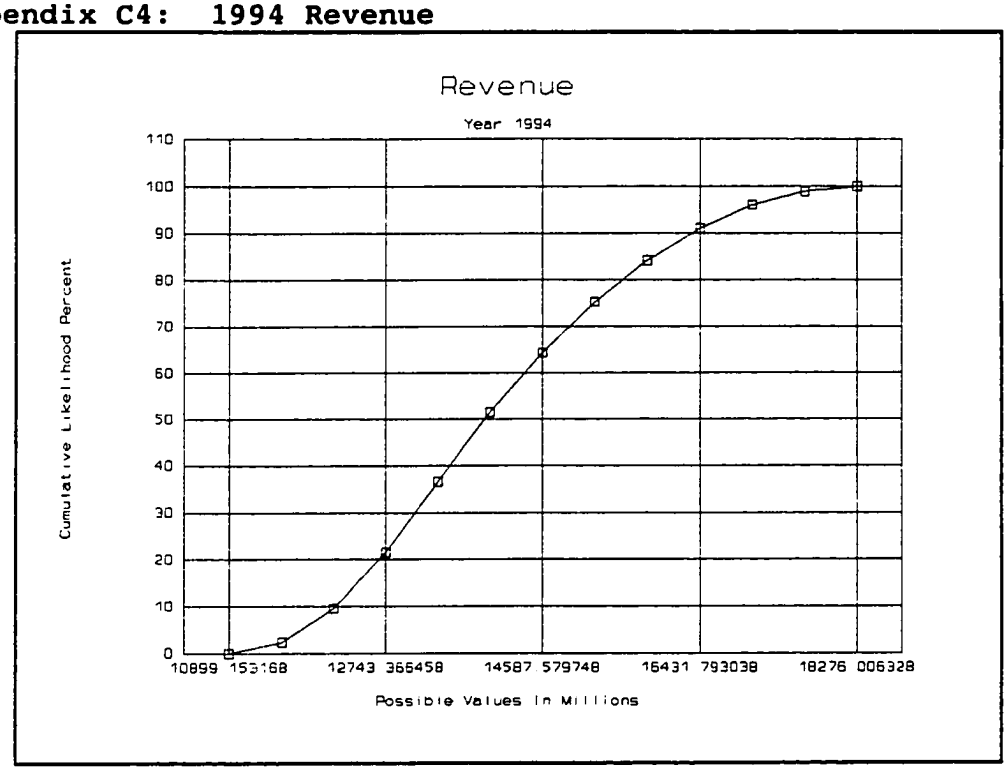


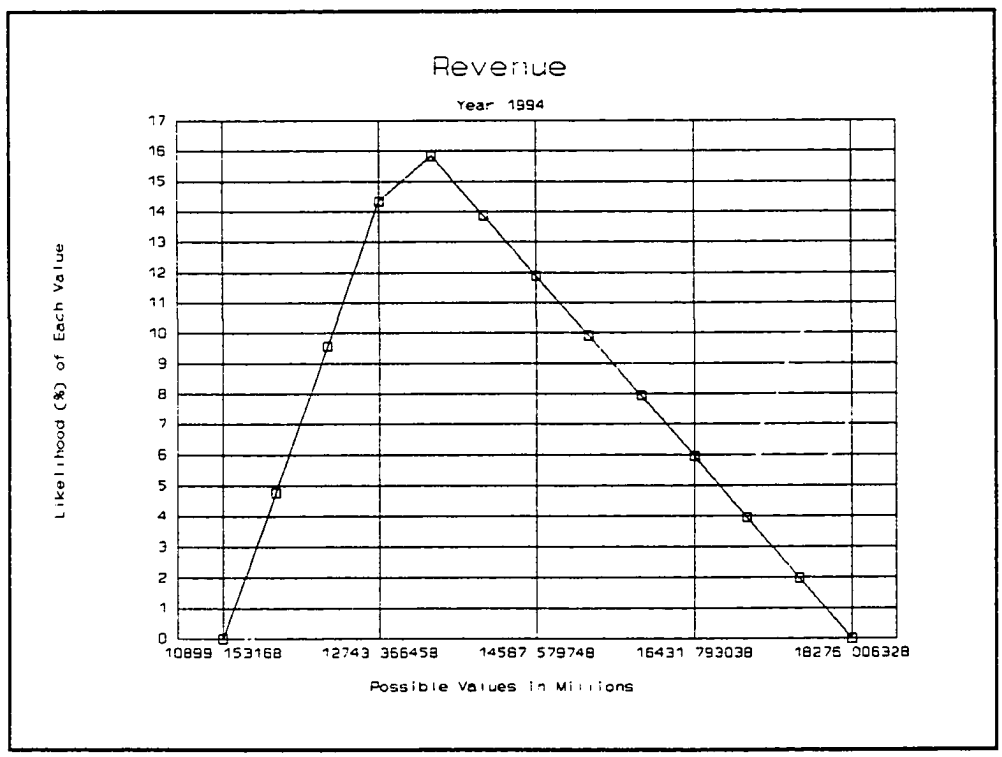
Appendix C3: 1994 Guestrooms and Visitor Volume Correlation



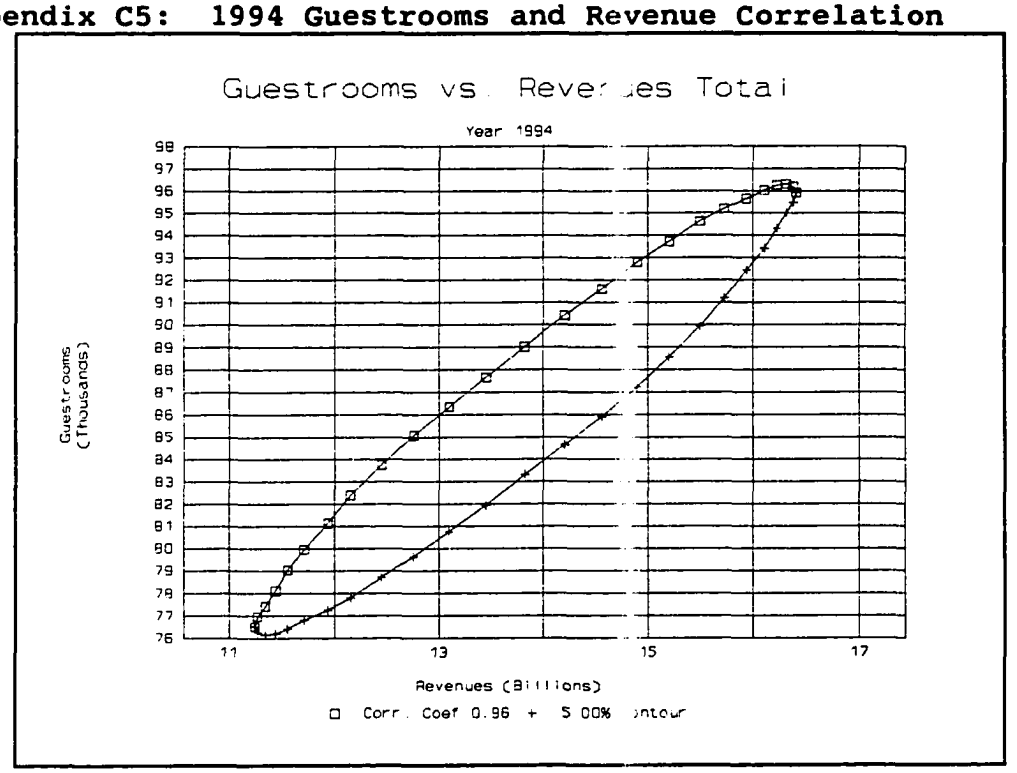


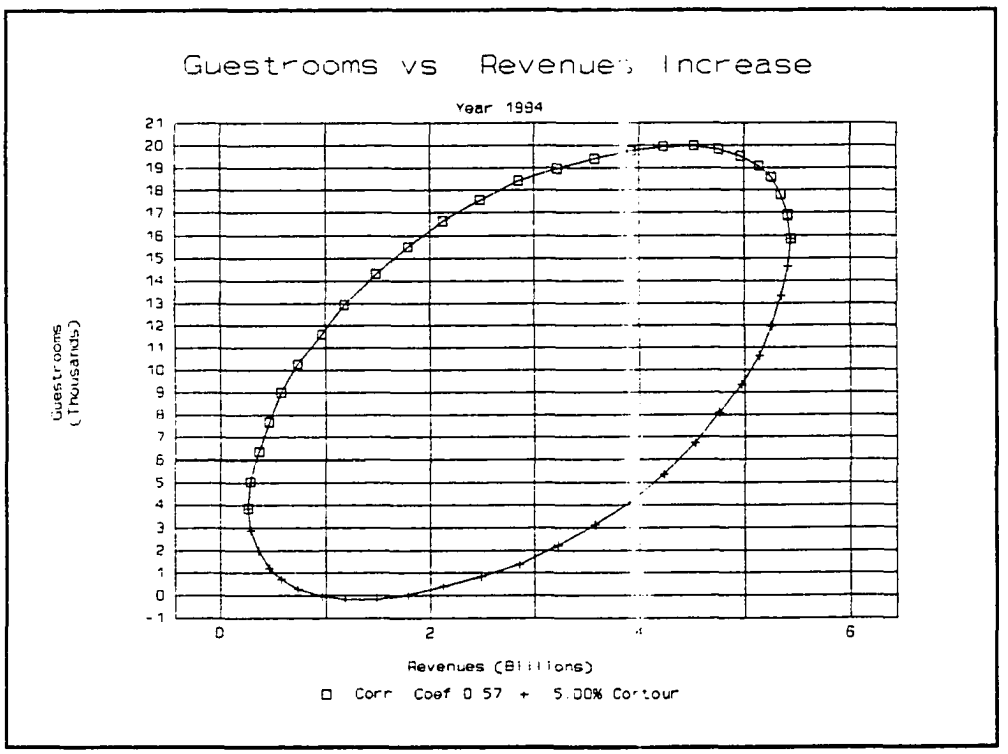
Appendix C4: 1994 Revenue



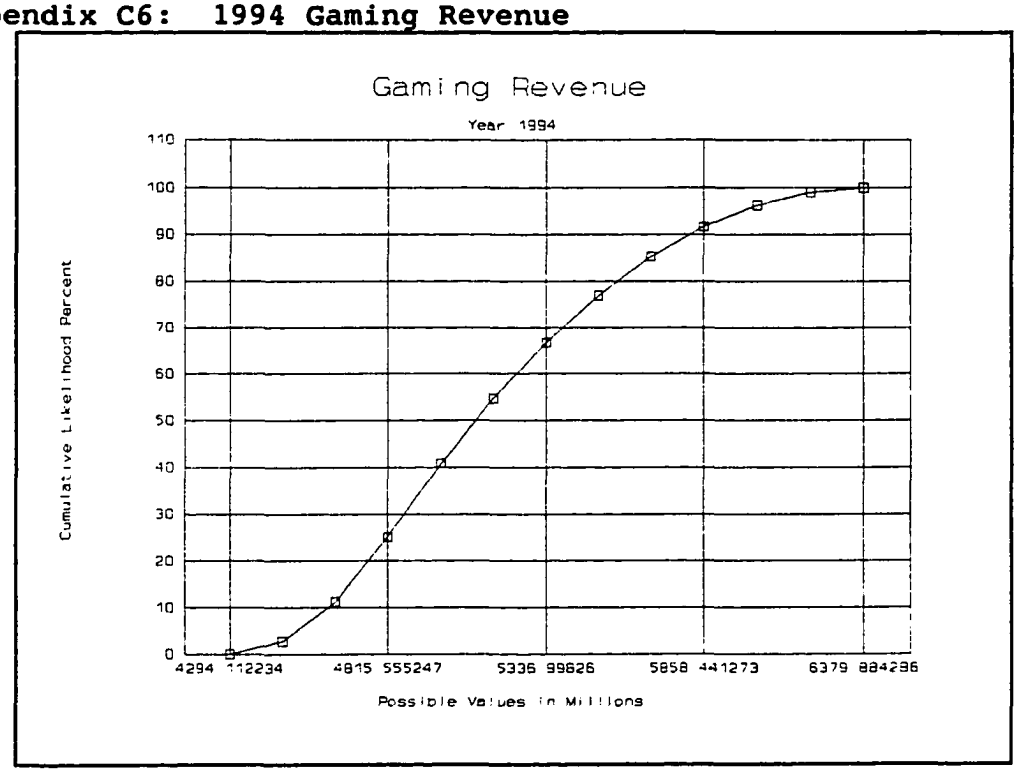


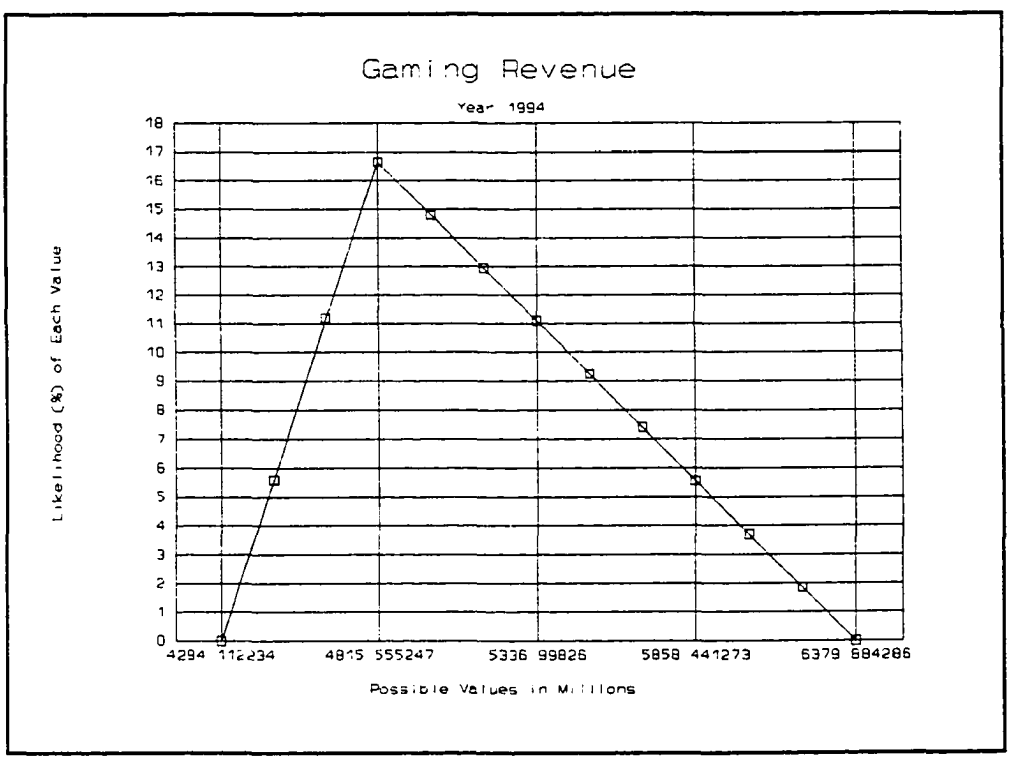
Appendix C5: 1994 Guestrooms and Revenue Correlation



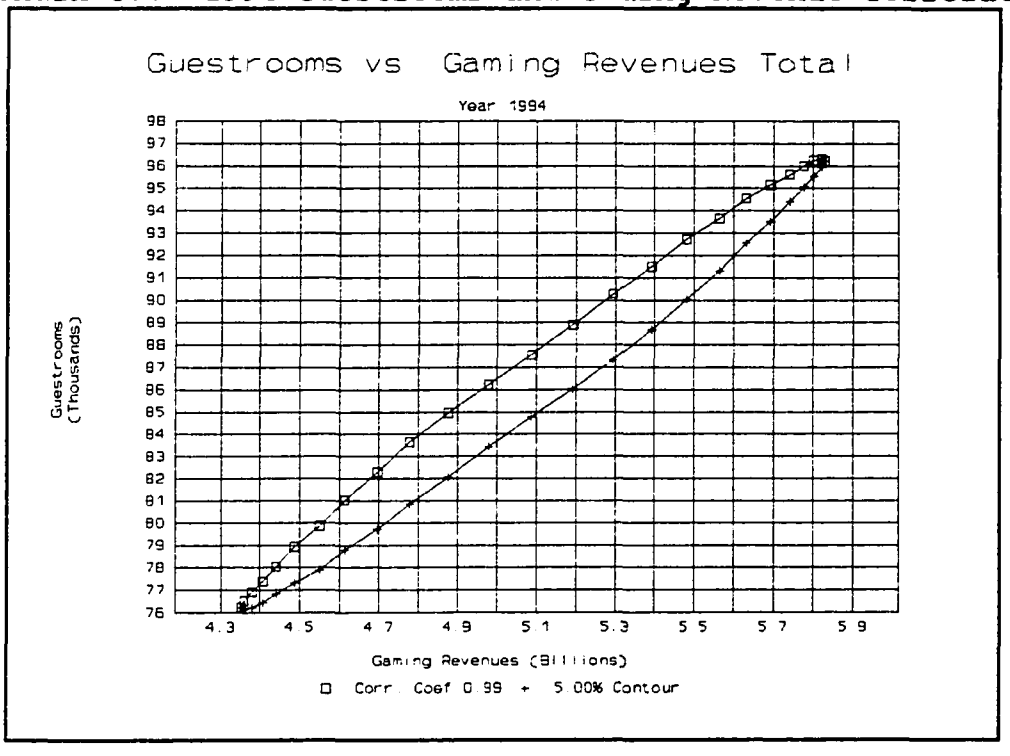


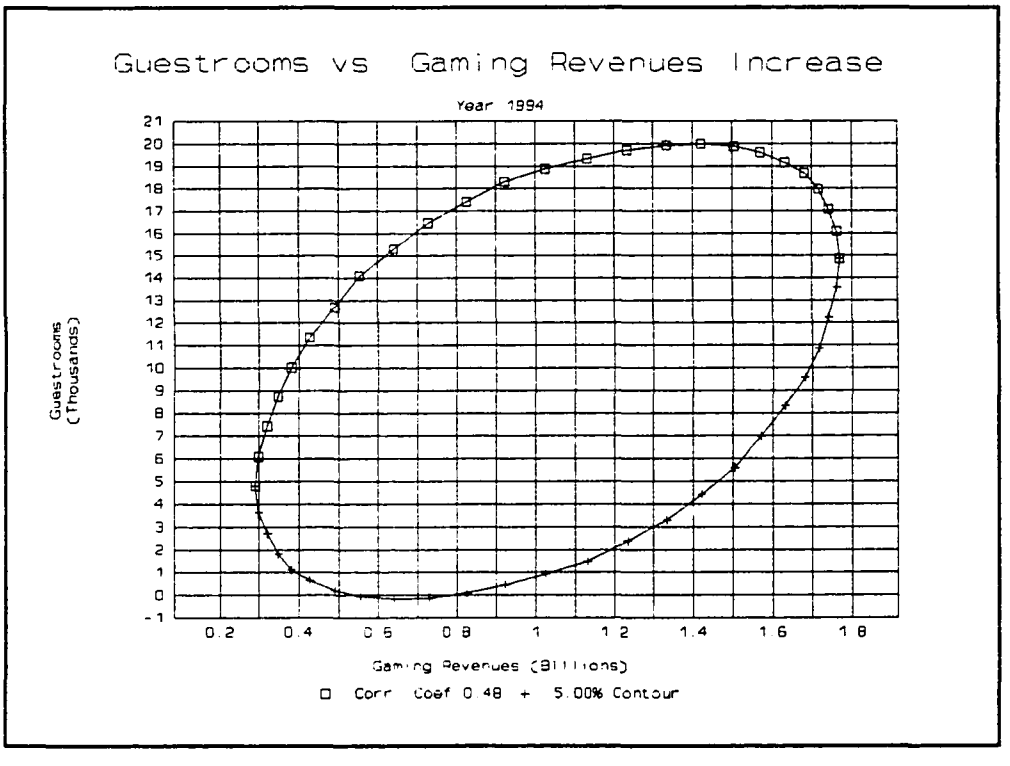
Appendix C6: 1994 Gaming Revenue



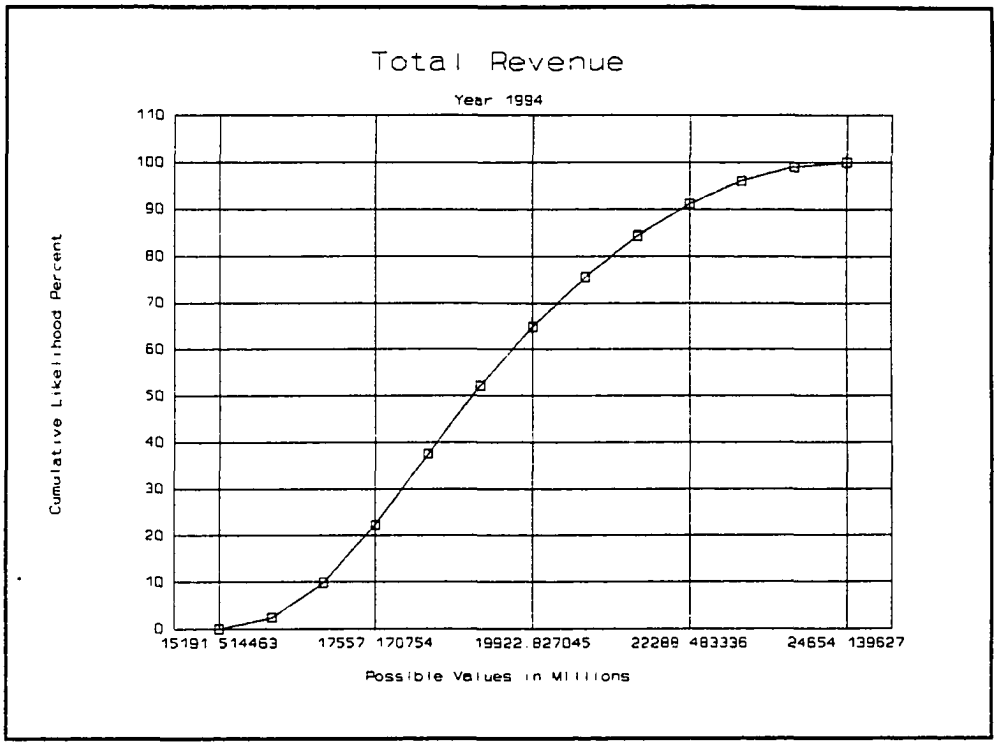


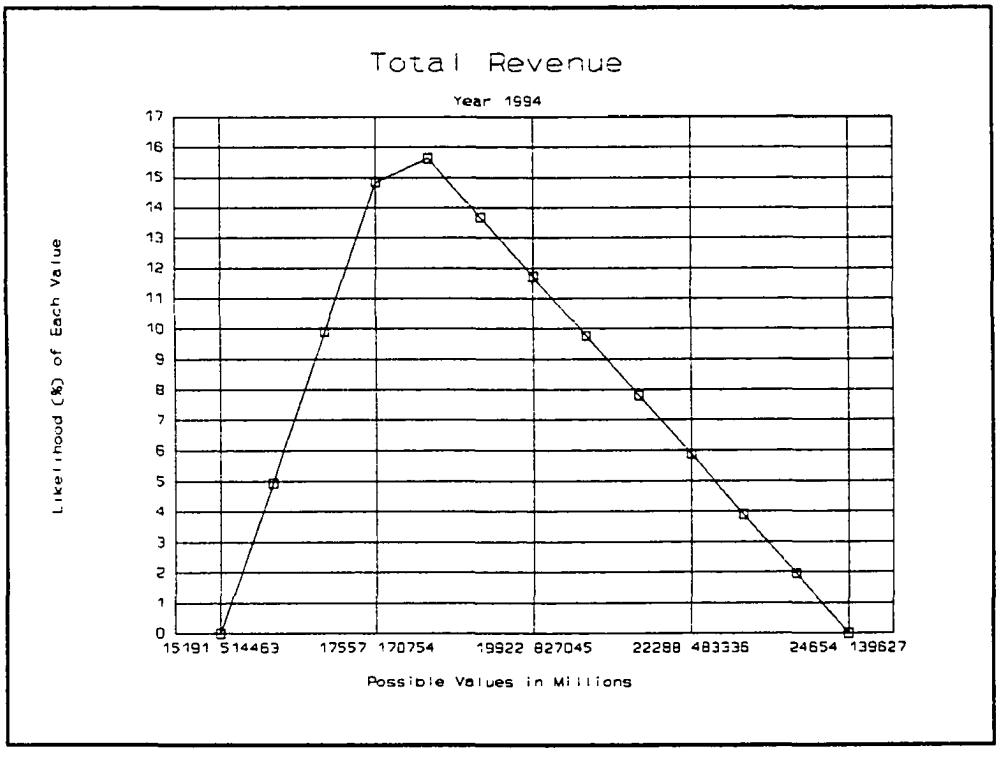
Appendix C7: 1994 Guestrooms and Gaming Revenue Correlation



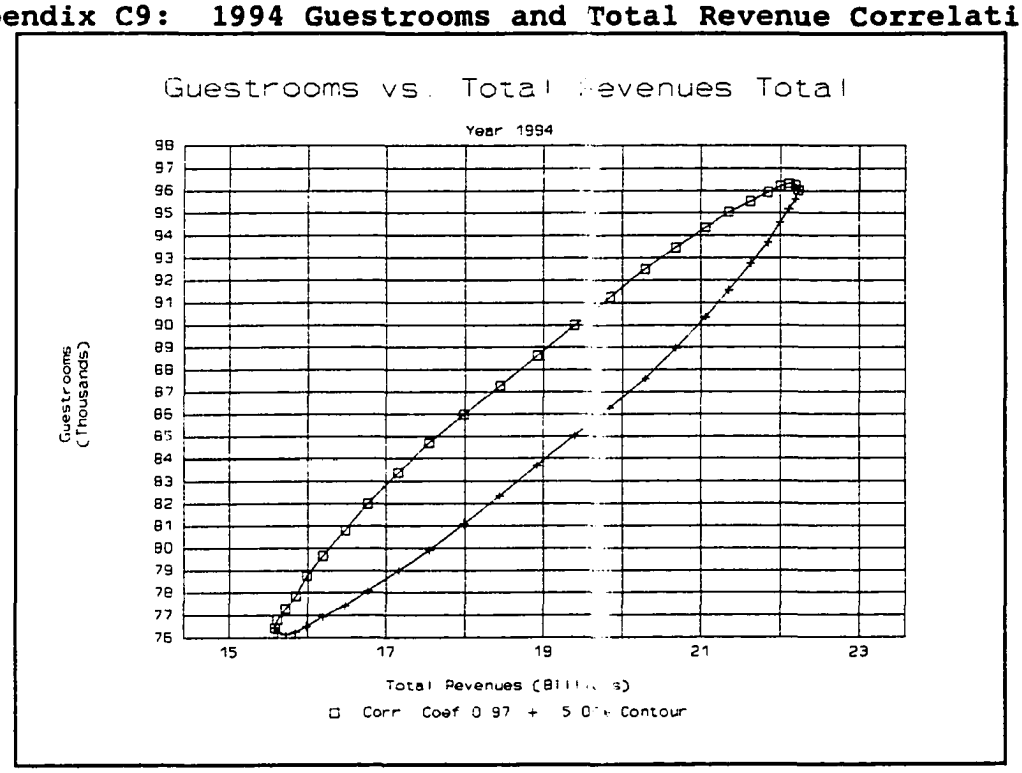


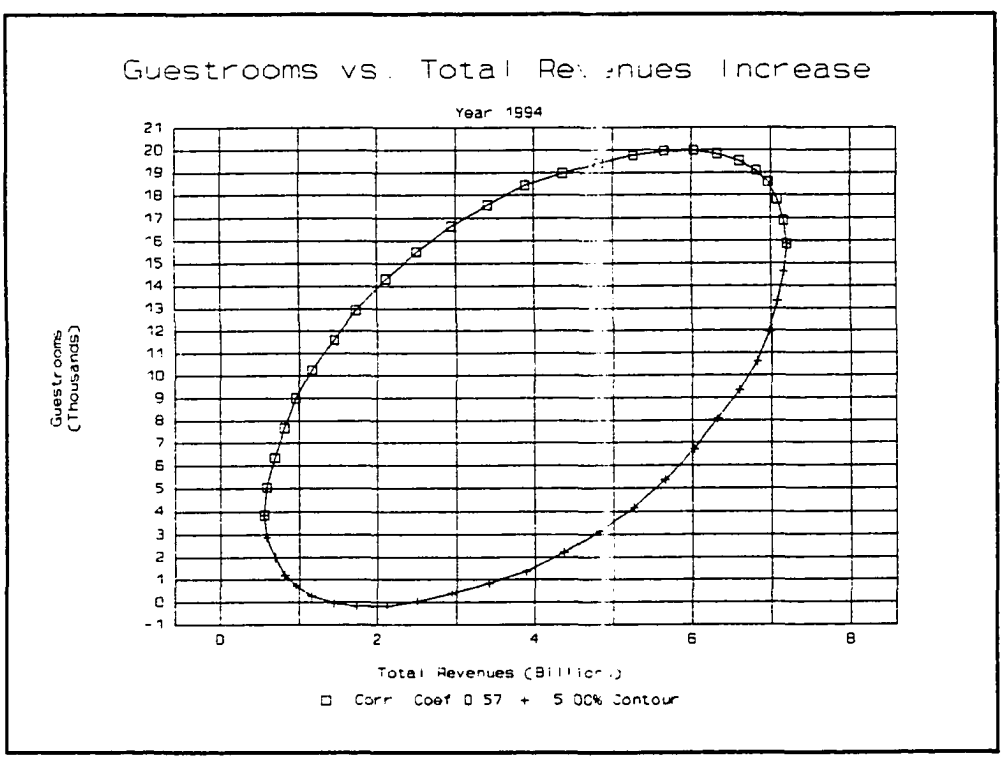
Appendix C8: 1994 Total Revenue



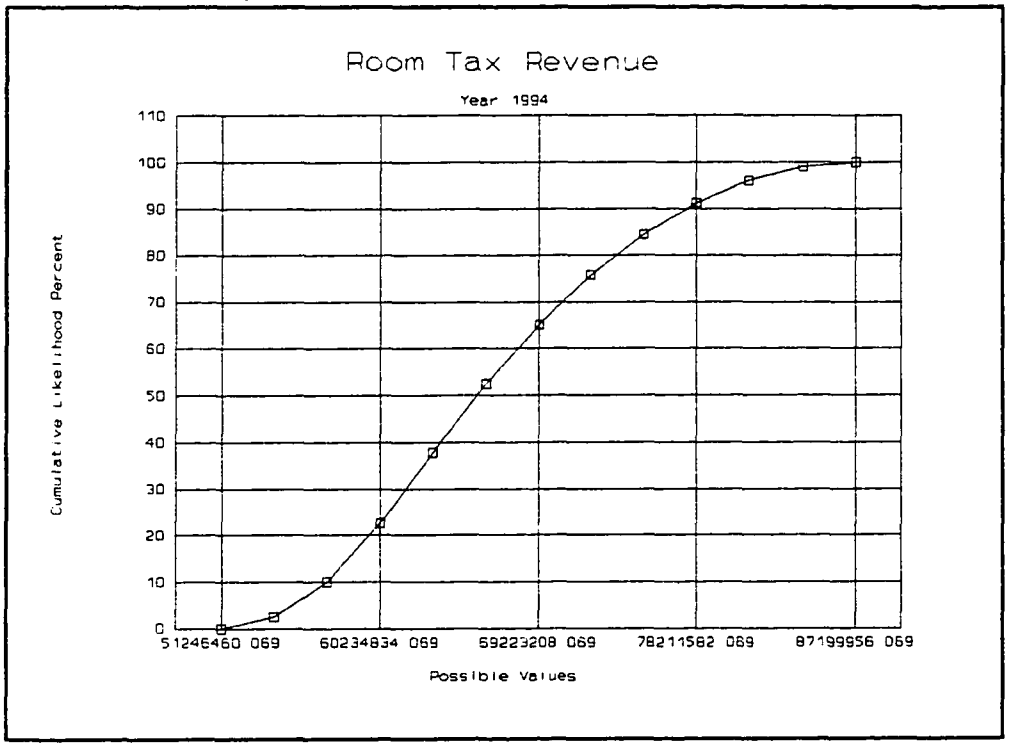


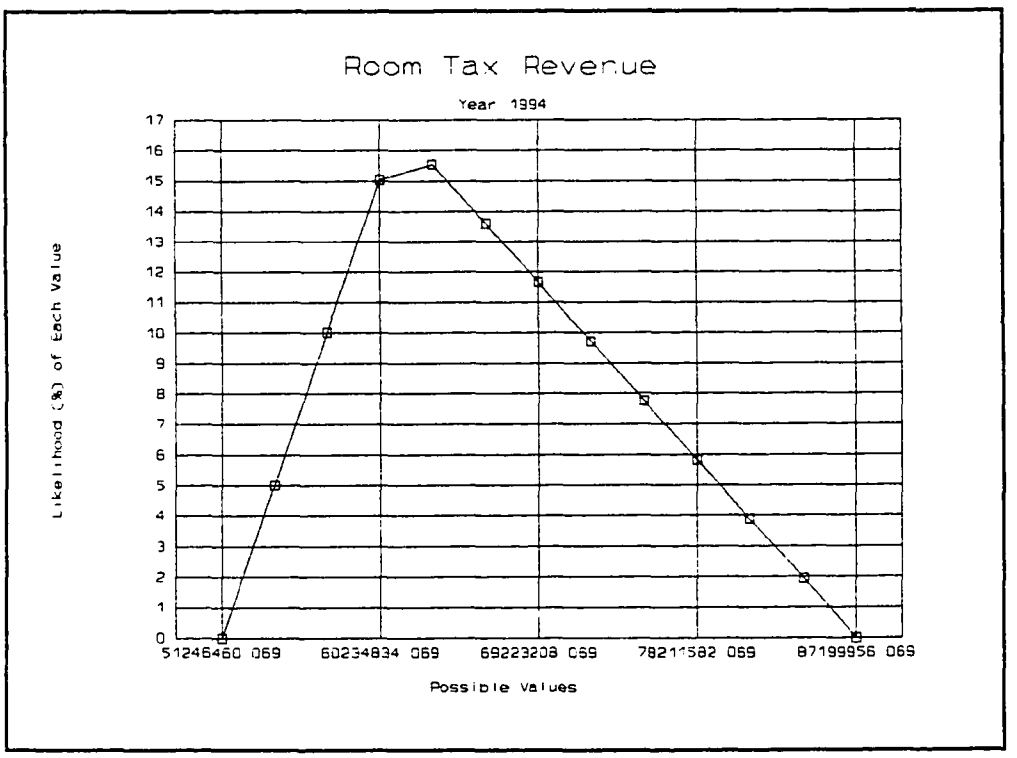
Appendix C9: 1994 Guestrooms and Total Revenue Correlation



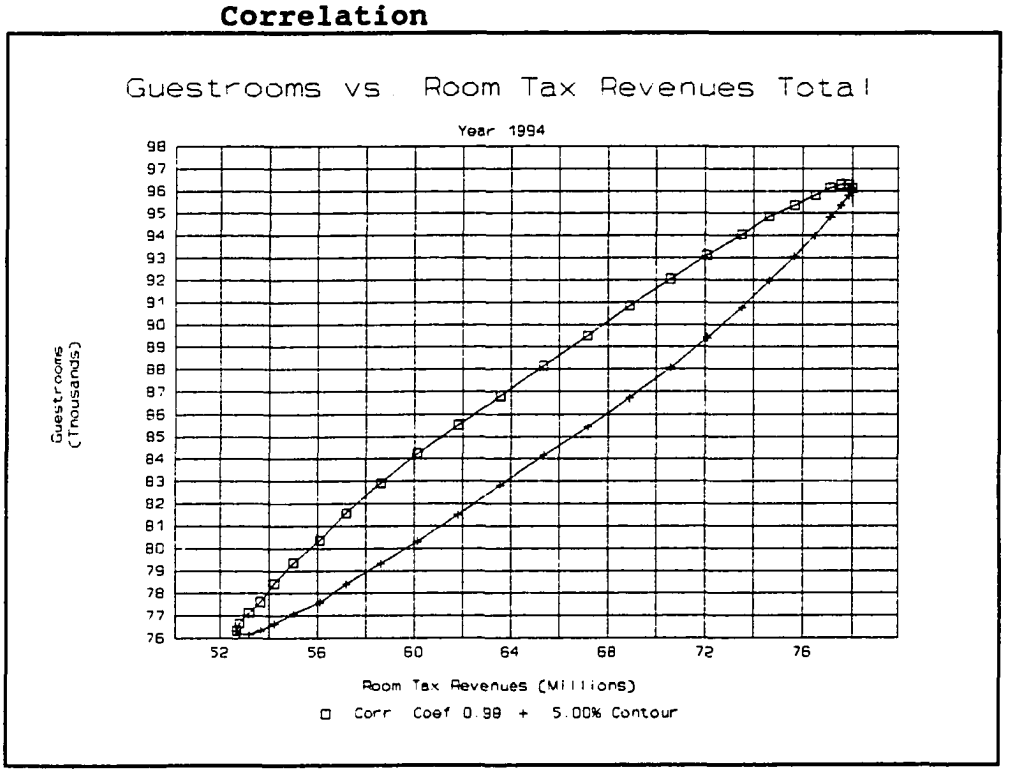


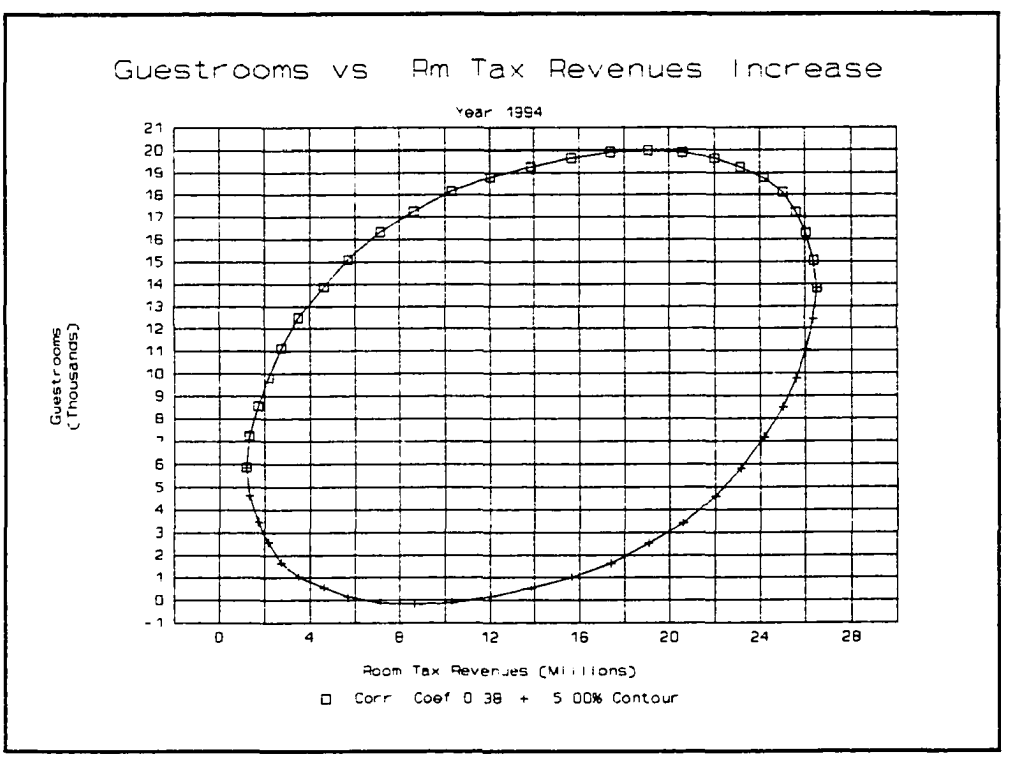
Appendix C10: 1994 Room Tax Revenue



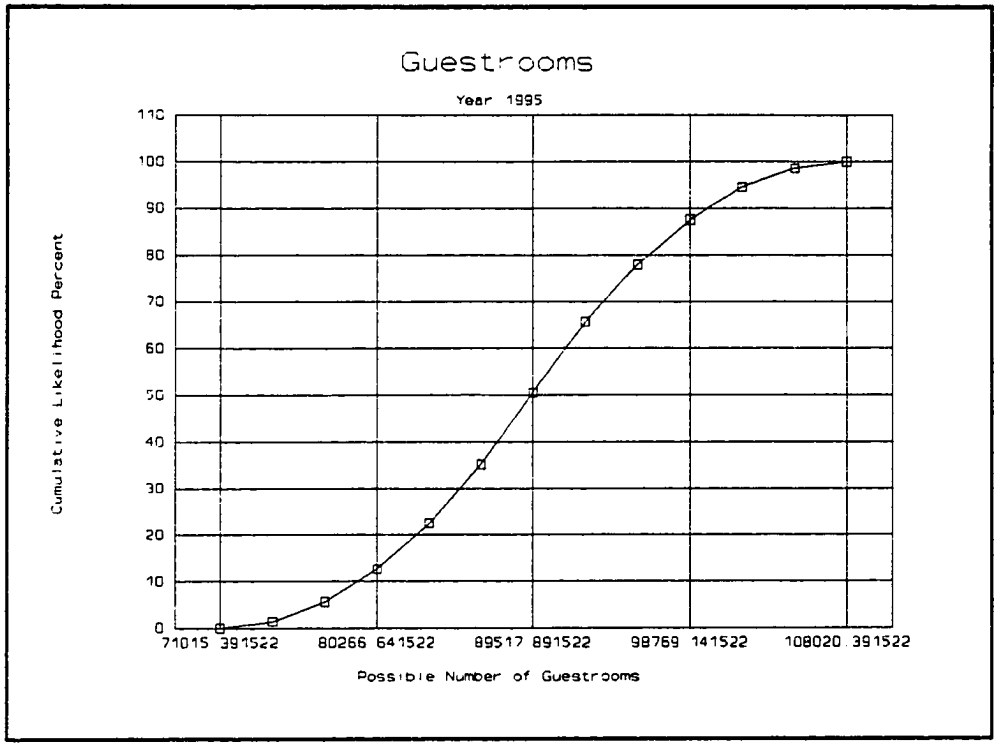


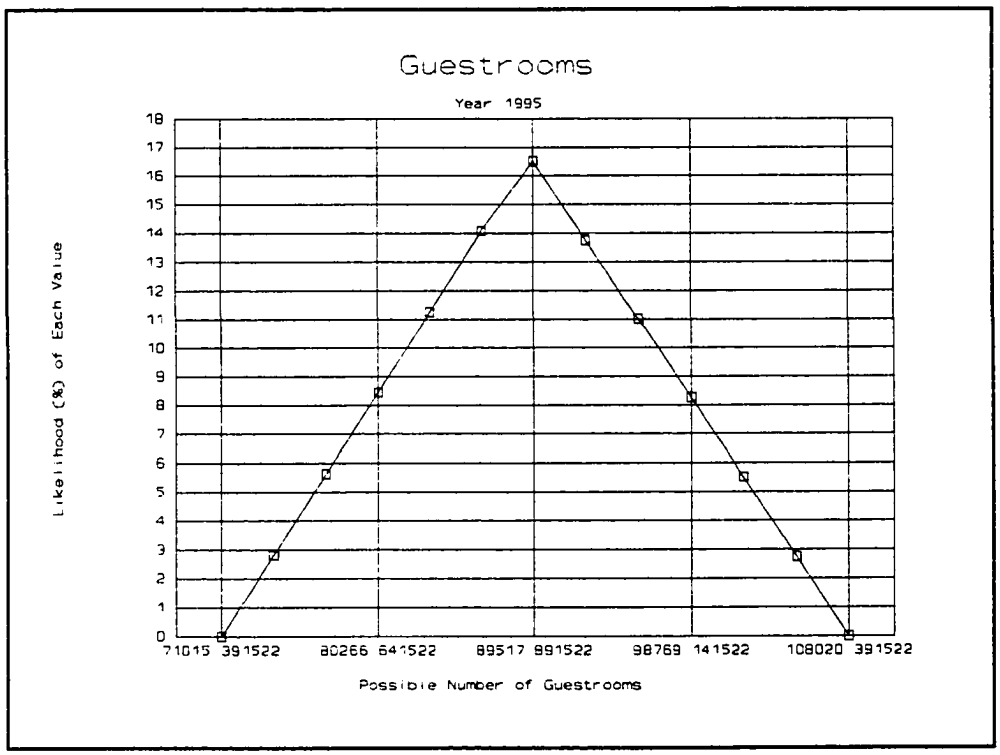
Appendix C11: 1994 Guestrooms and Room Tax Revenue Correlation



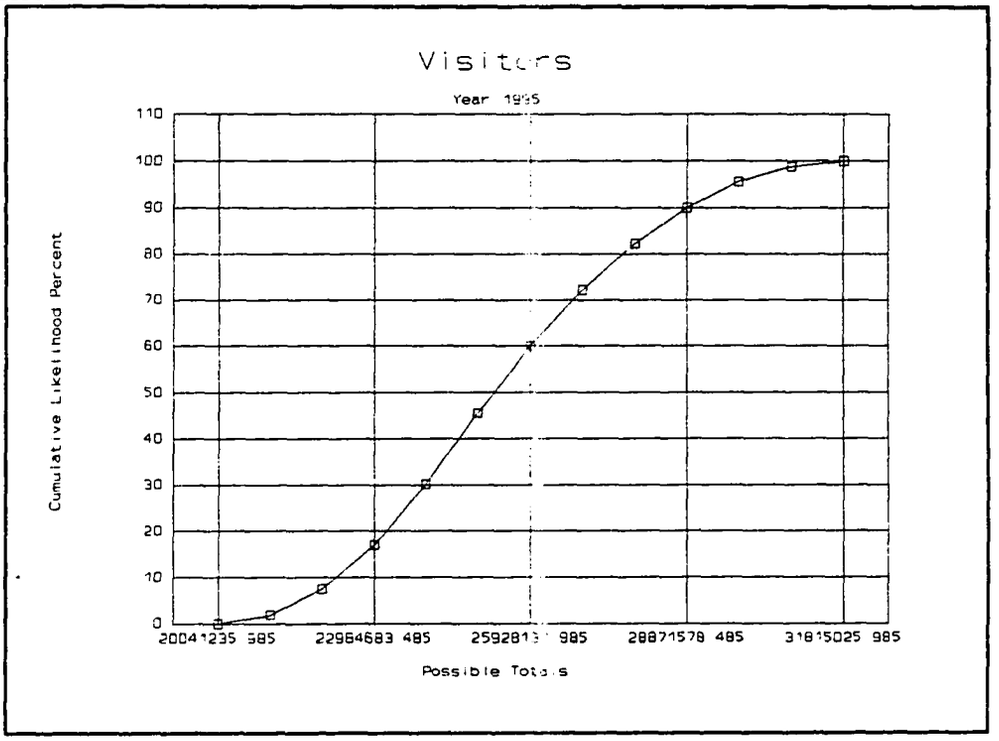


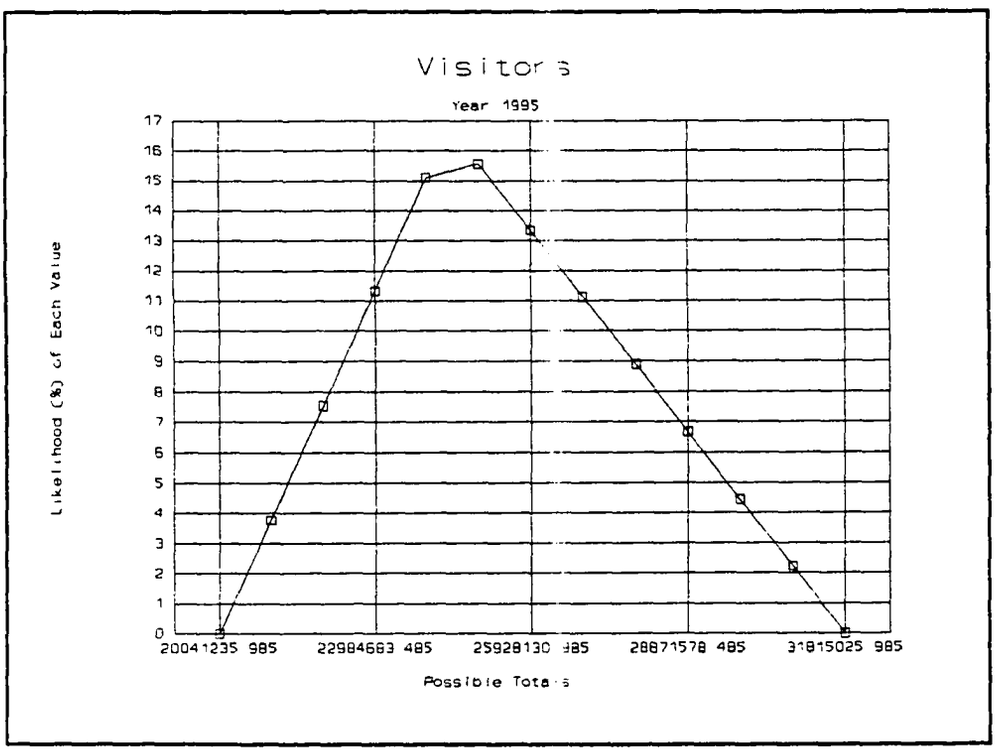
Appendix D1: 1995 Guestrooms



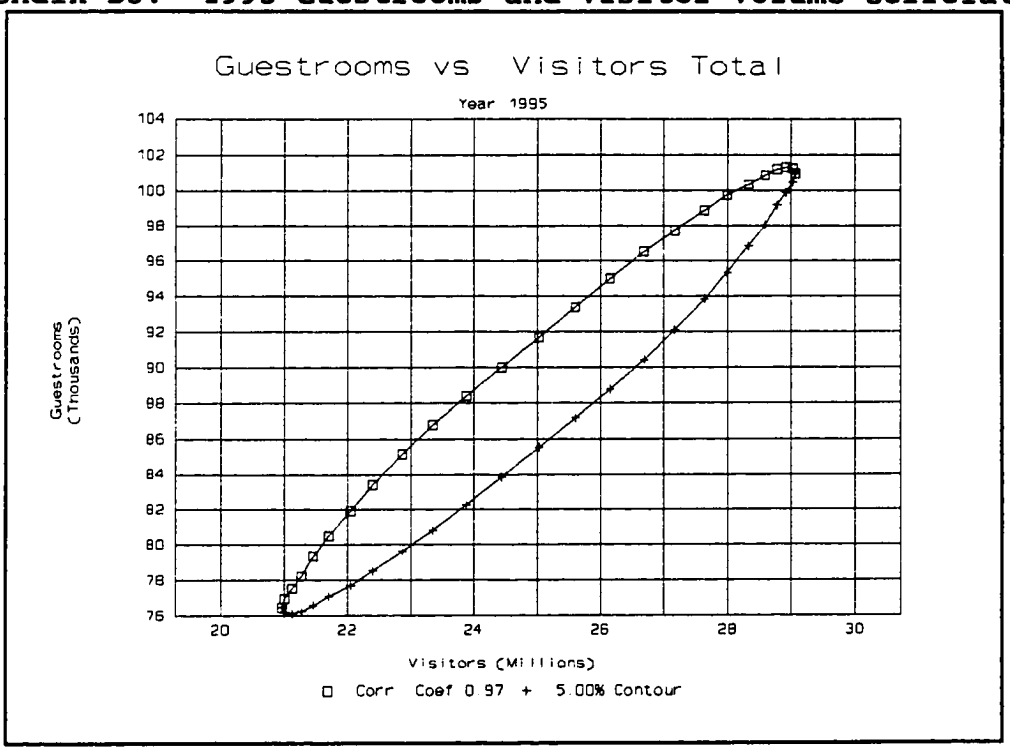


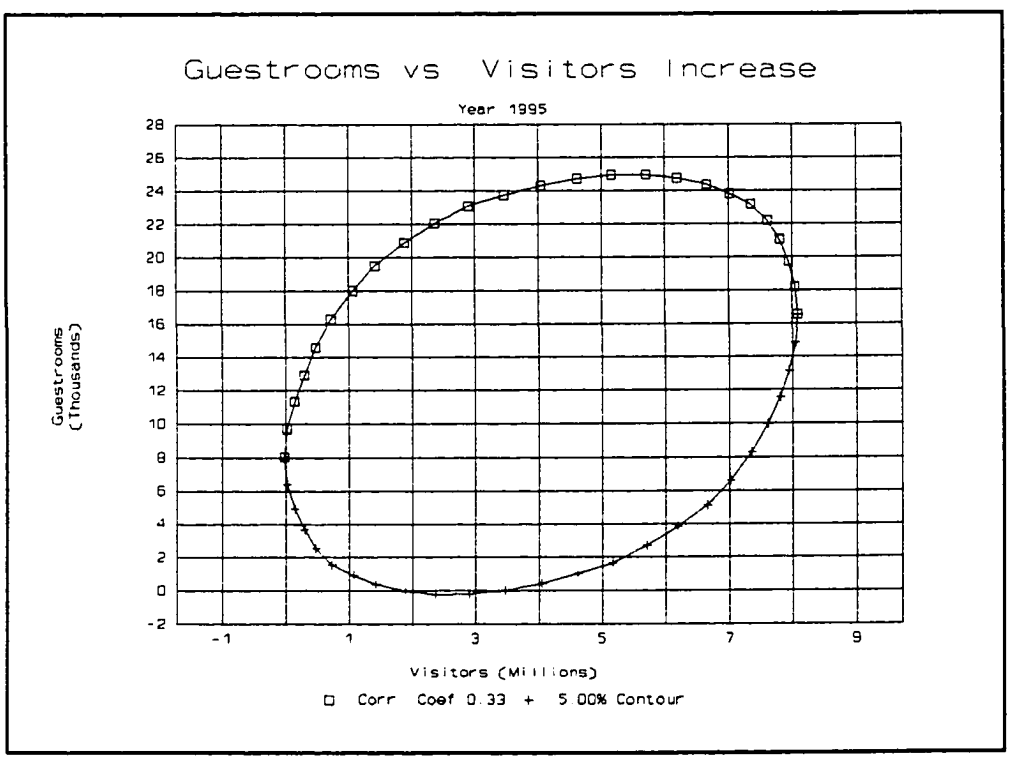
Appendix D2: 1995 Visitor Counts



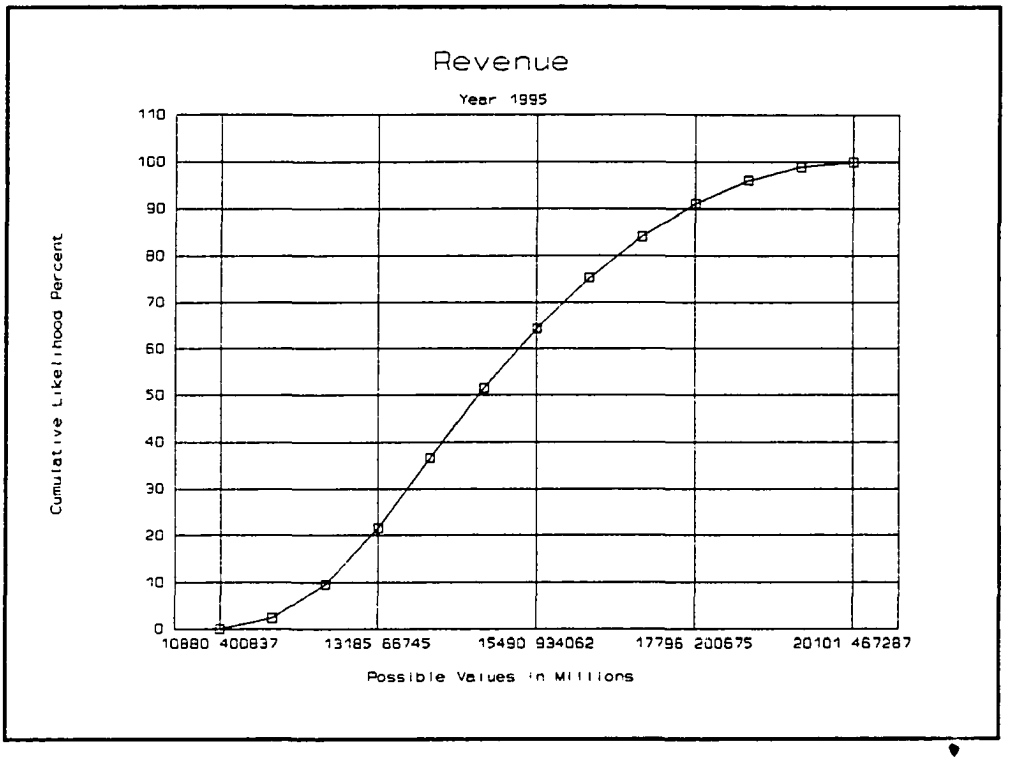


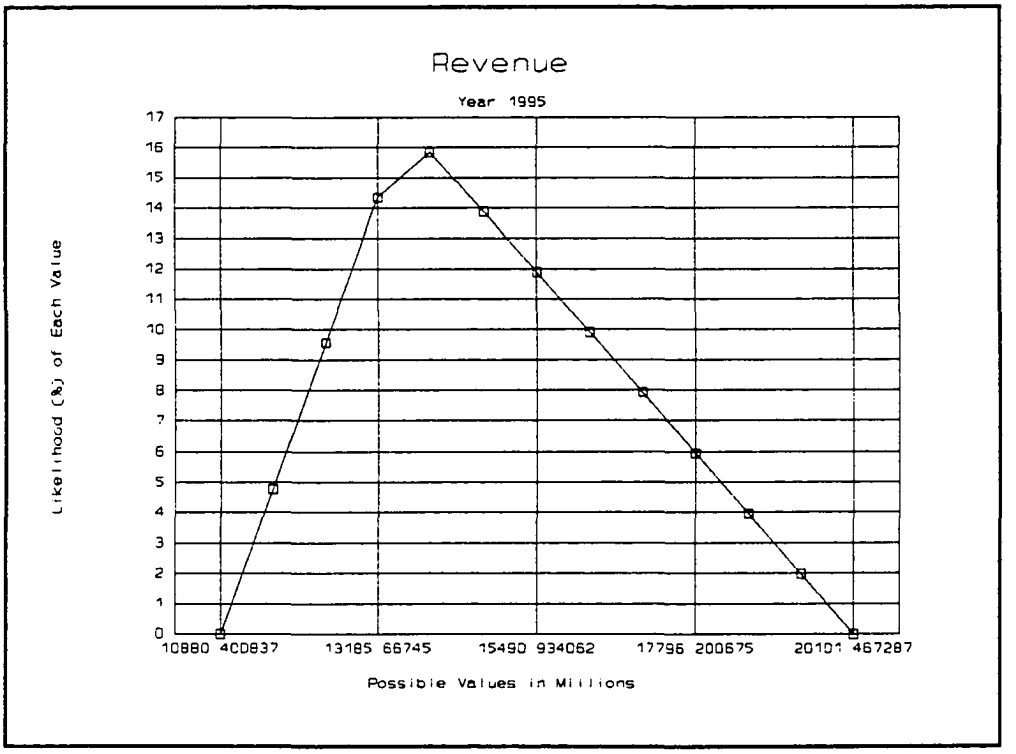
Appendix D3: 1995 Guestrooms and Visitor Volume Correlation



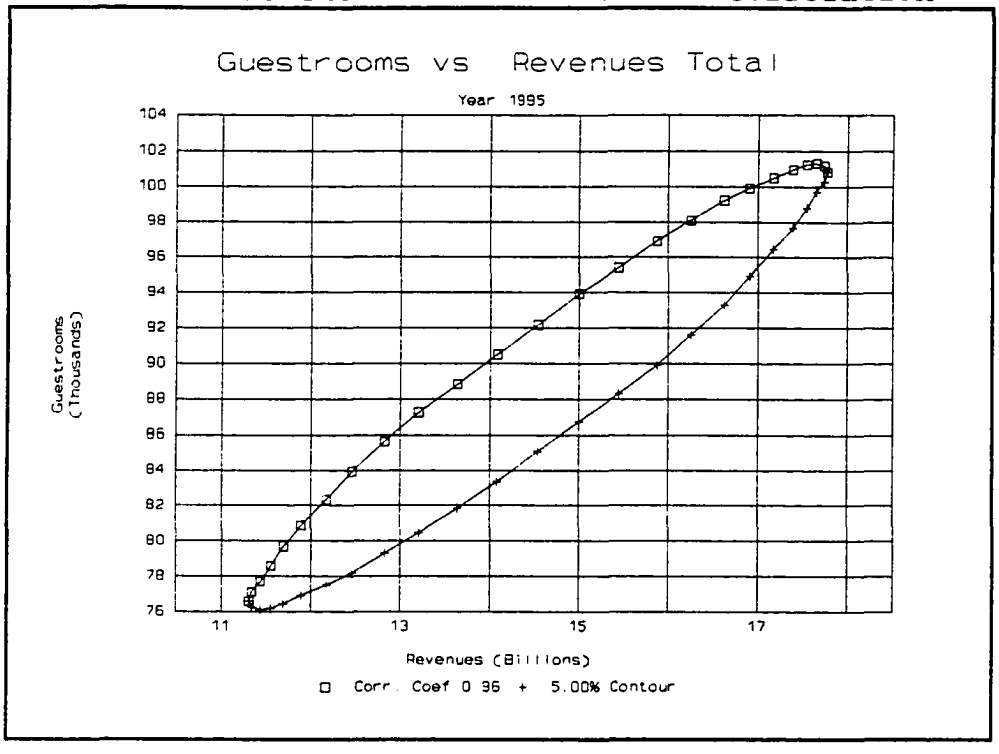


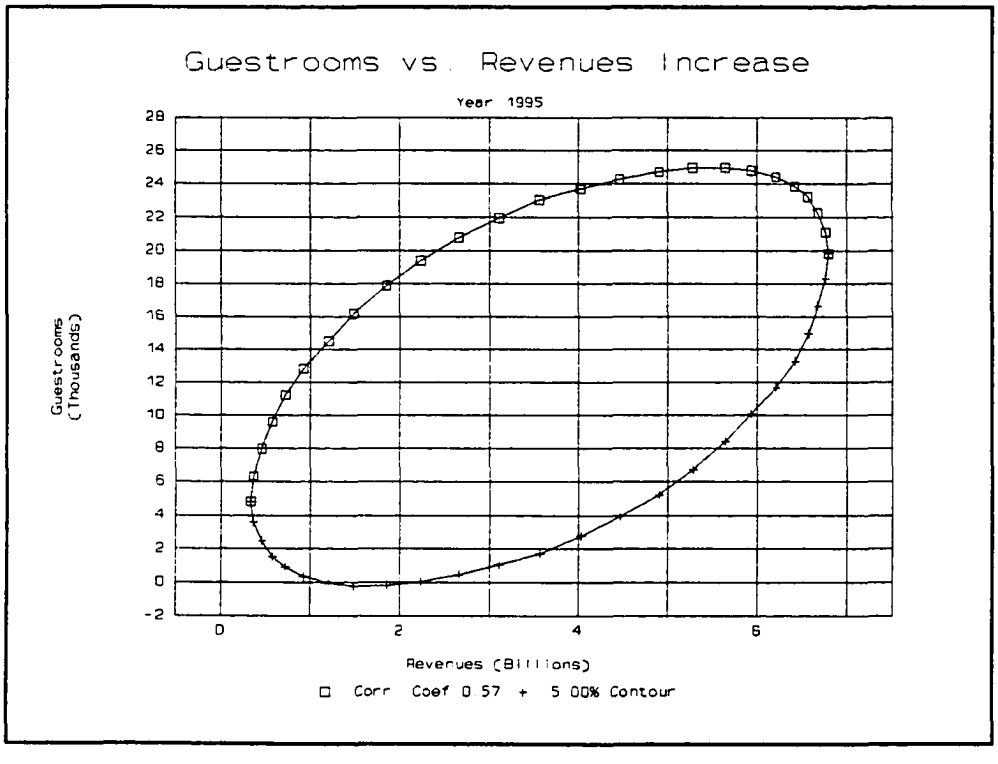
Appendix D4: 1995 Revenue



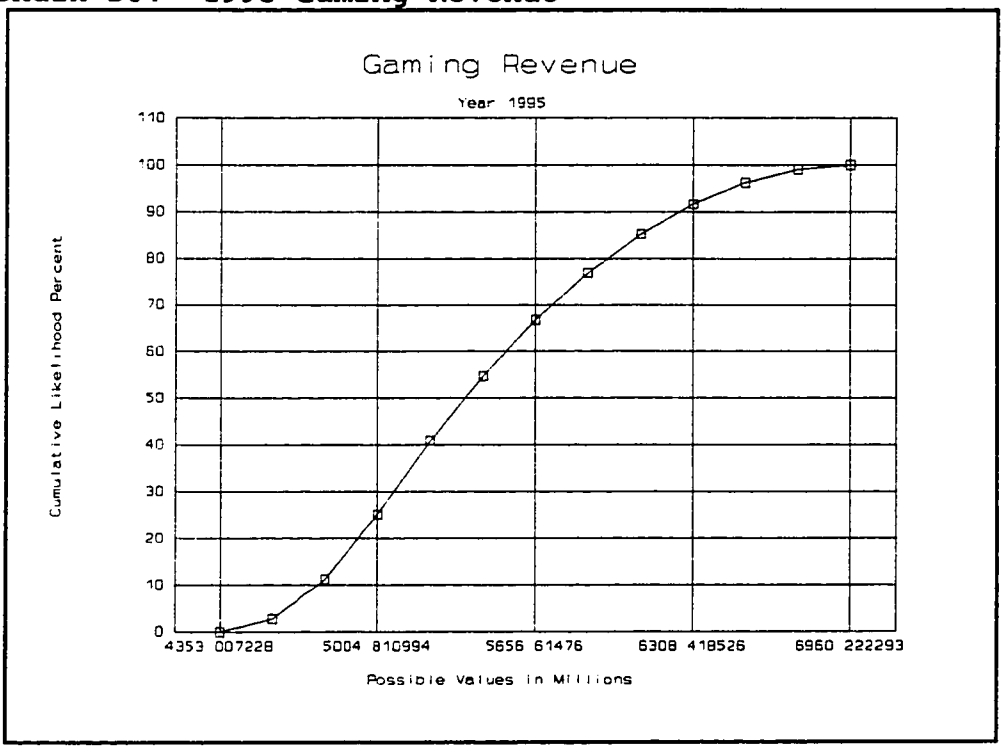


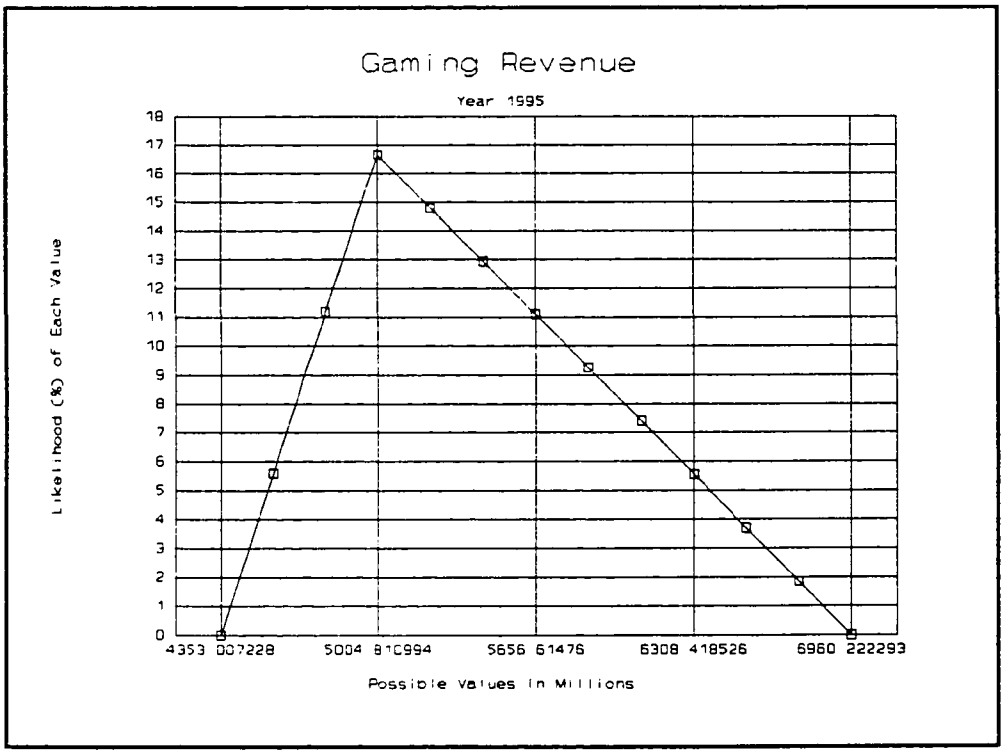
Appendix D5: 1995 Guestrooms and Revenue Correlation



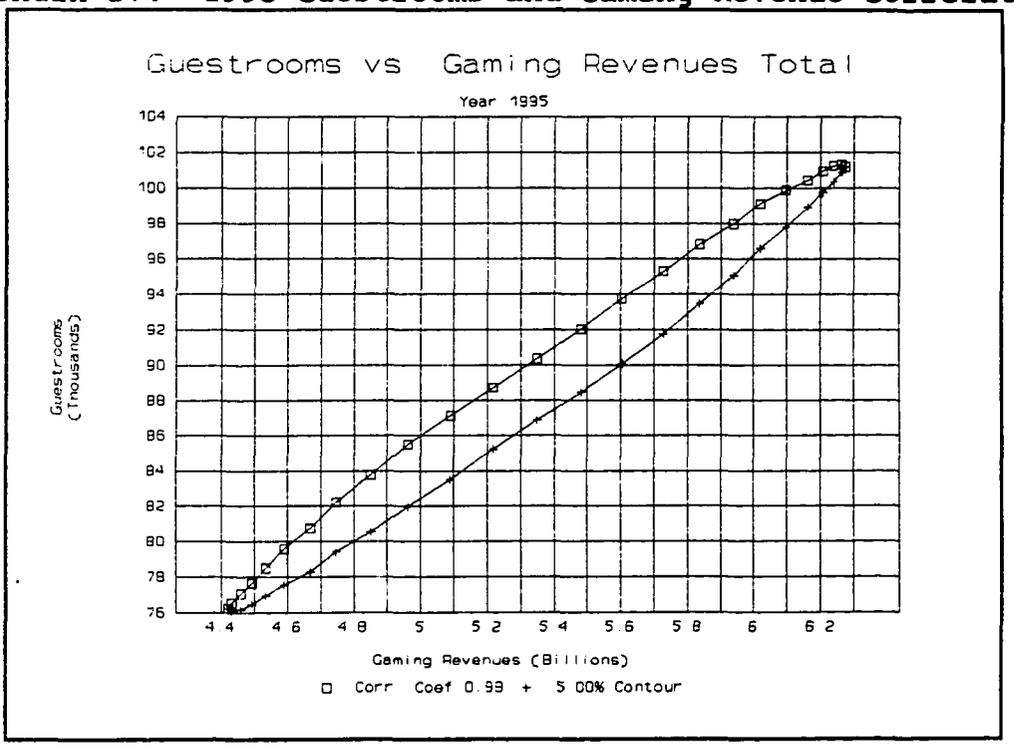


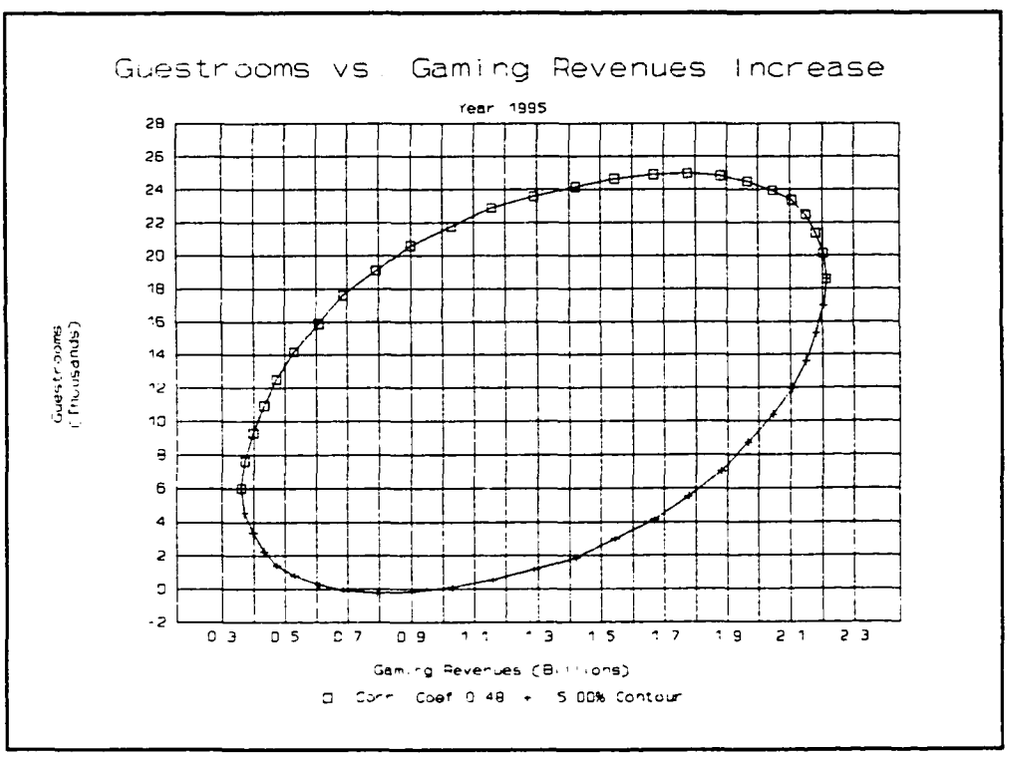
Appendix D6: 1995 Gaming Revenue



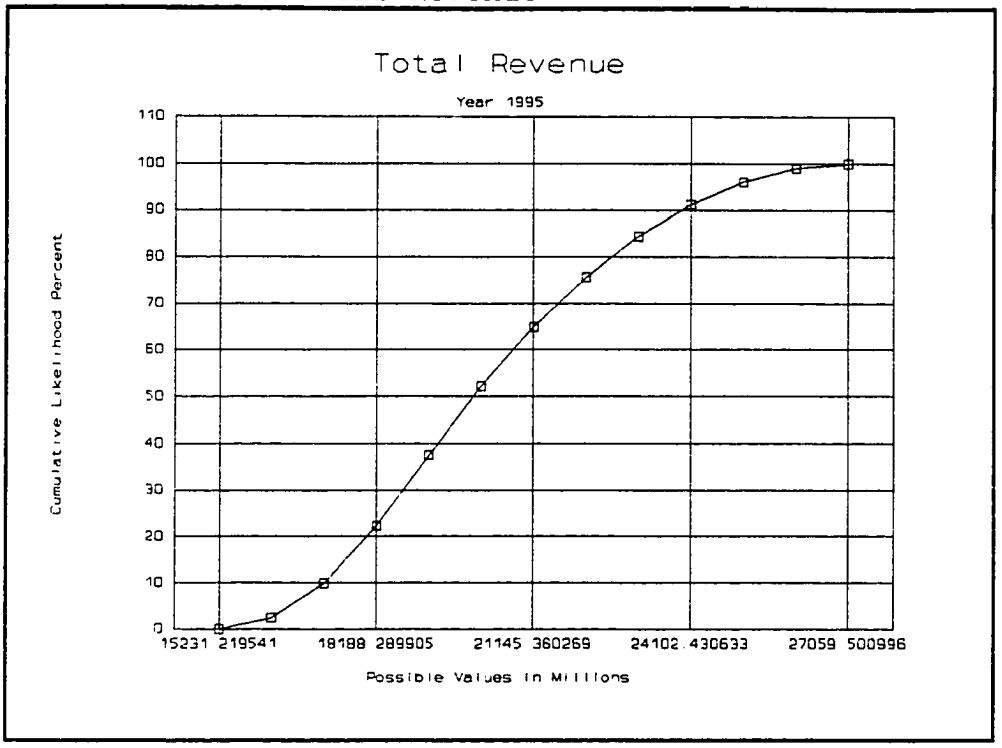


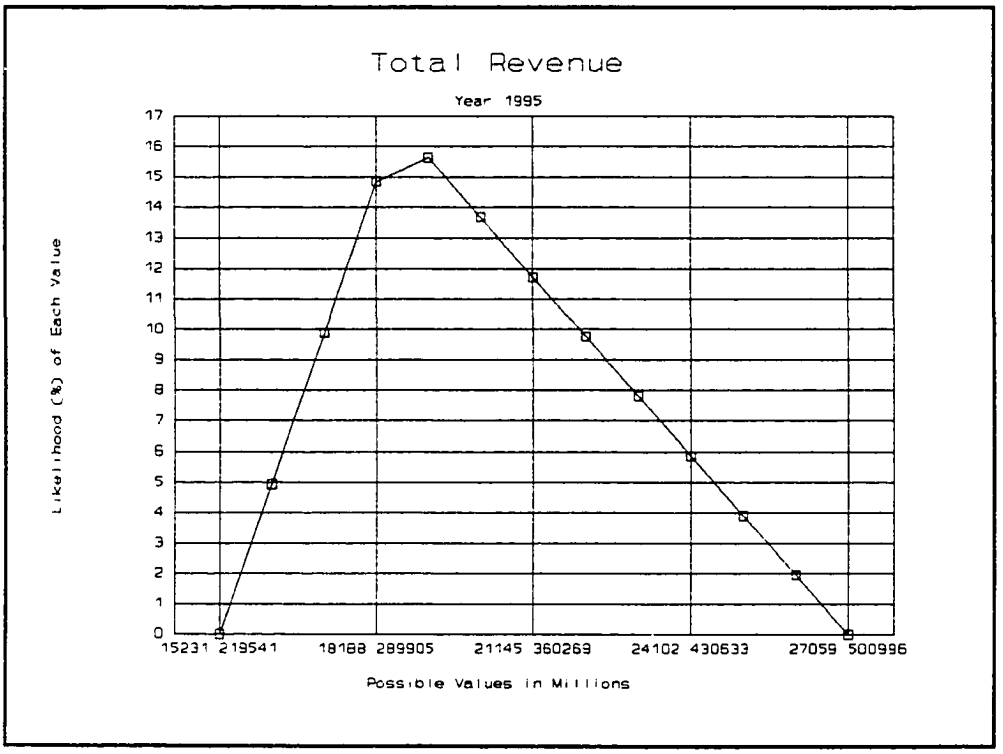
Appendix D7: 1995 Guestrooms and Gaming Revenue Correlation



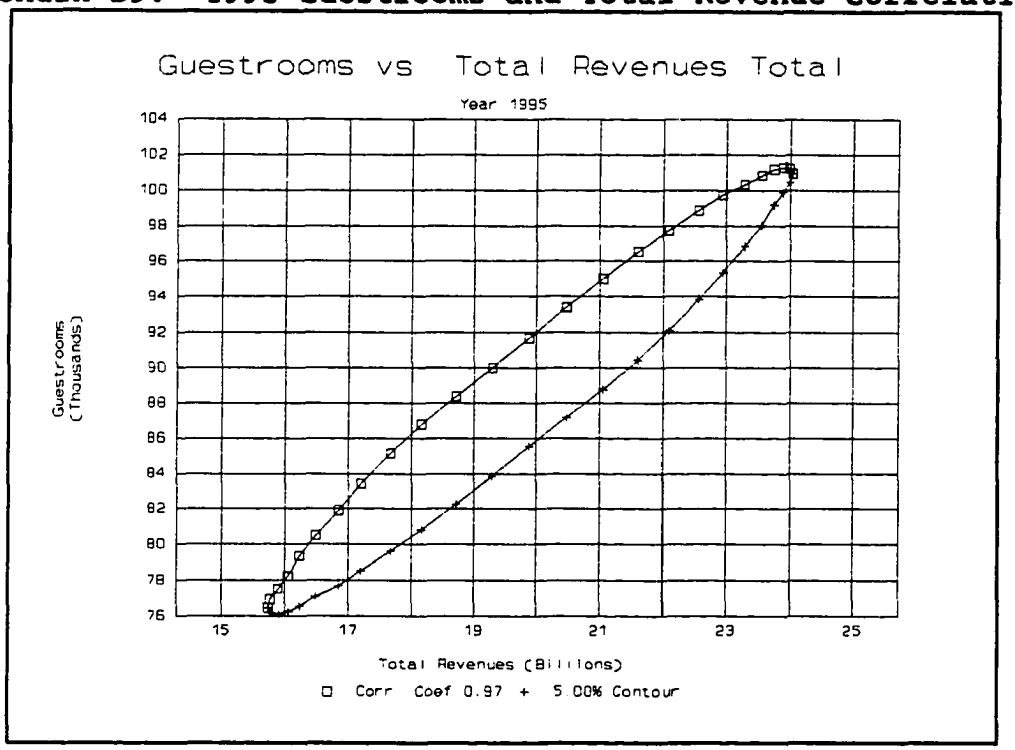


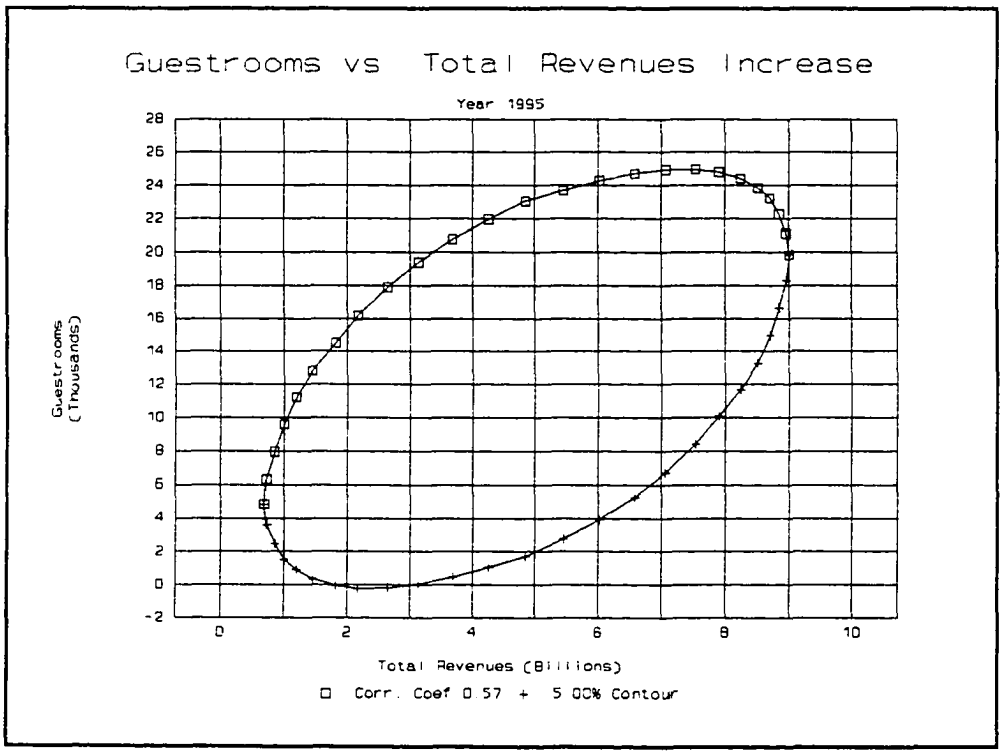
Appendix D8: 1995 Total Revenue



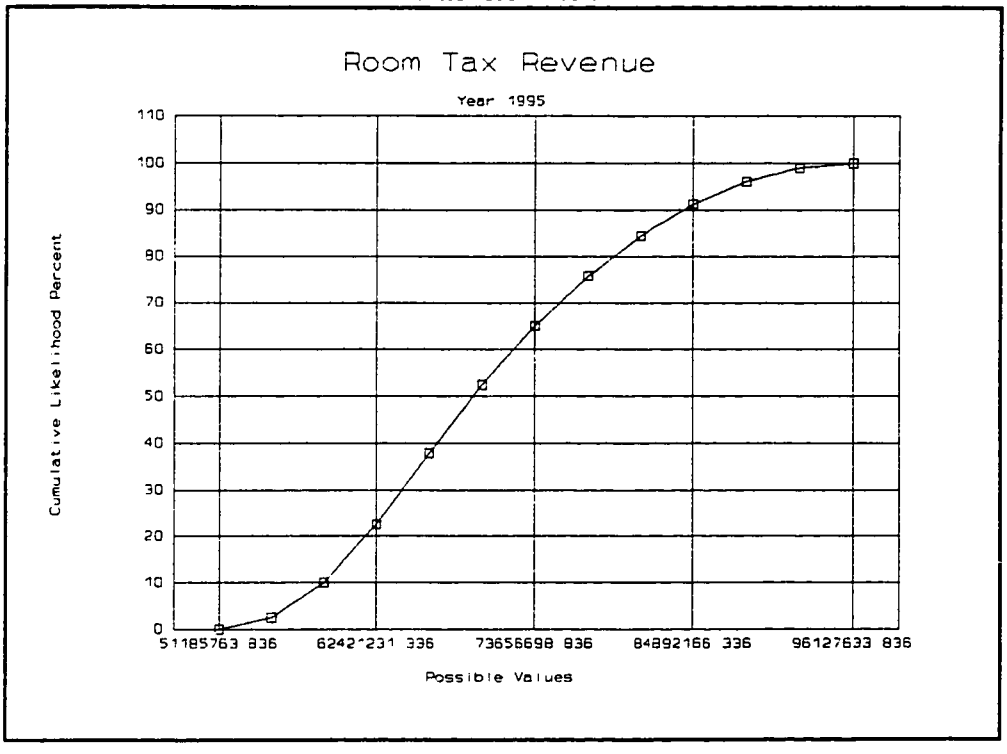


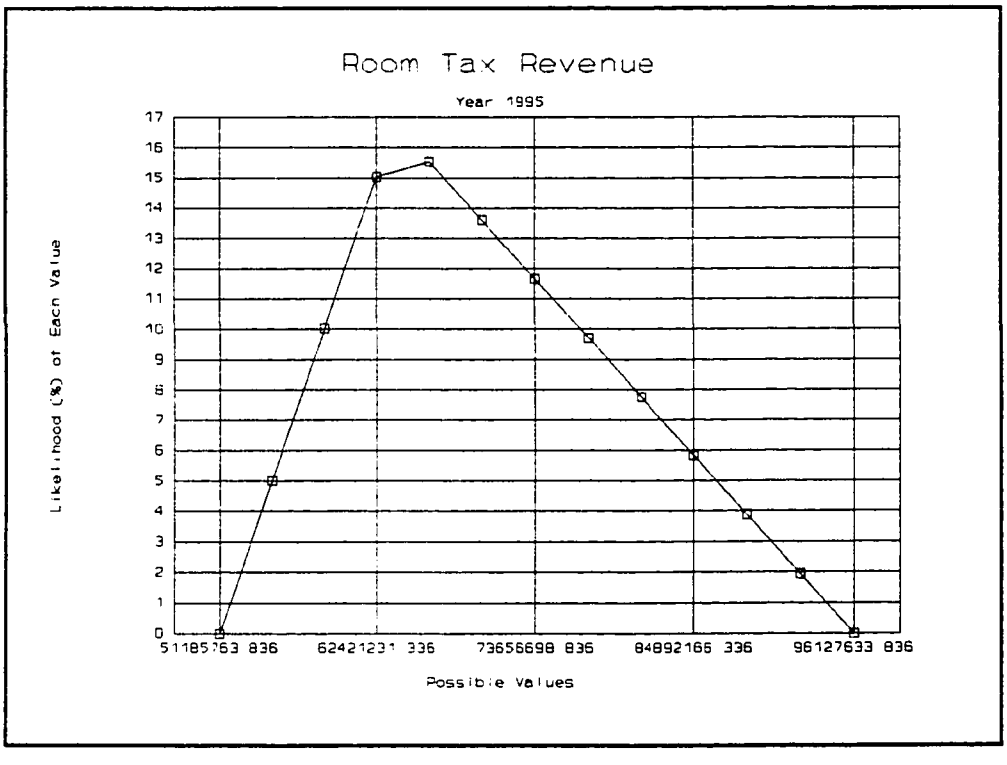
Appendix D9: 1995 Guestrooms and Total Revenue Correlation



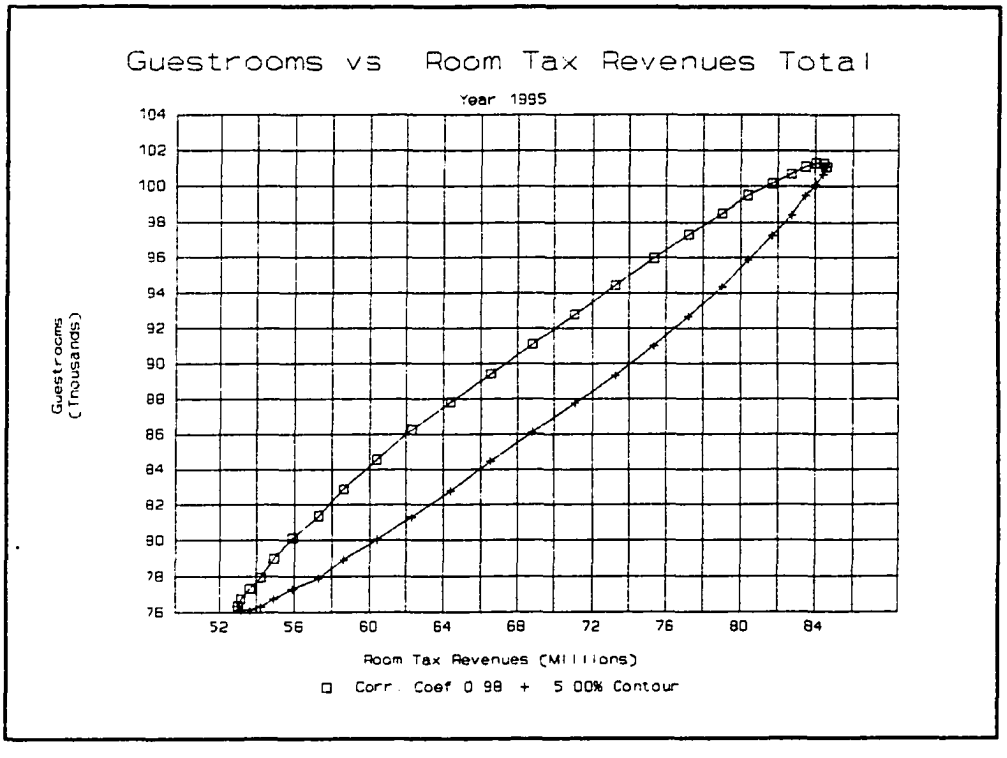


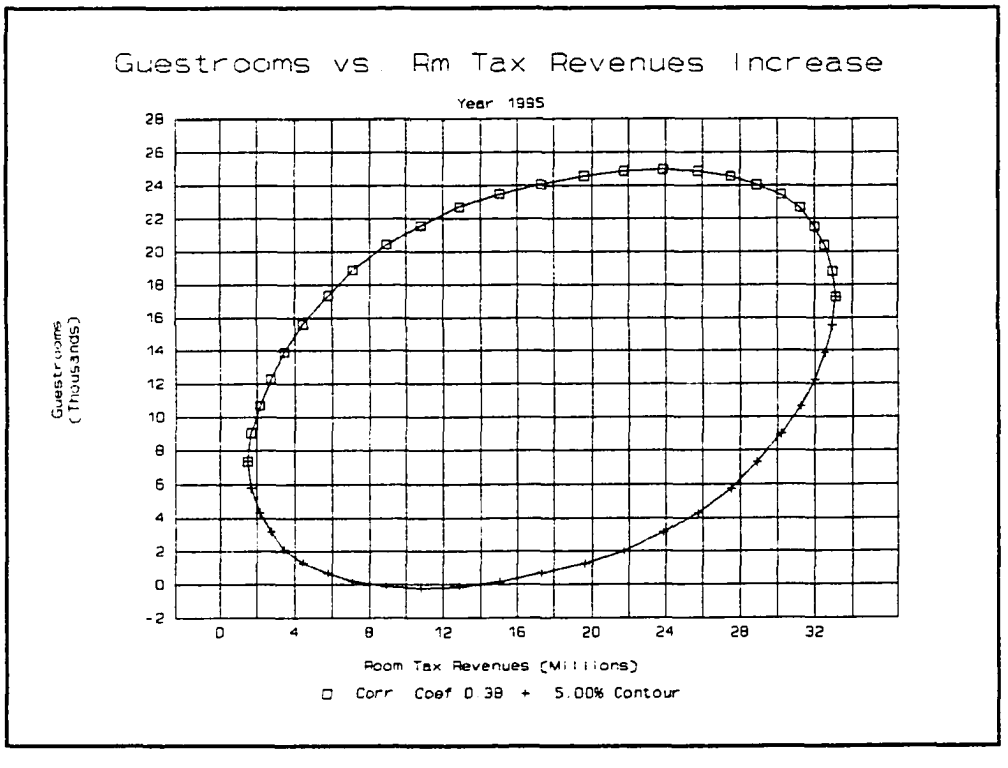
Appendix D10: 1995 Room Tax Revenue



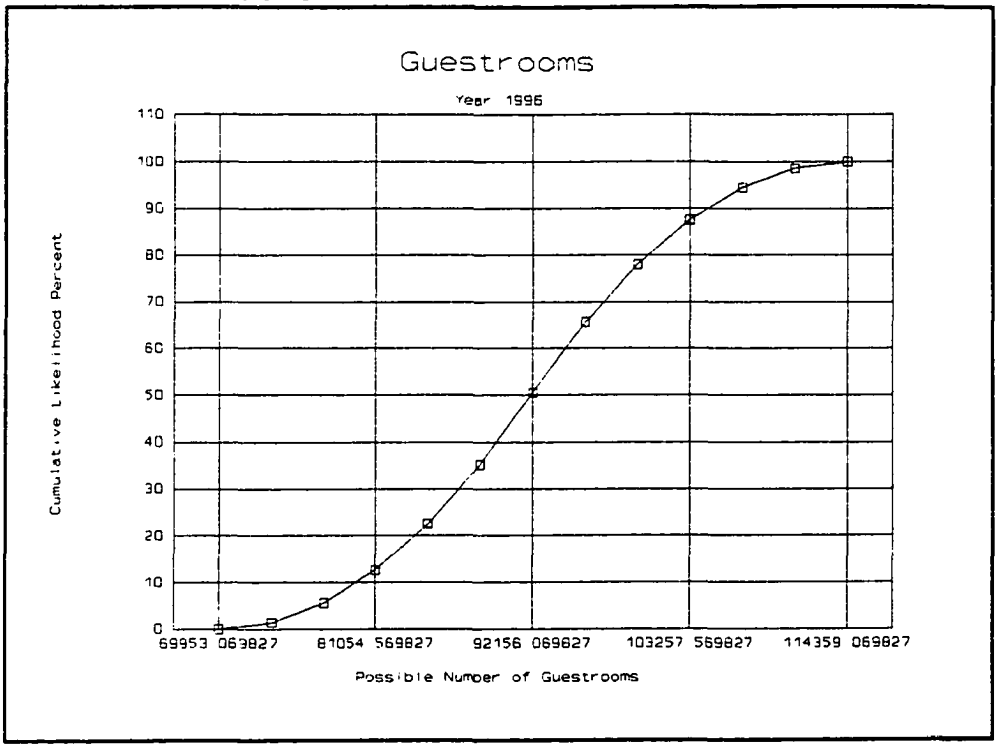


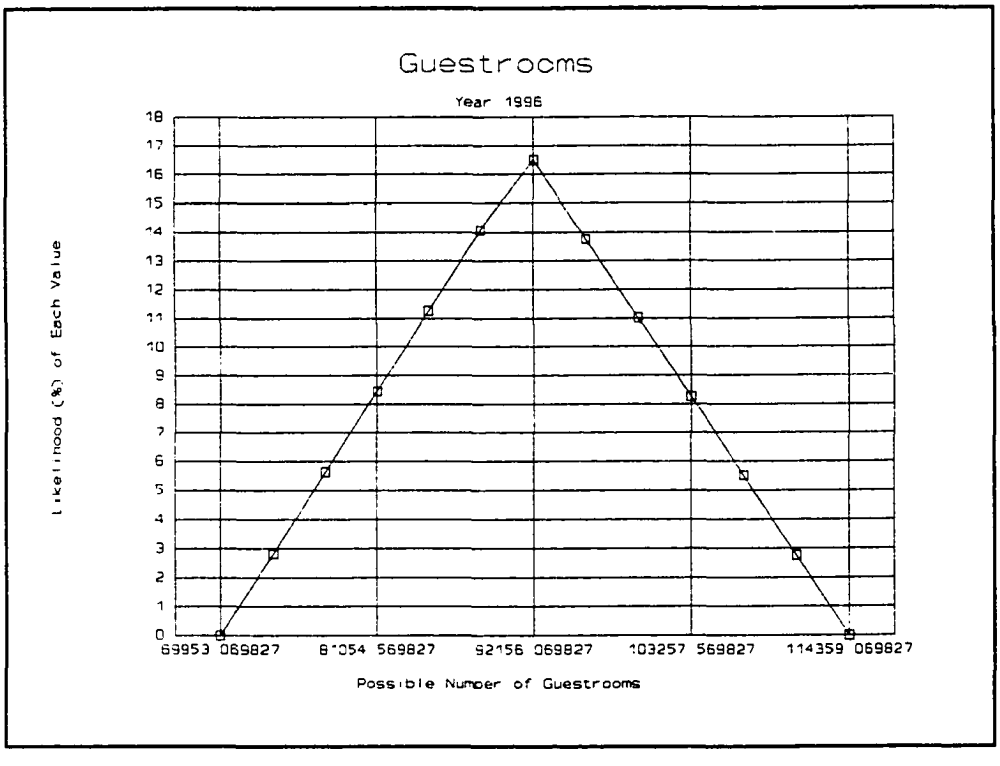
Appendix D11: 1995 Guestrooms and Room Tax Revenue Correlation



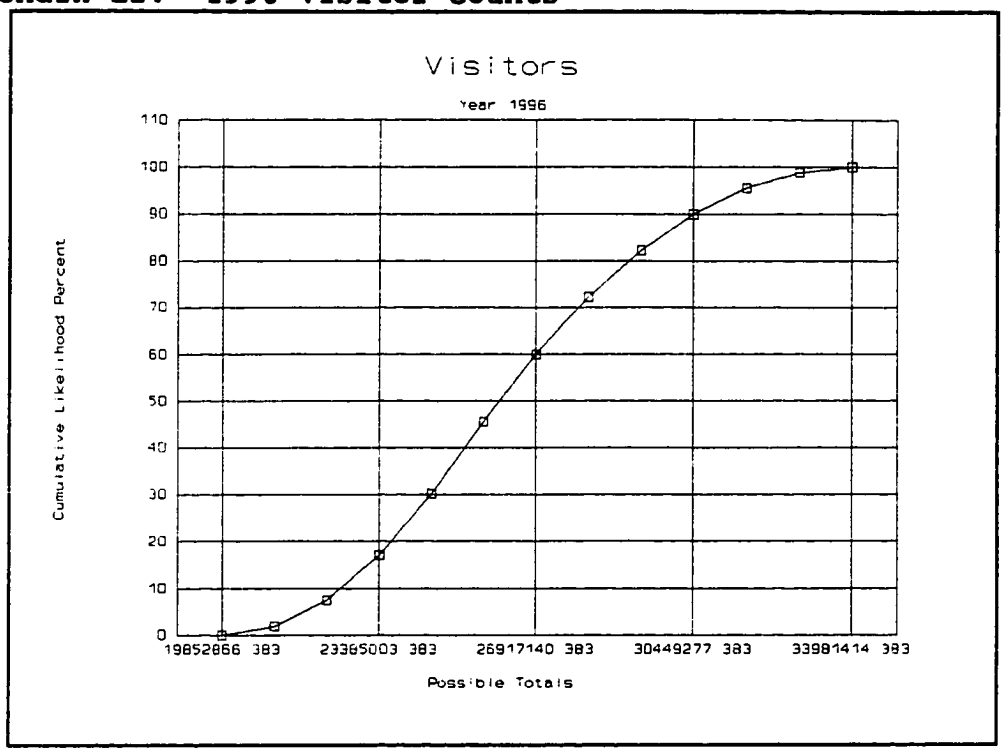


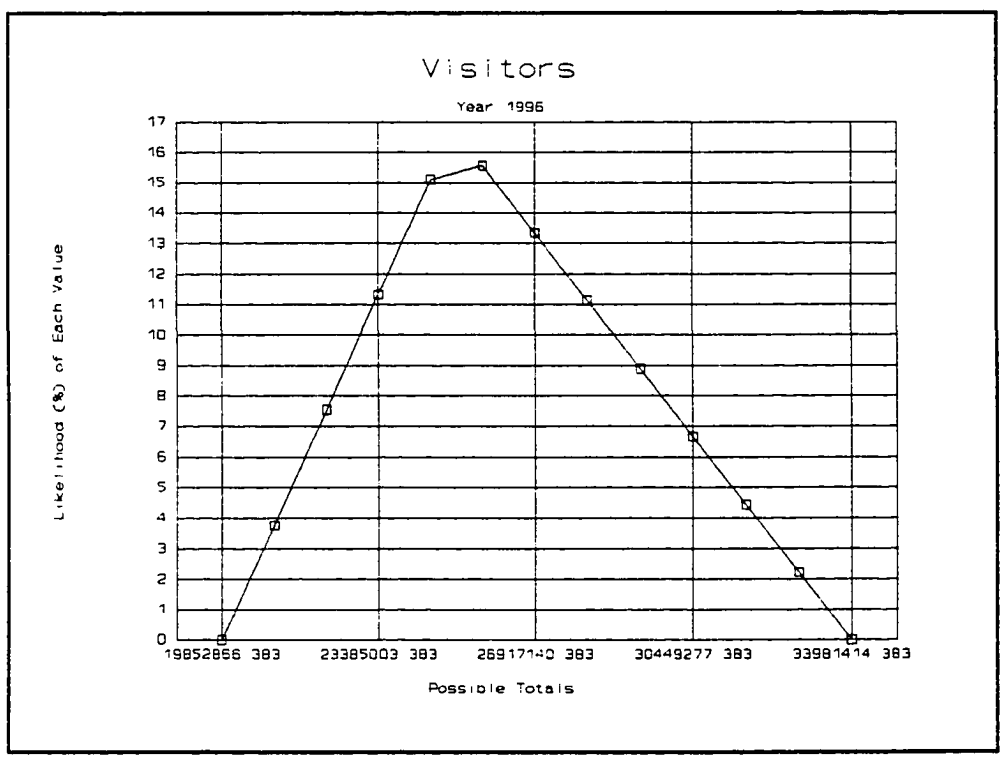
Appendix E1: 1996 Guestrooms



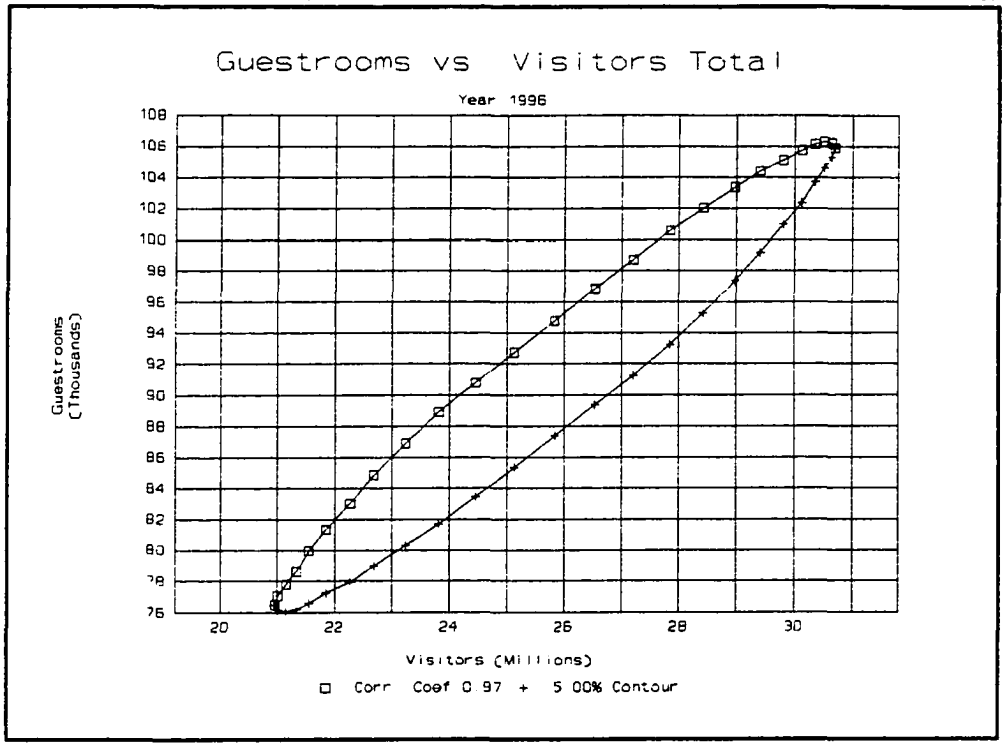


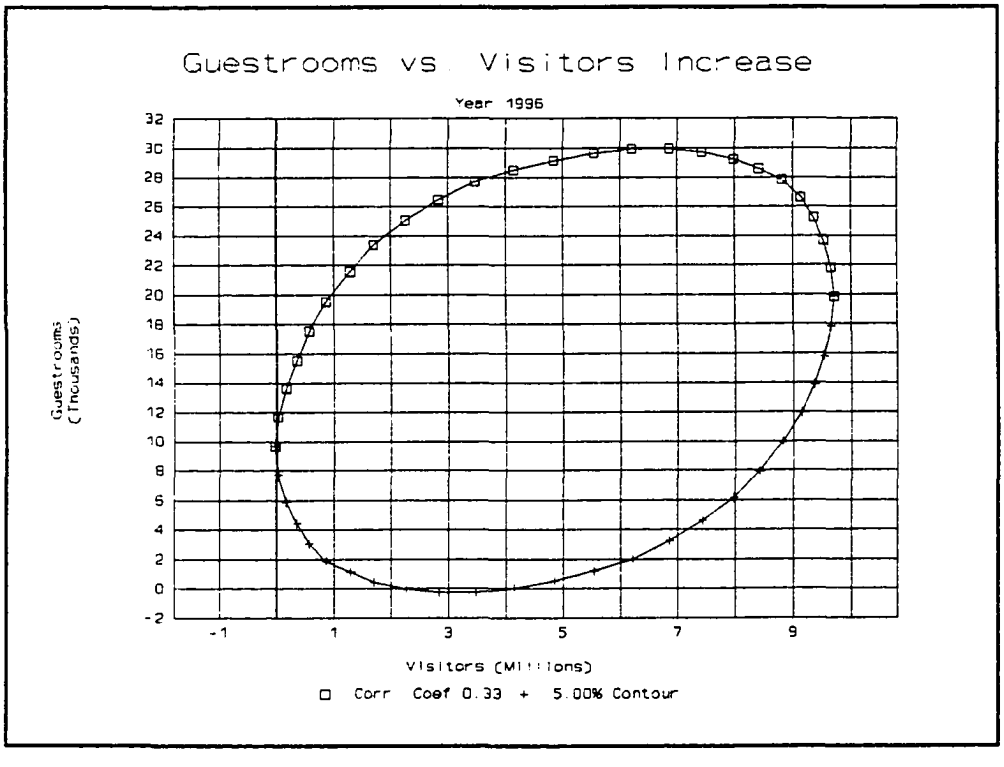
Appendix E2: 1996 Visitor Counts



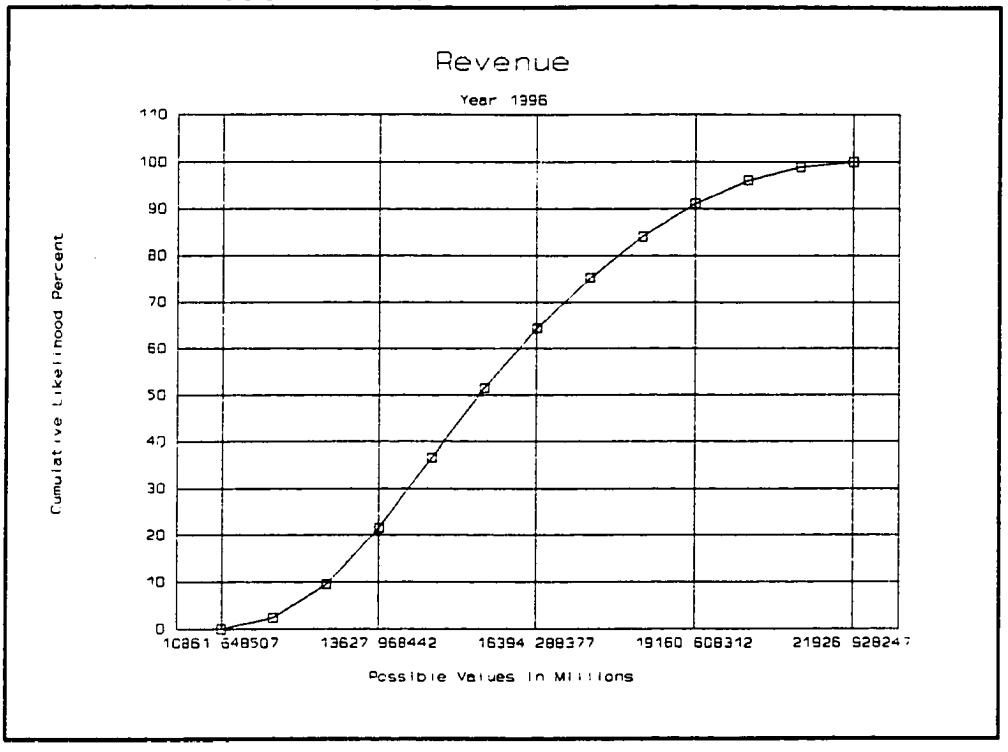


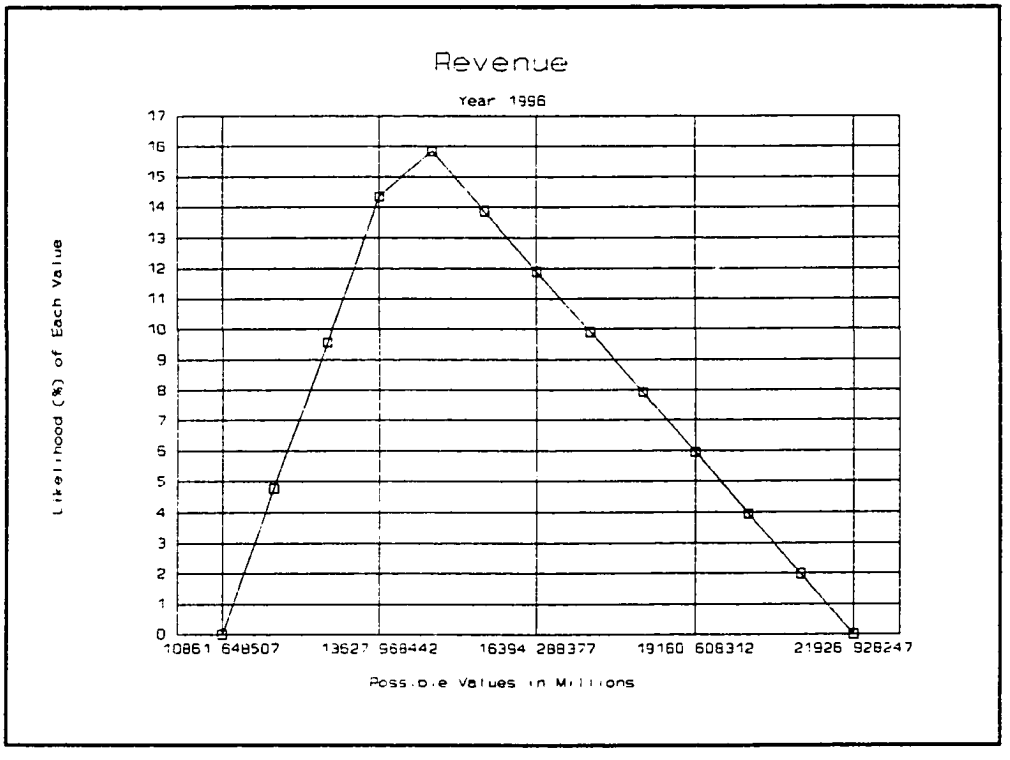
Appendix E3: 1996 Guestrooms and Visitor Volume Correlation



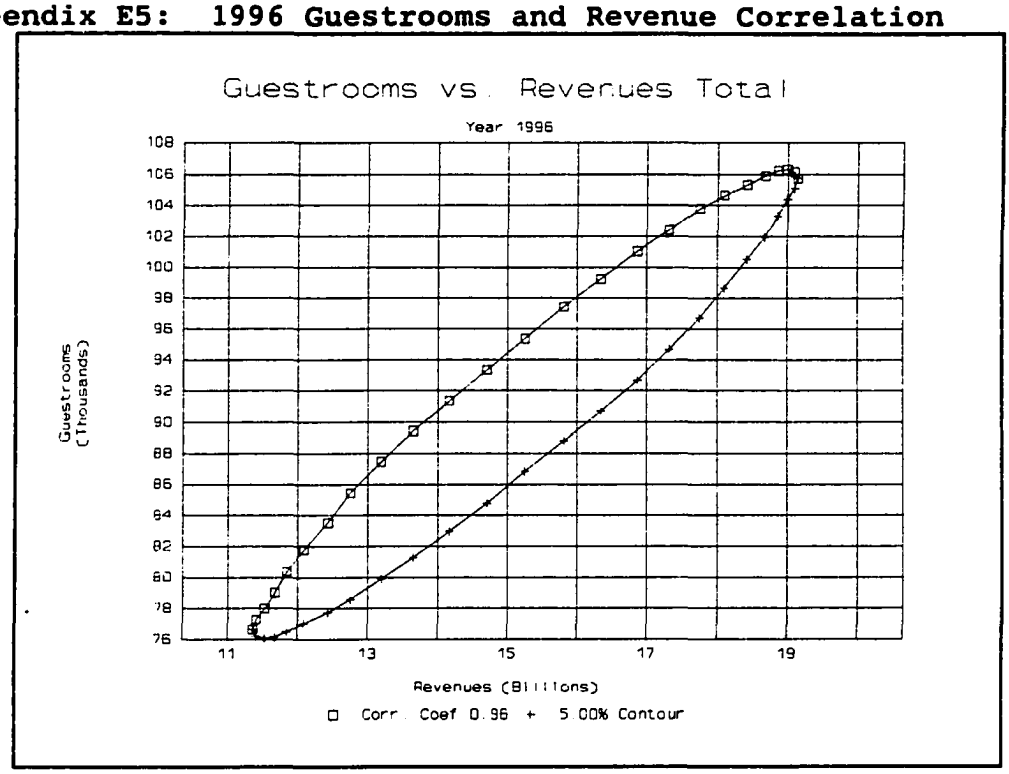


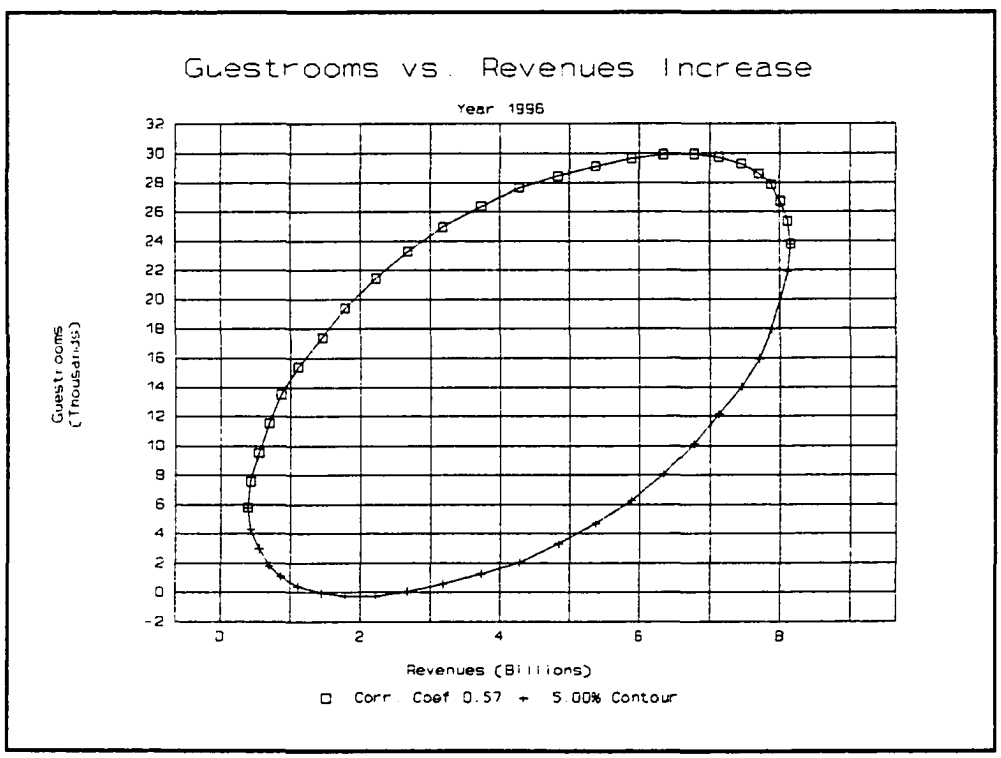
Appendix E4: 1996 Revenue



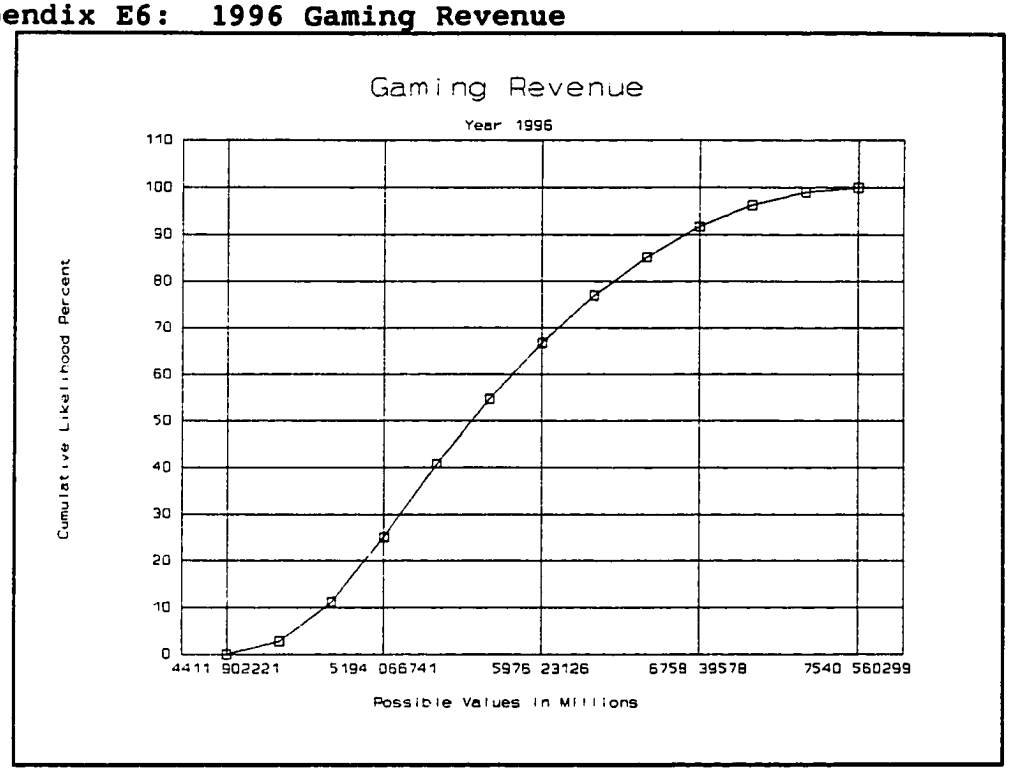


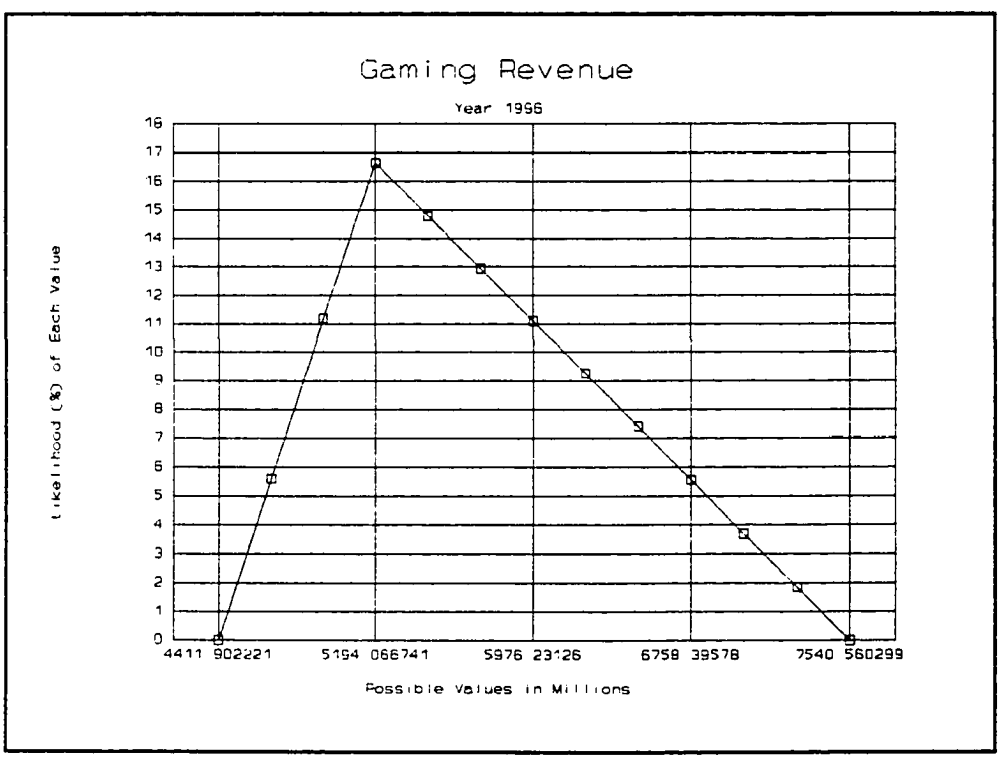
Appendix E5: 1996 Guestrooms and Revenue Correlation



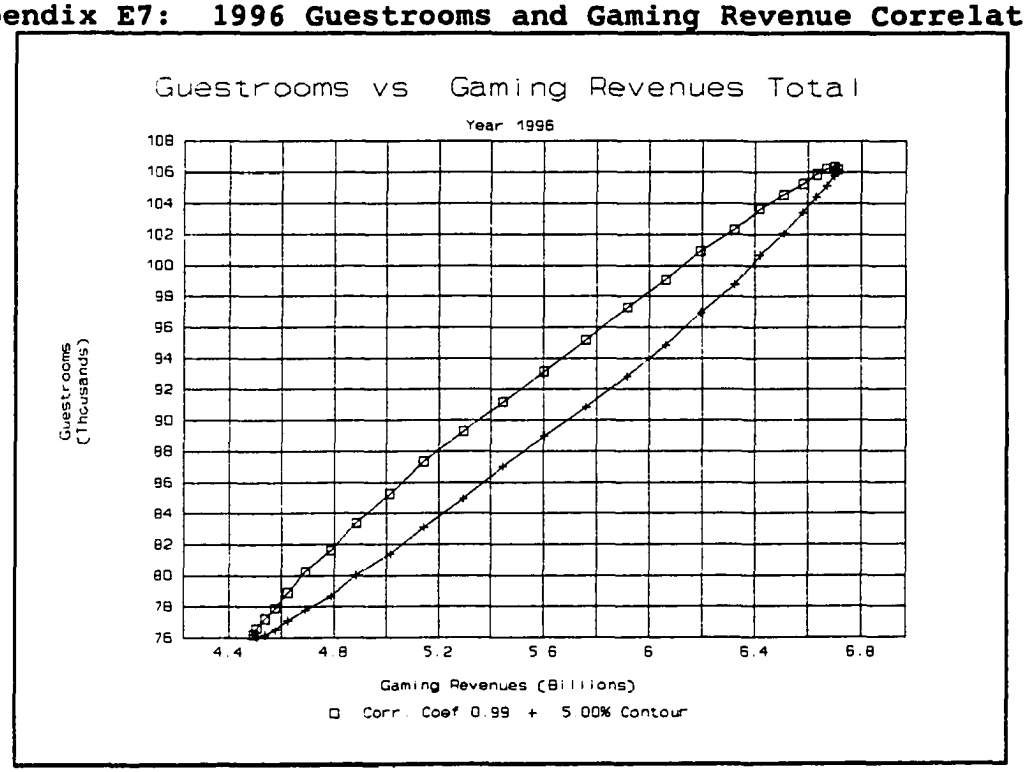


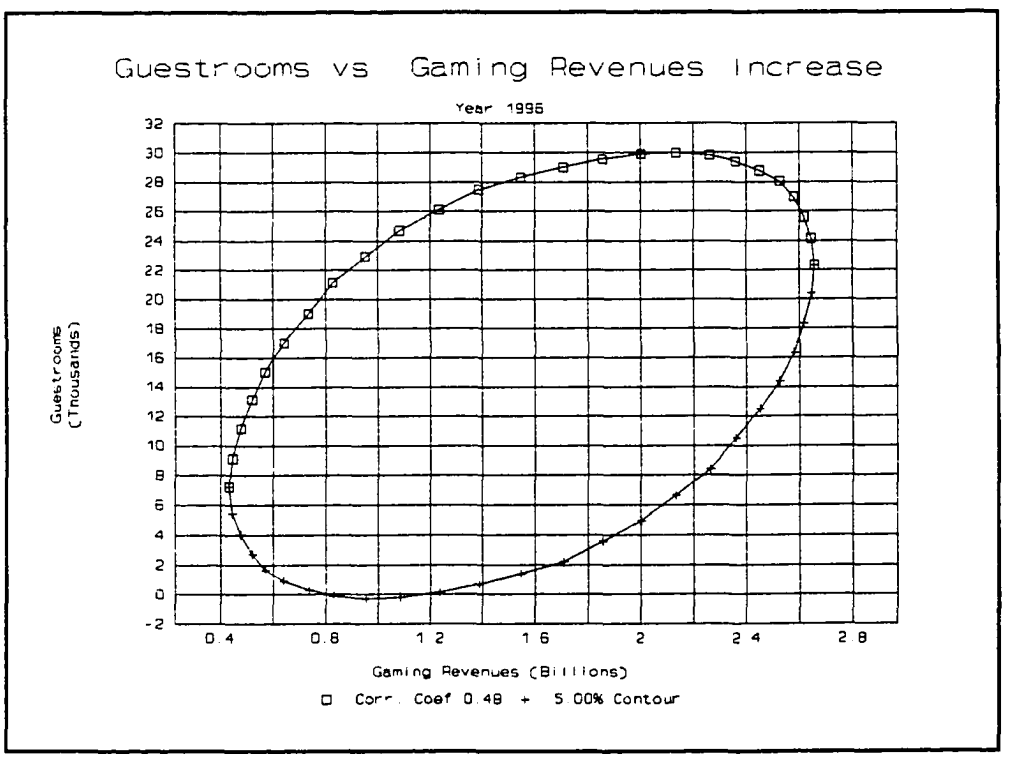
Appendix E6: 1996 Gaming Revenue



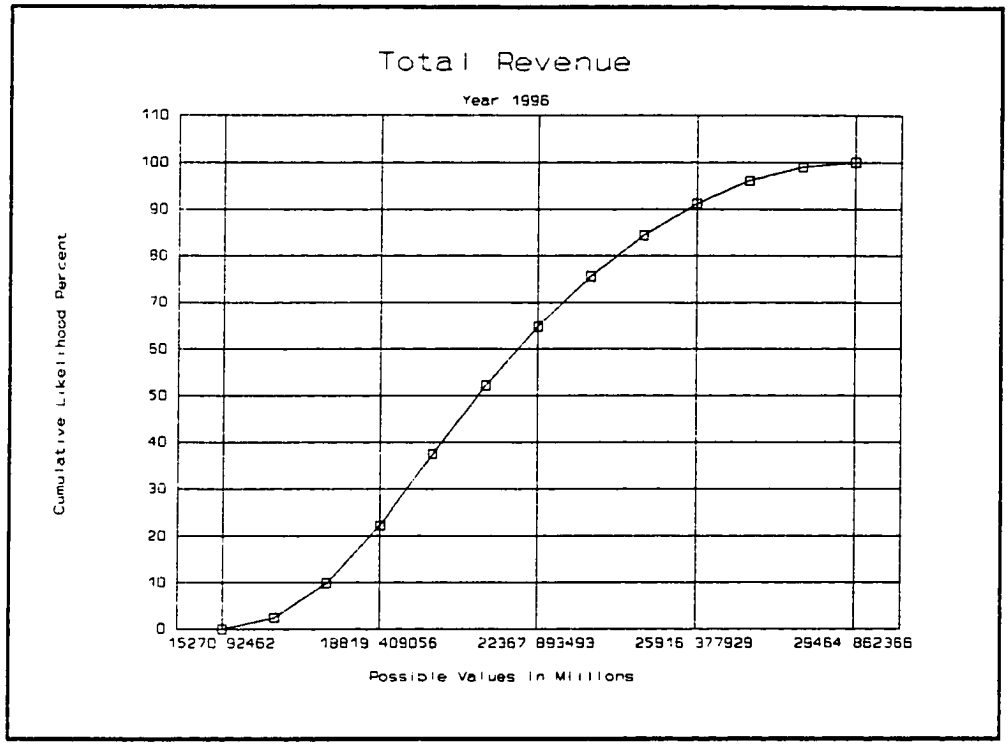


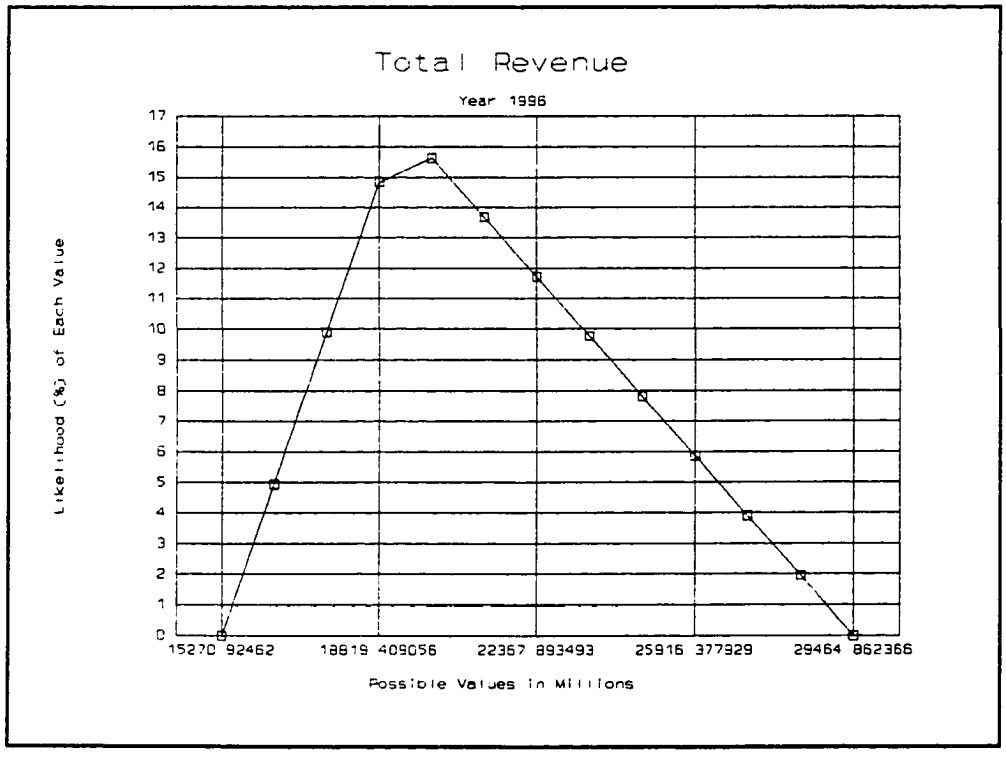
Appendix E7: 1996 Guestrooms and Gaming Revenue Correlation



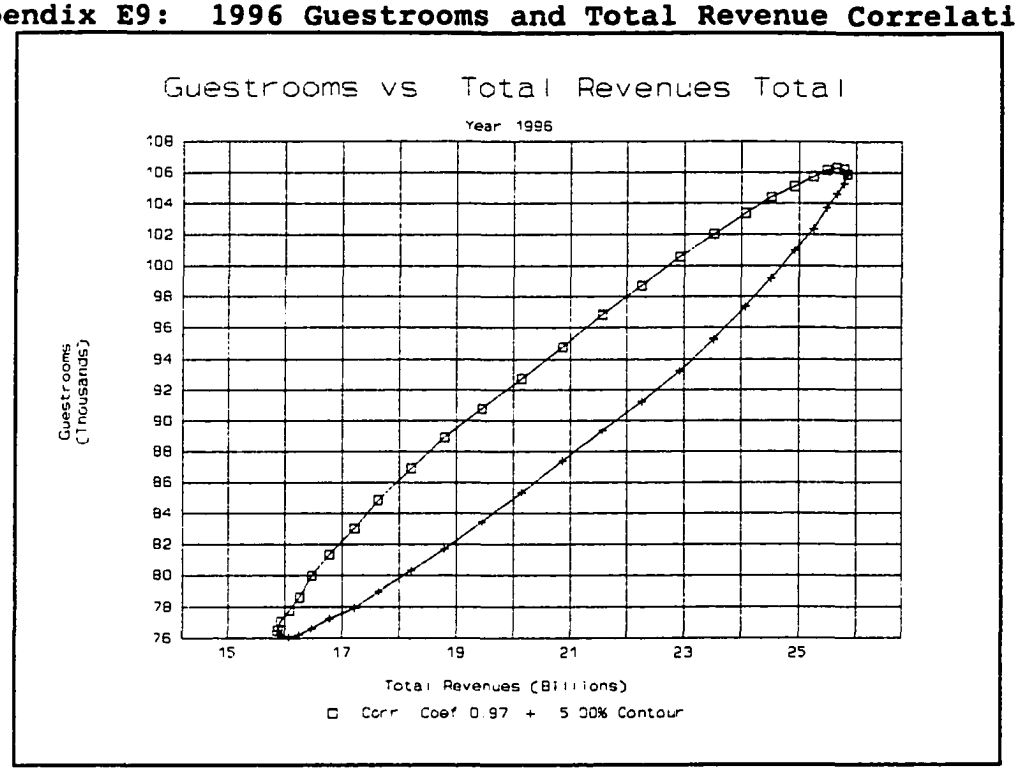


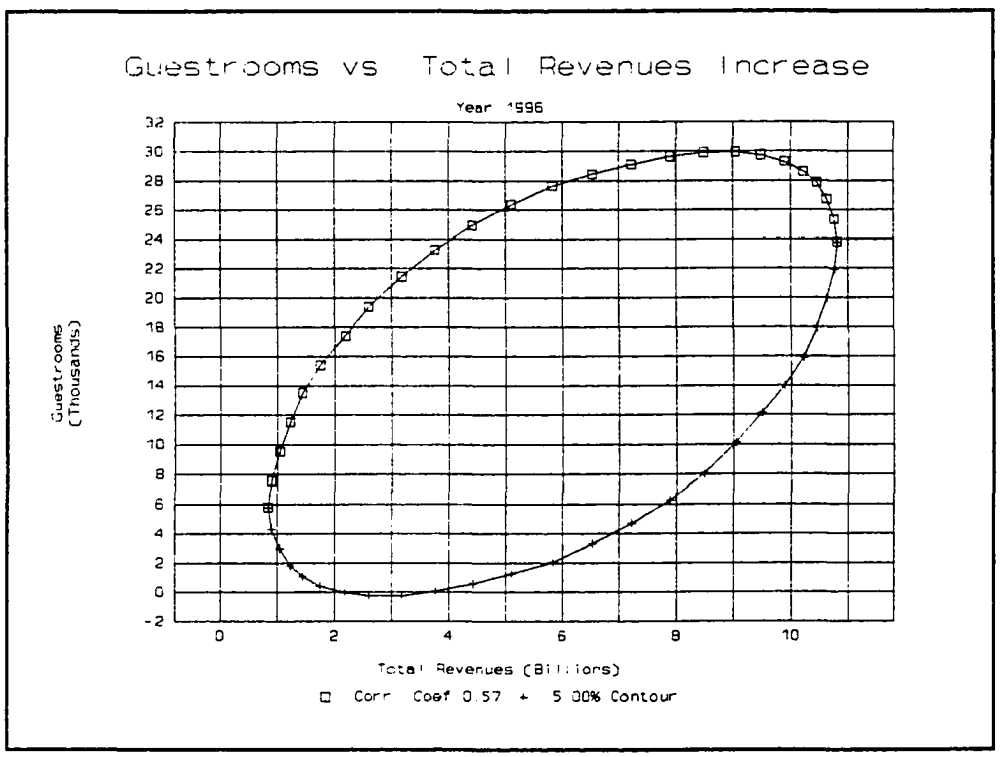
Appendix E8: 1996 Total Revenue



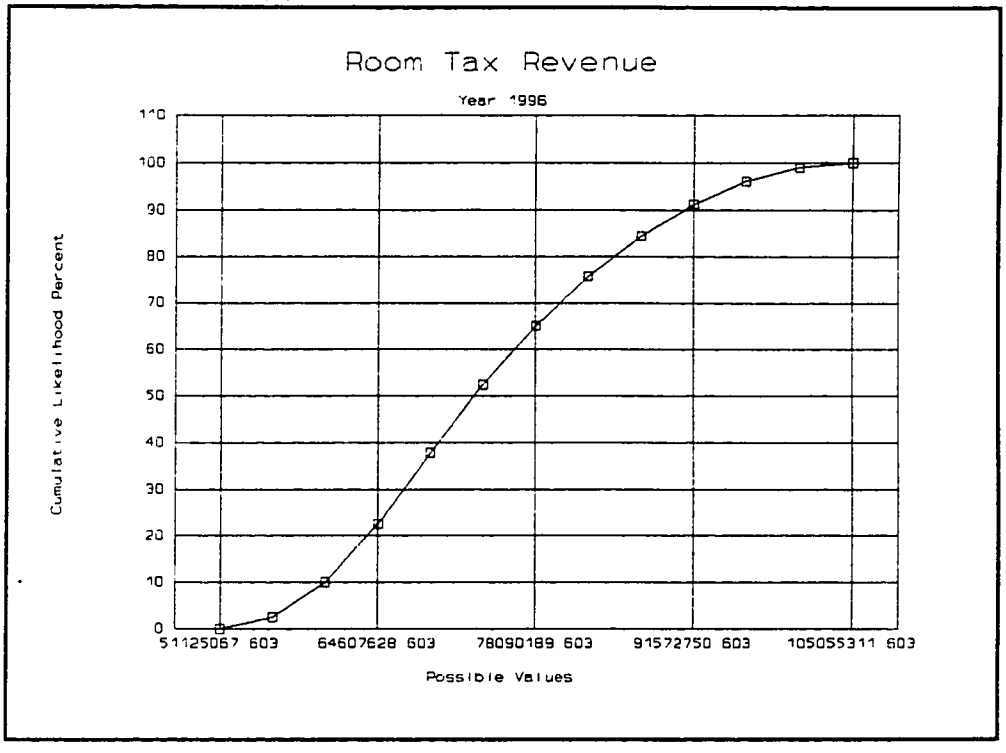


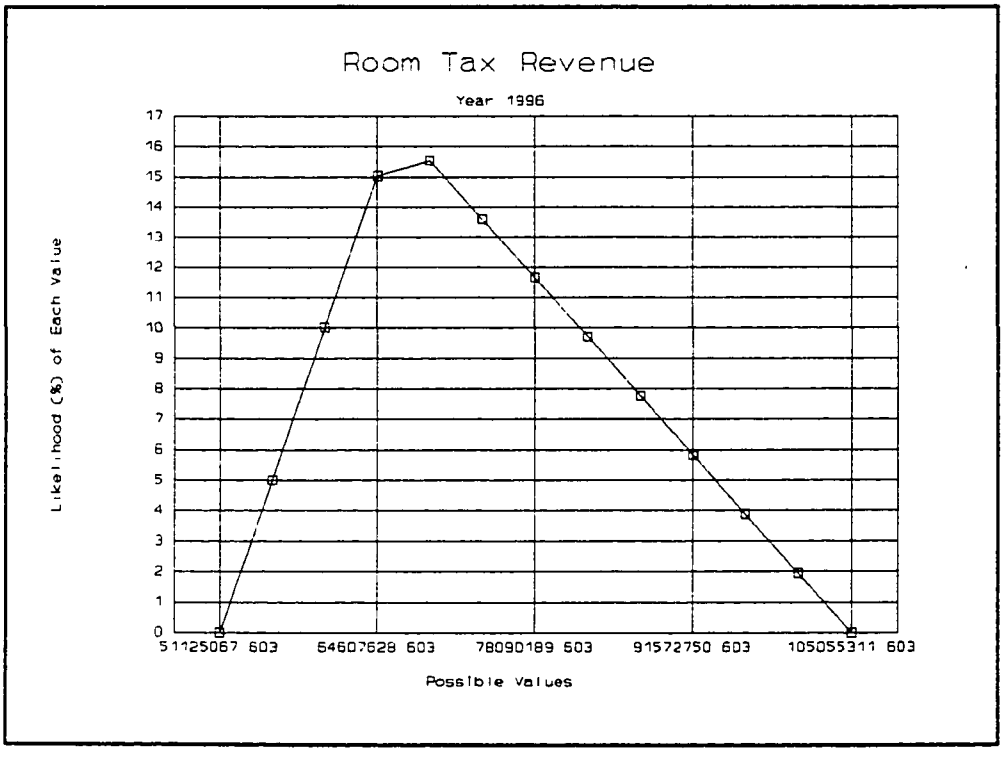
Appendix E9: 1996 Guestrooms and Total Revenue Correlation



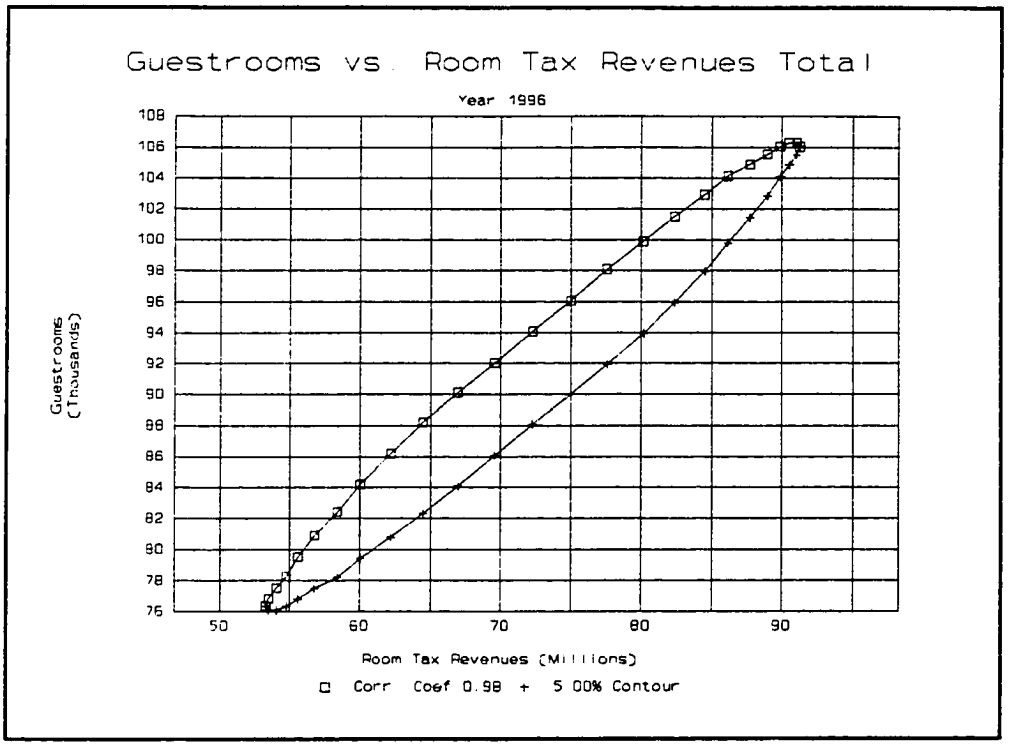


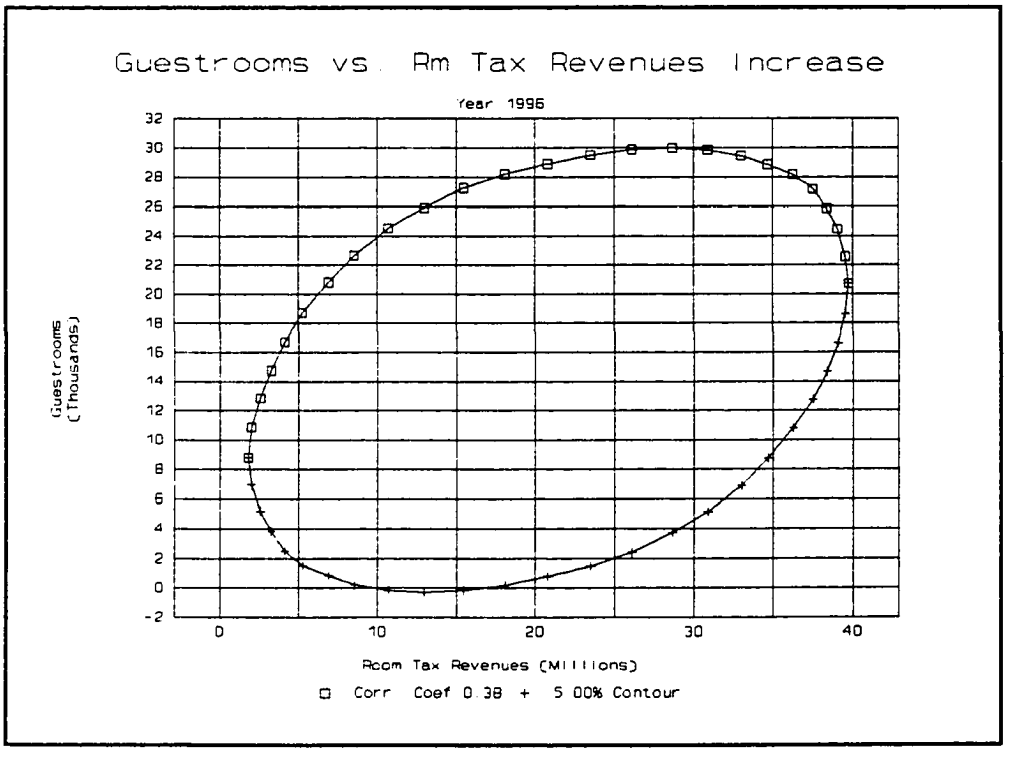
Appendix E10: 1996 Room Tax Revenue



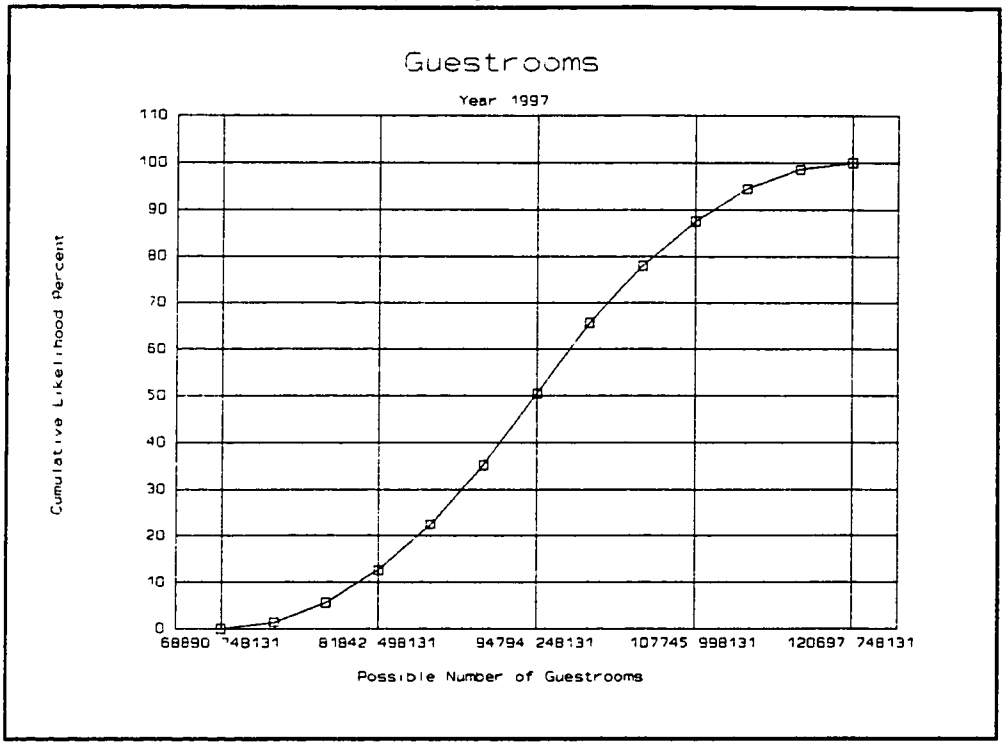


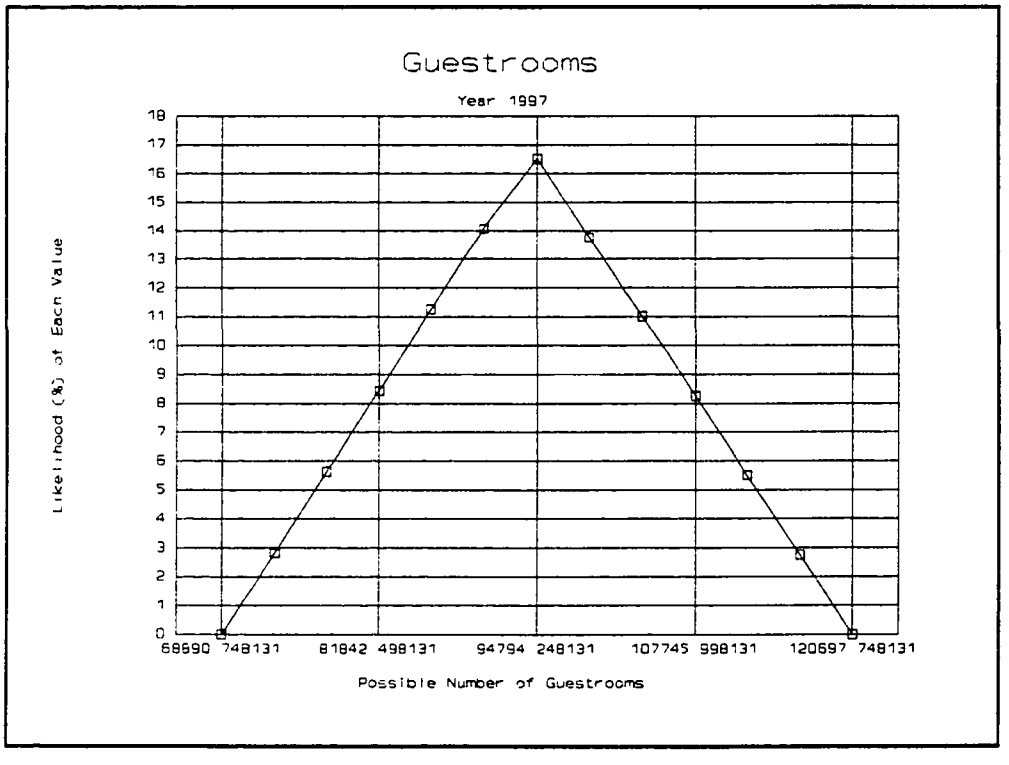
Appendix E11: 1996 Guestrooms and Room Tax Revenue Correlation



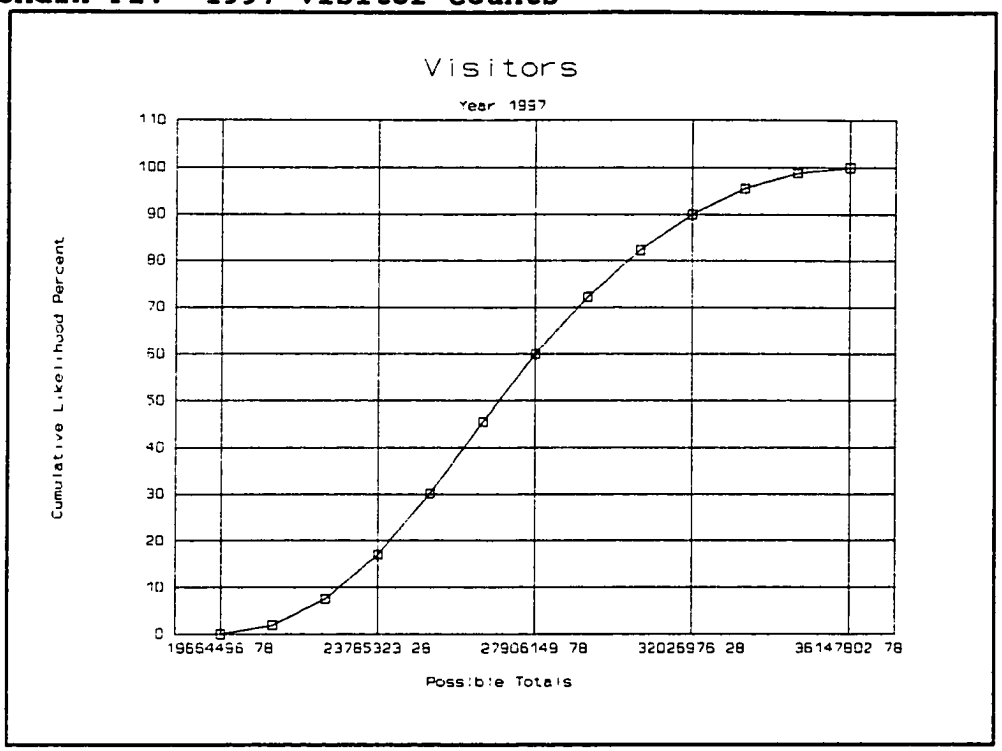


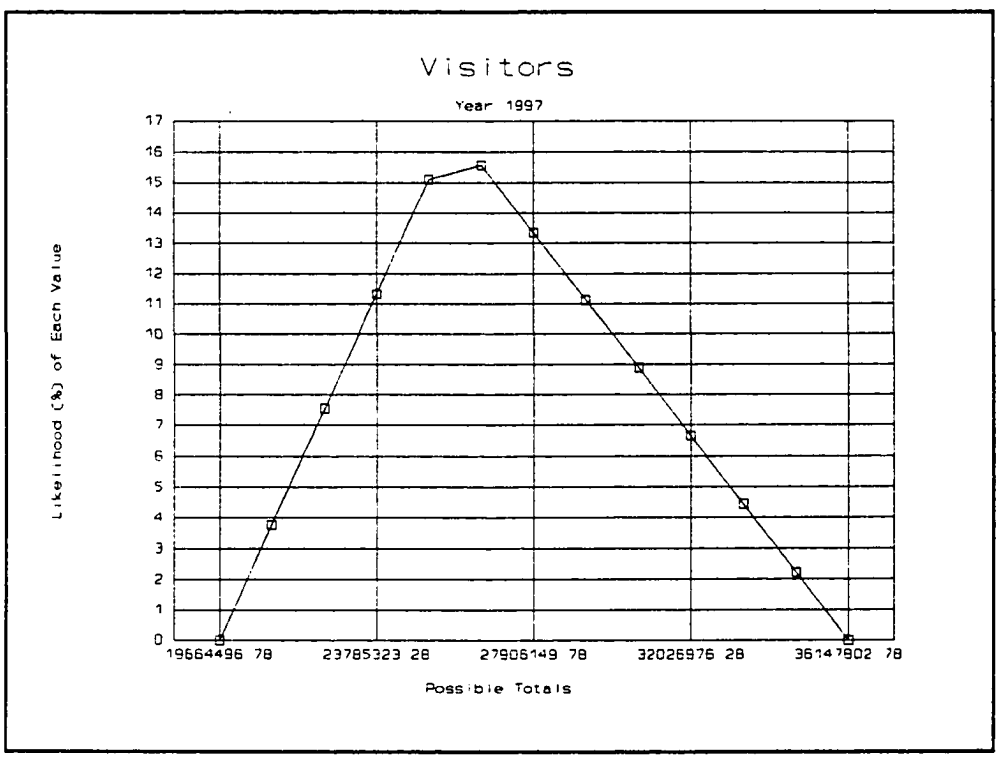
Appendix F1: 1997 Guestrooms



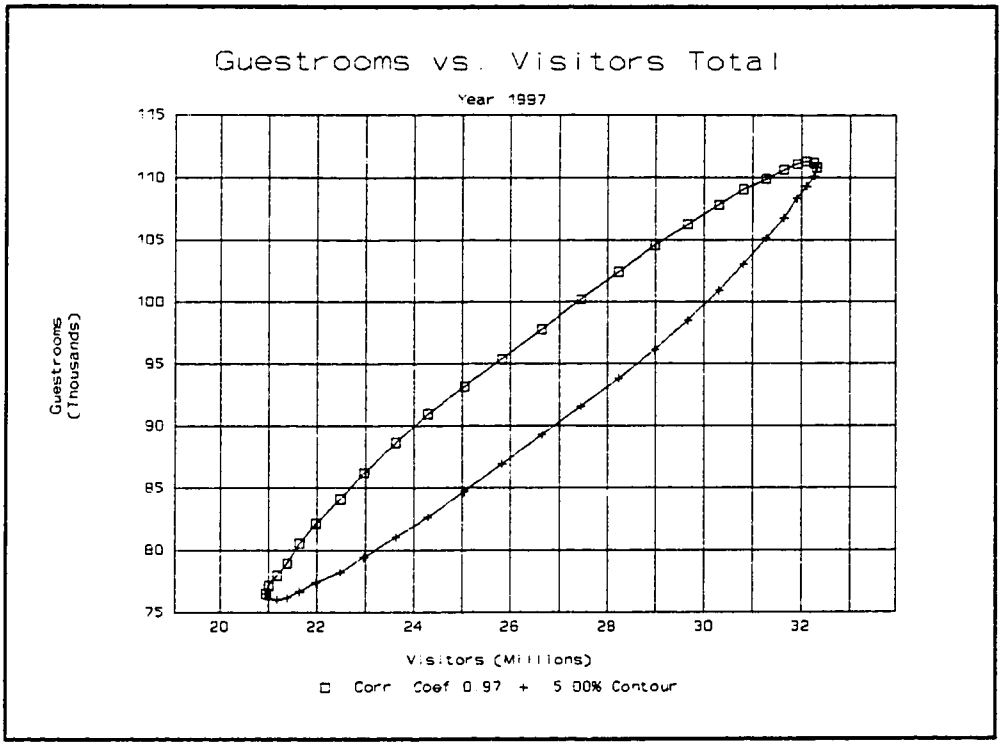


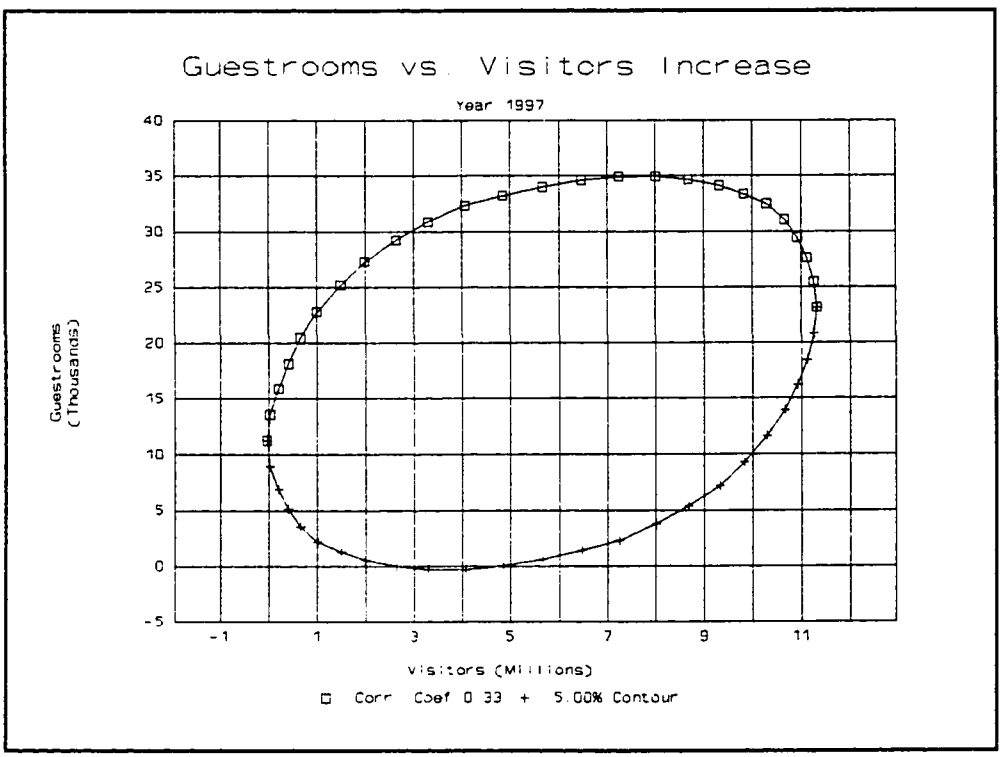
Appendix F2: 1997 Visitor Counts



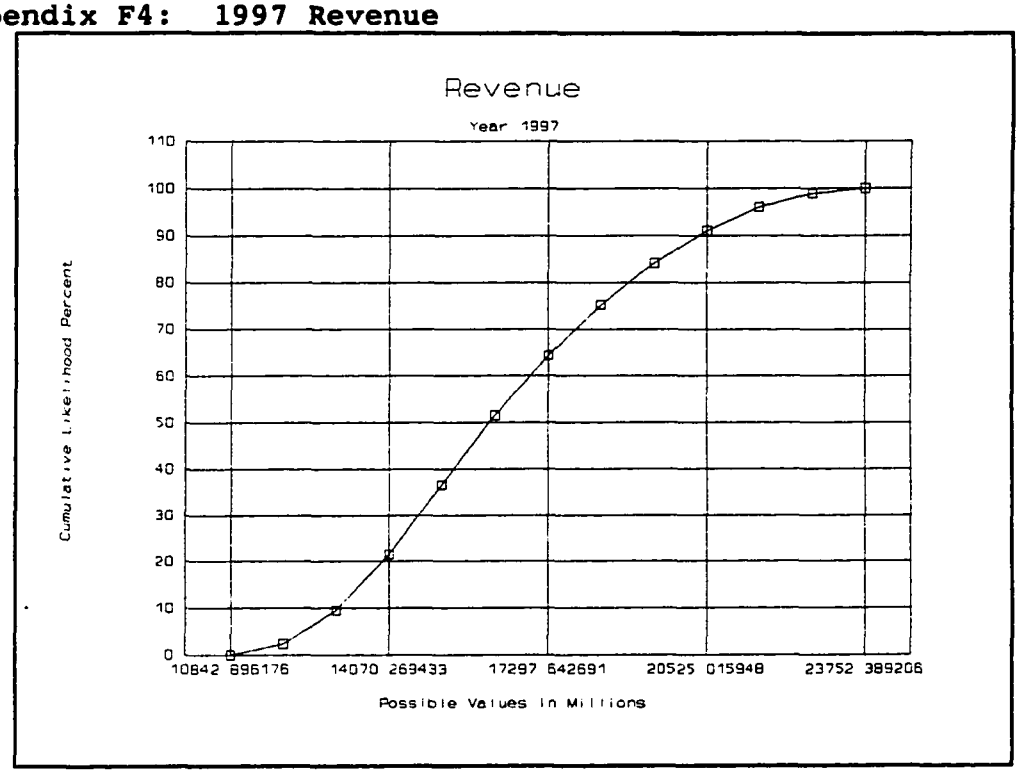


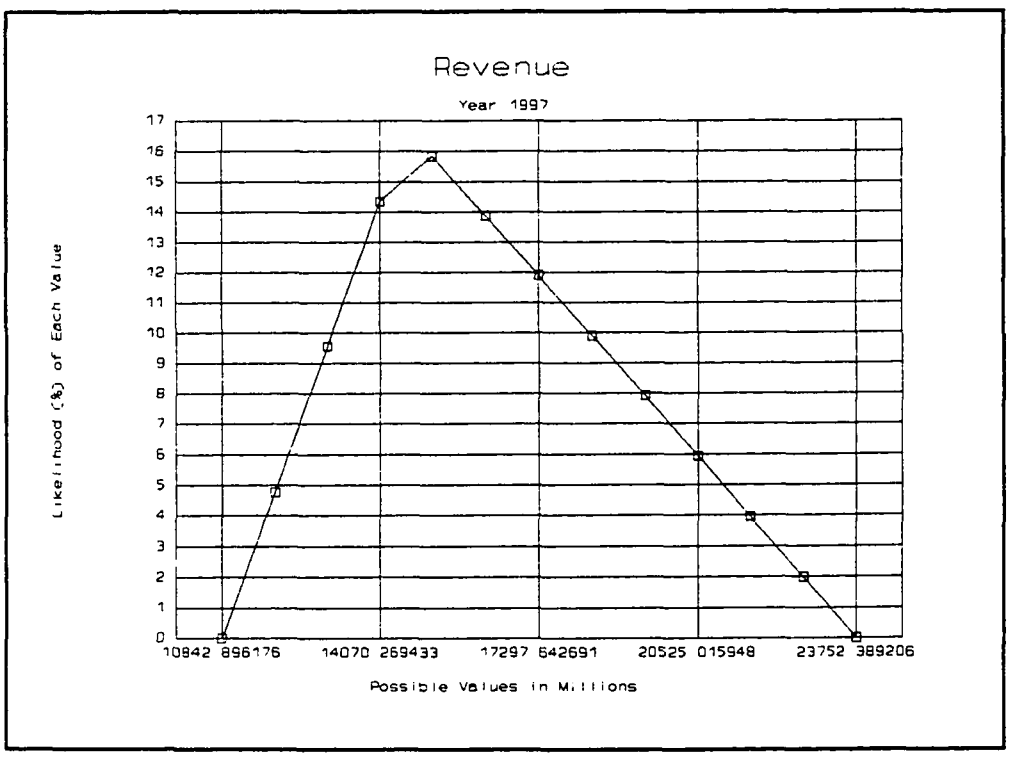
Appendix F3: 1997 Guestrooms and Visitor Volume Correlation



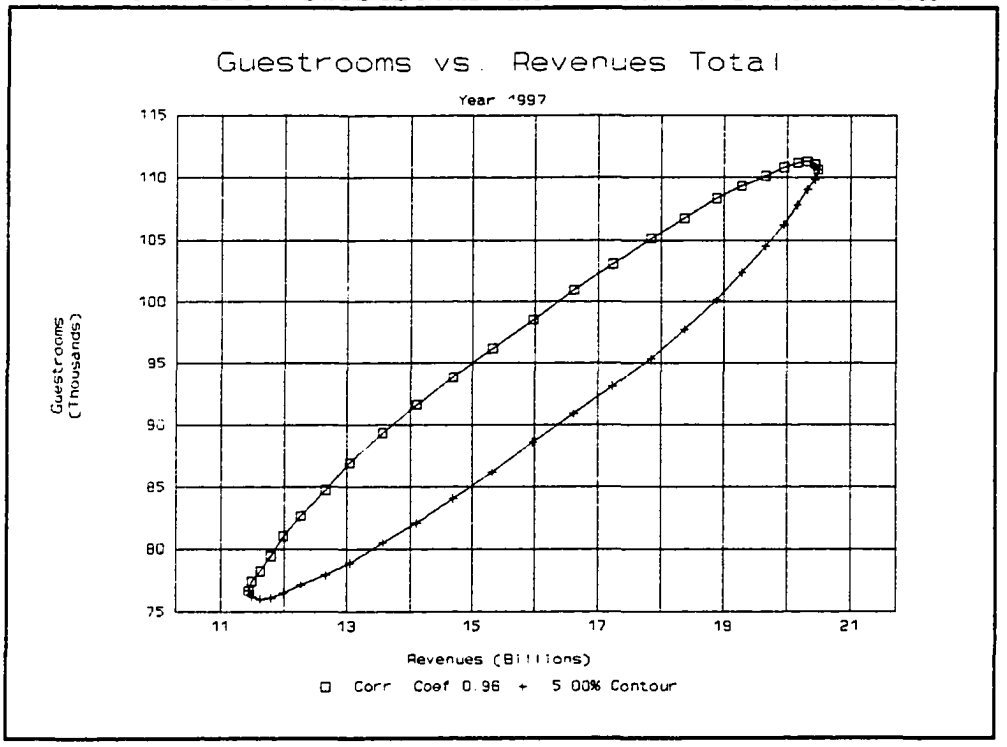


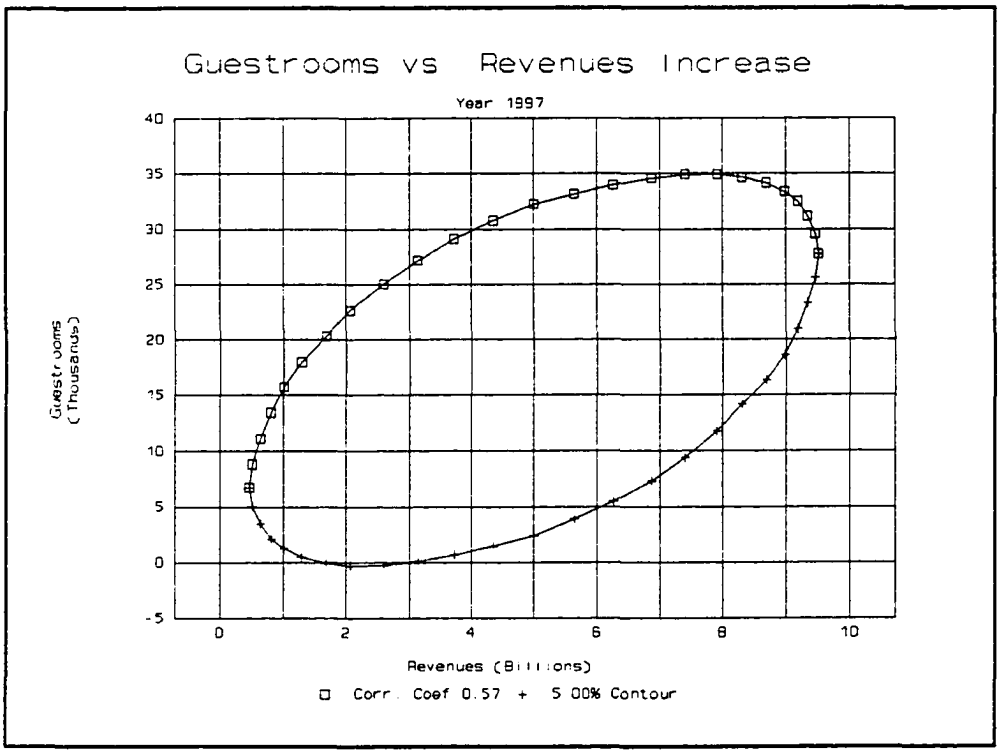
Appendix F4: 1997 Revenue



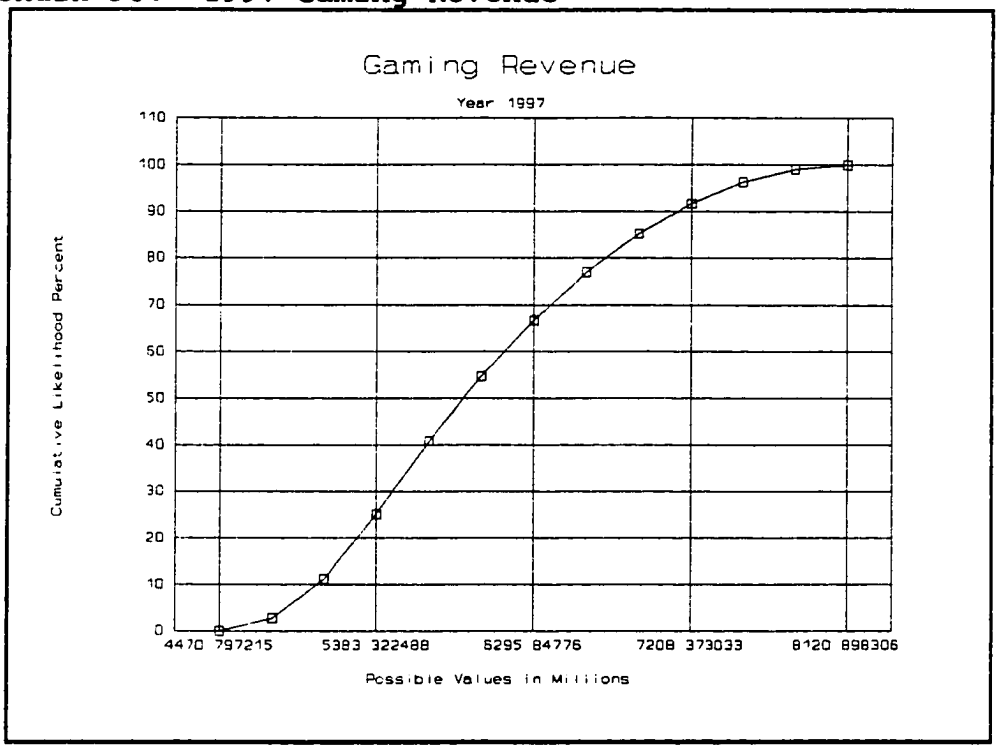


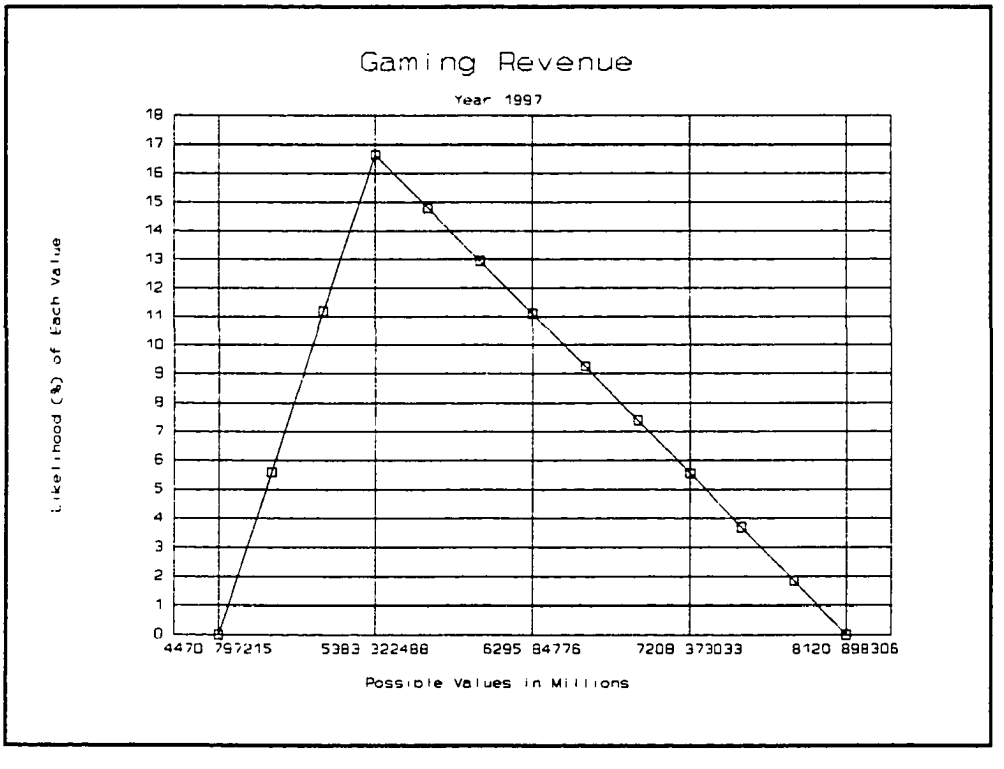
Appendix F5: 1997 Guestrooms and Revenue Correlation



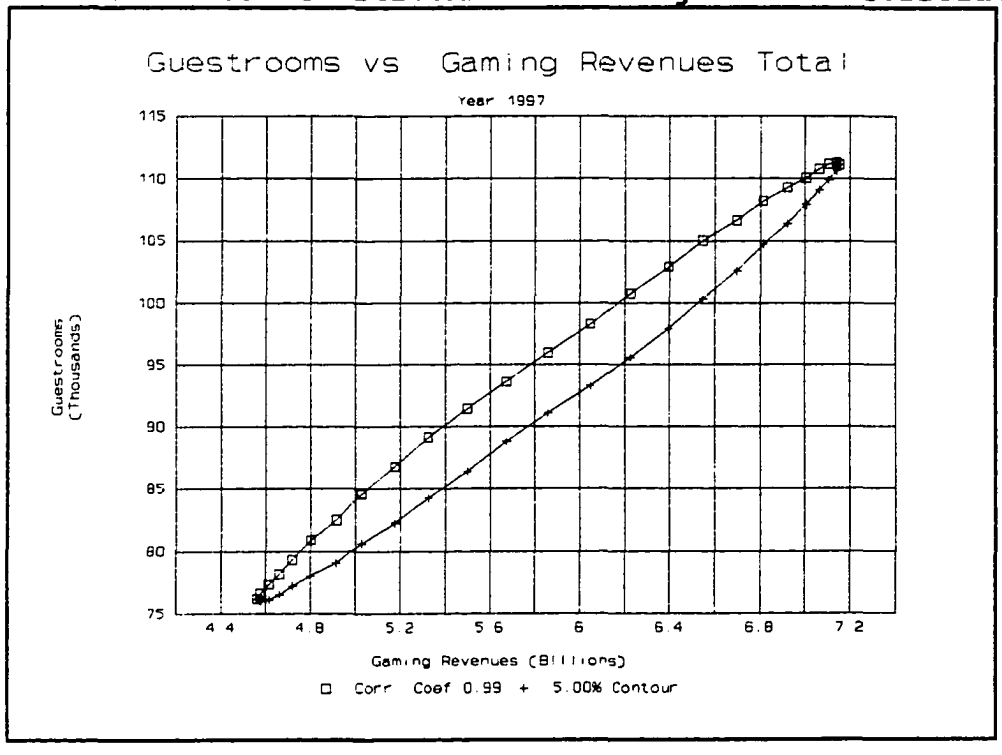


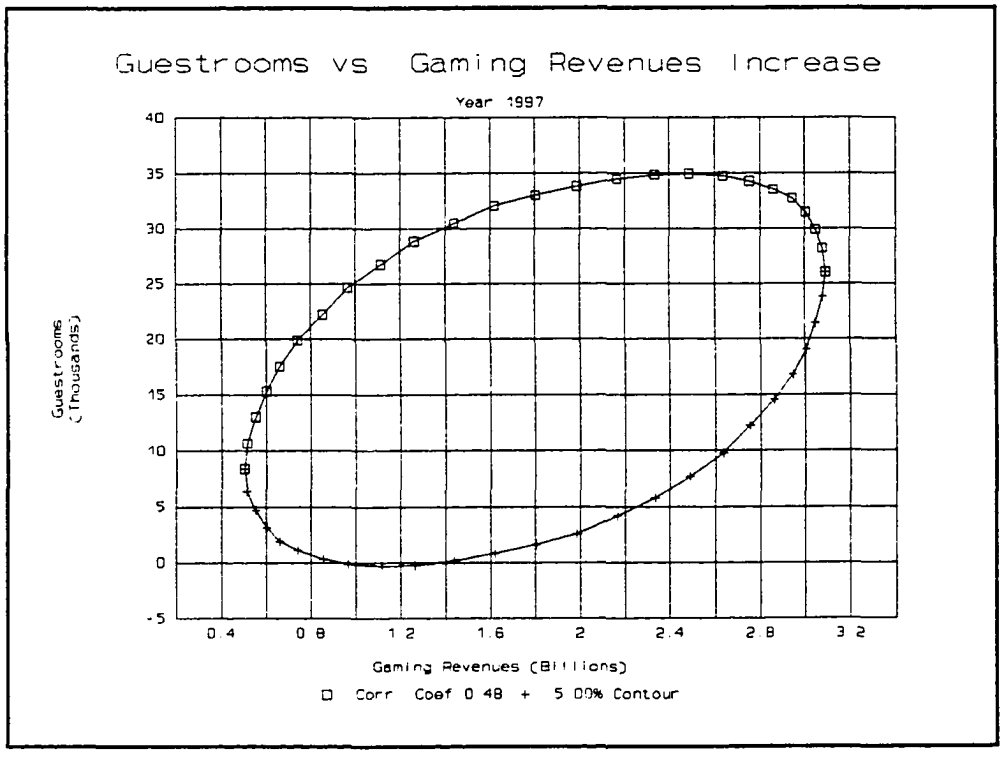
Appendix F6: 1997 Gaming Revenue



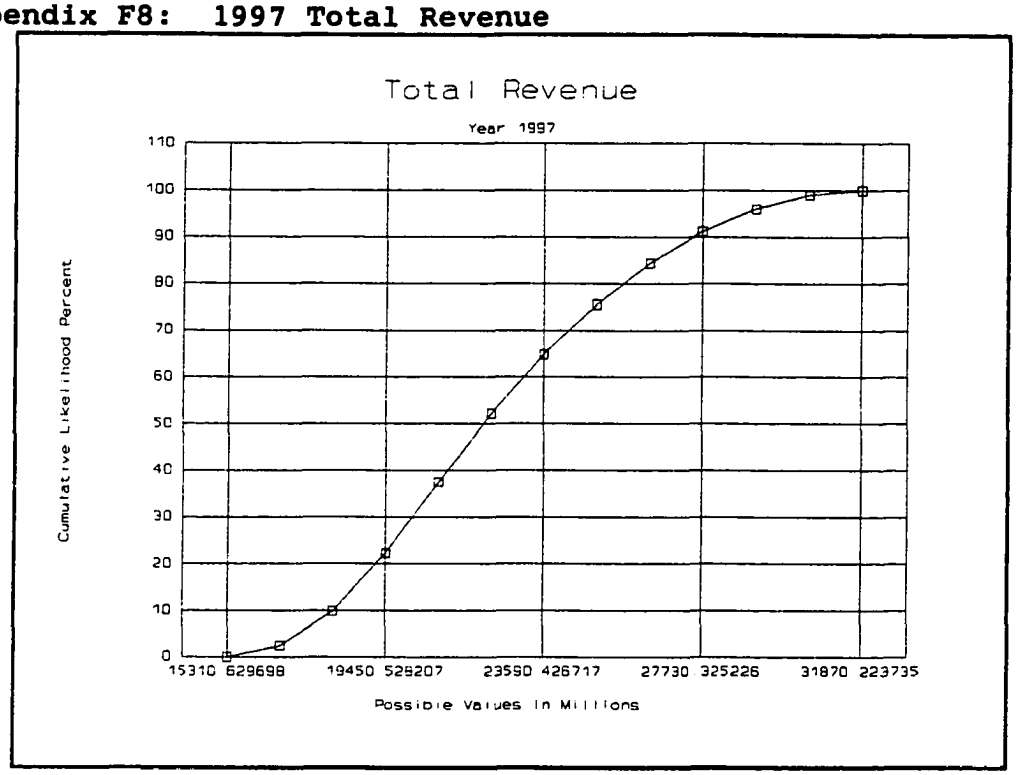


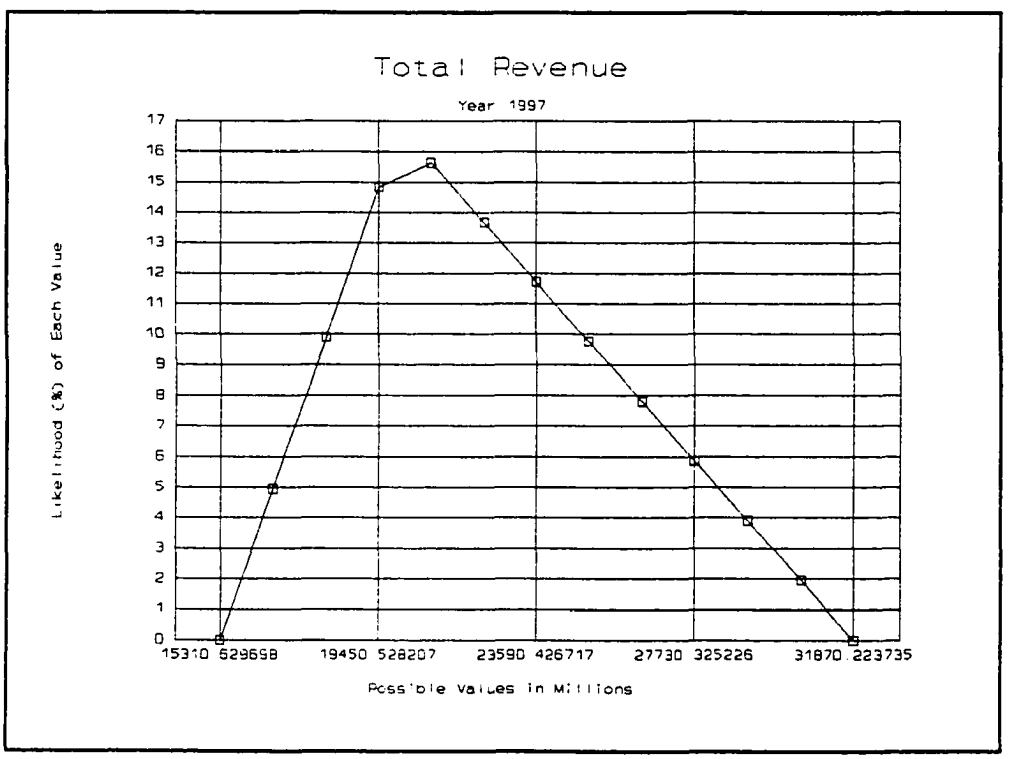
Appendix F7: 1997 Guestrooms and Gaming Revenue Correlation



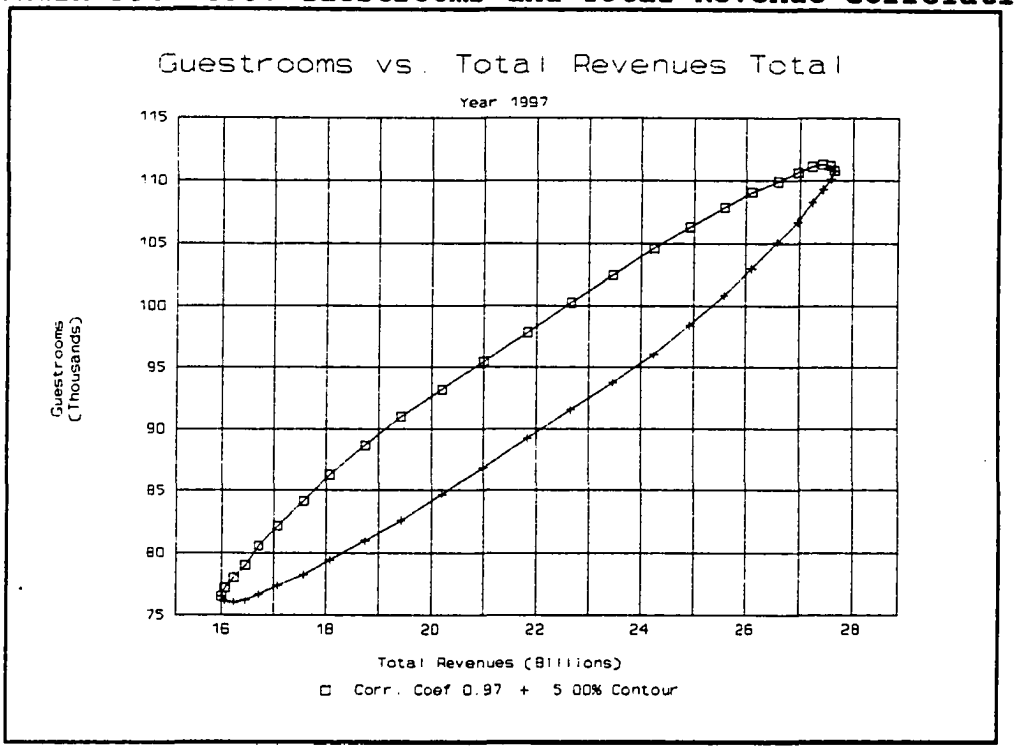


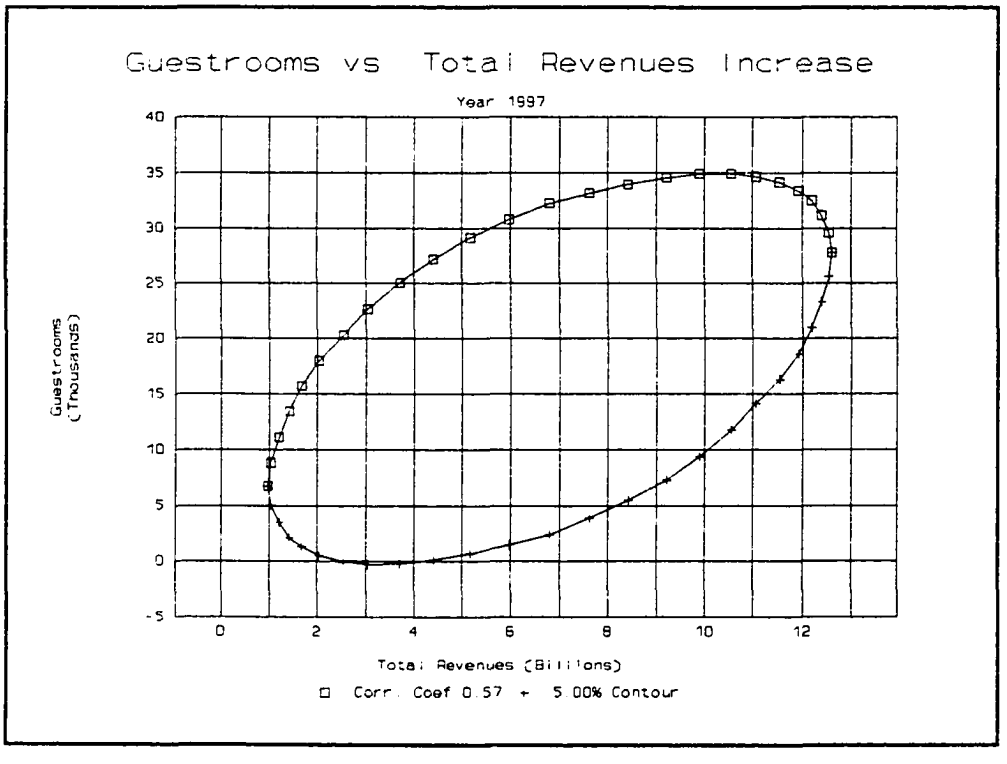
Appendix F8: 1997 Total Revenue



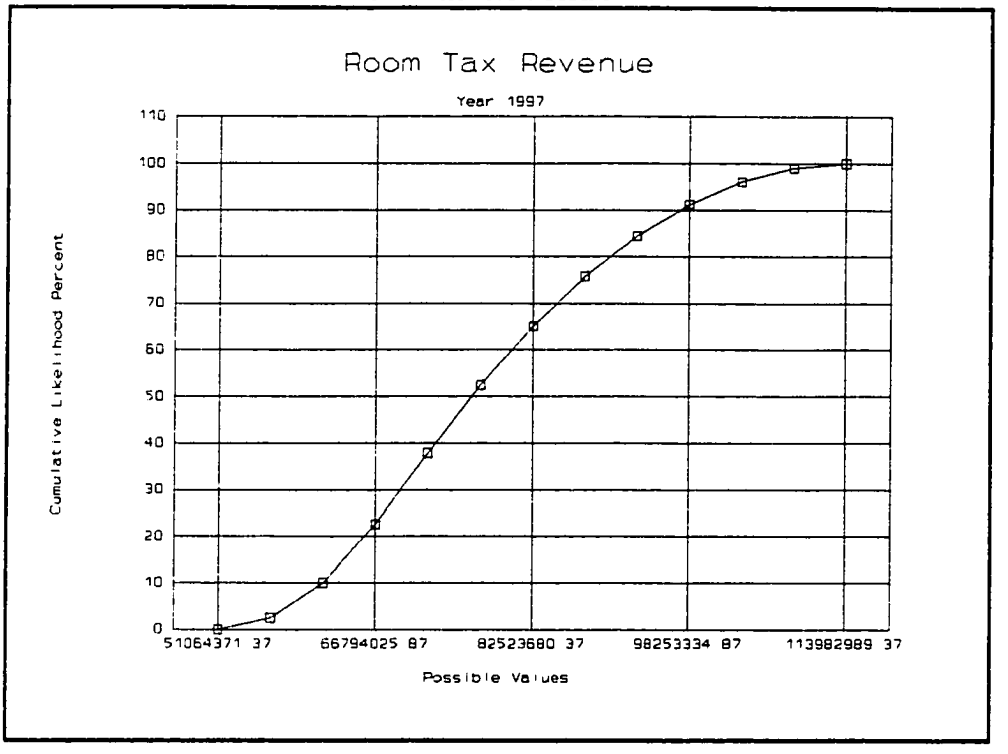


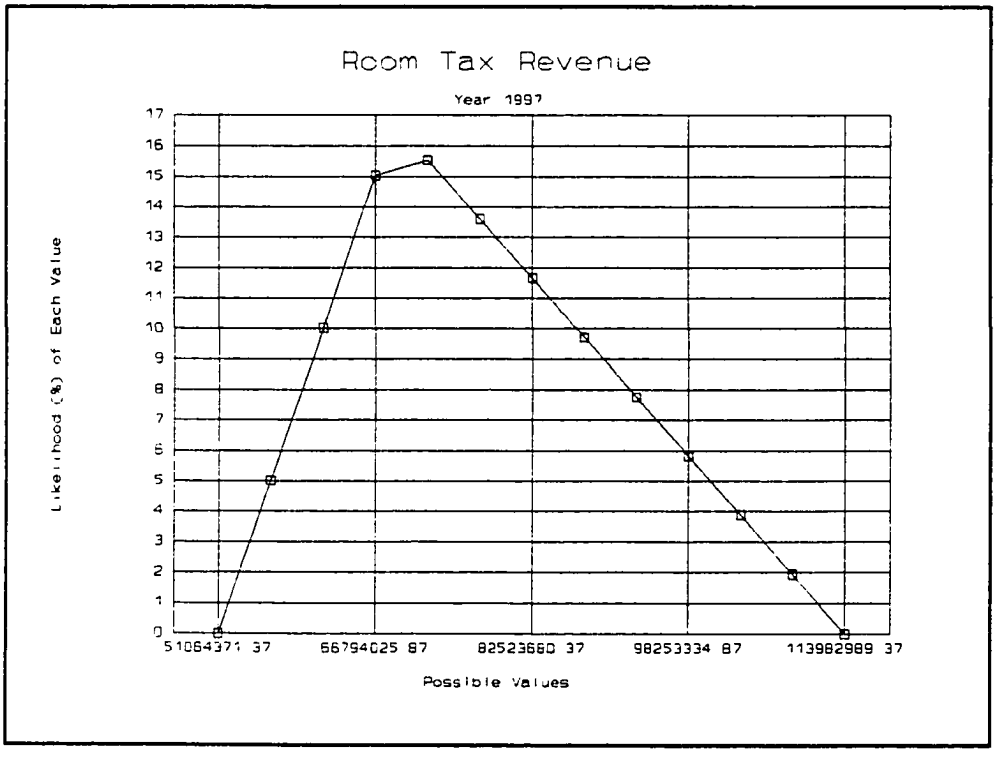
Appendix F9: 1997 Guestrooms and Total Revenue Correlation



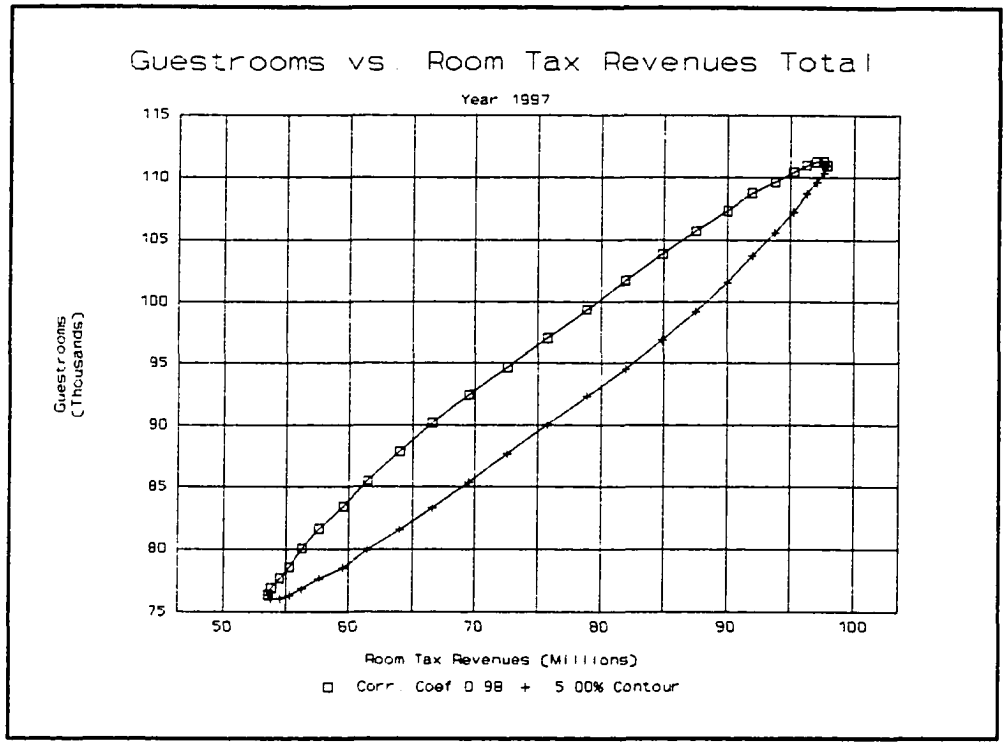


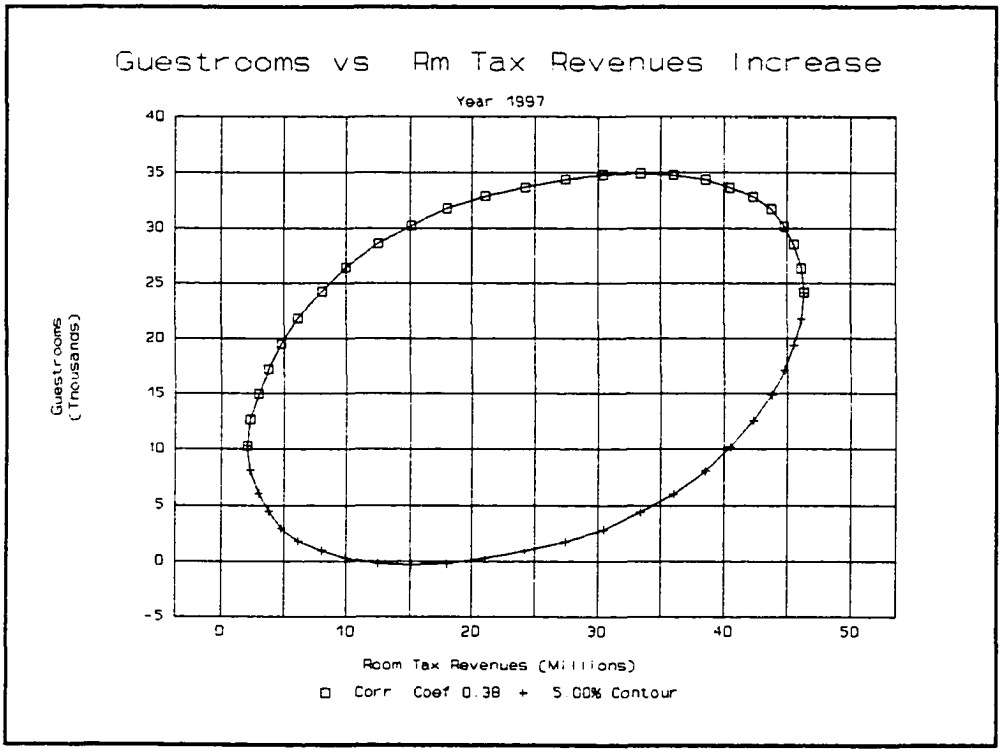
Appendix F10: 1997 Room Tax Revenue



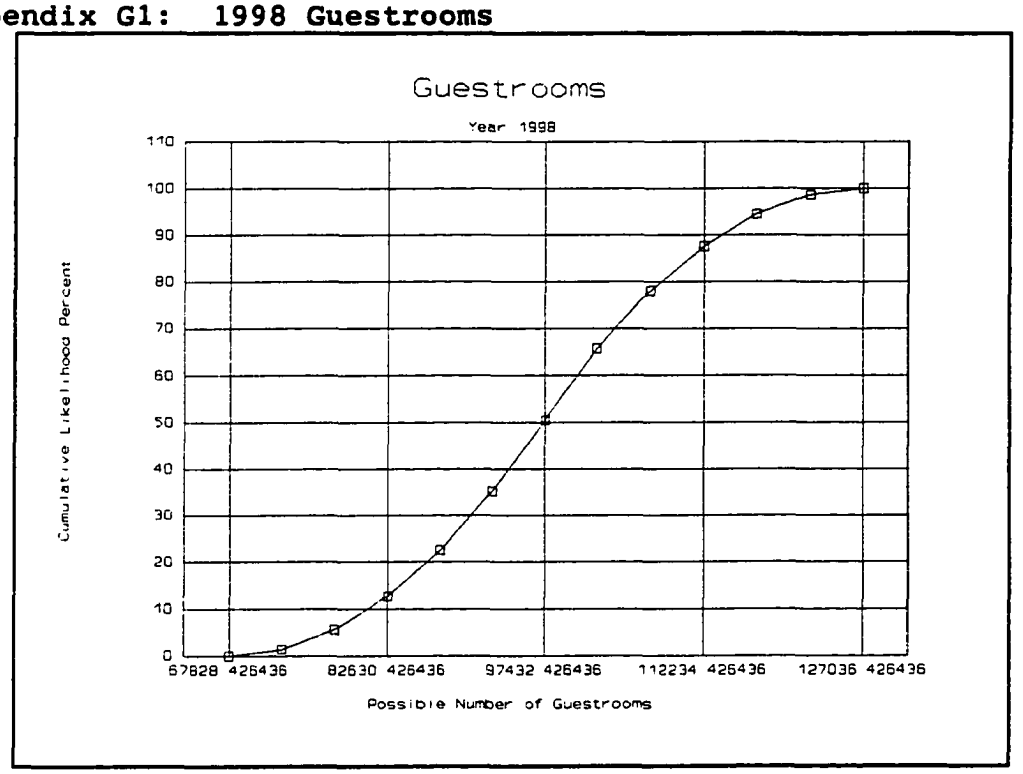


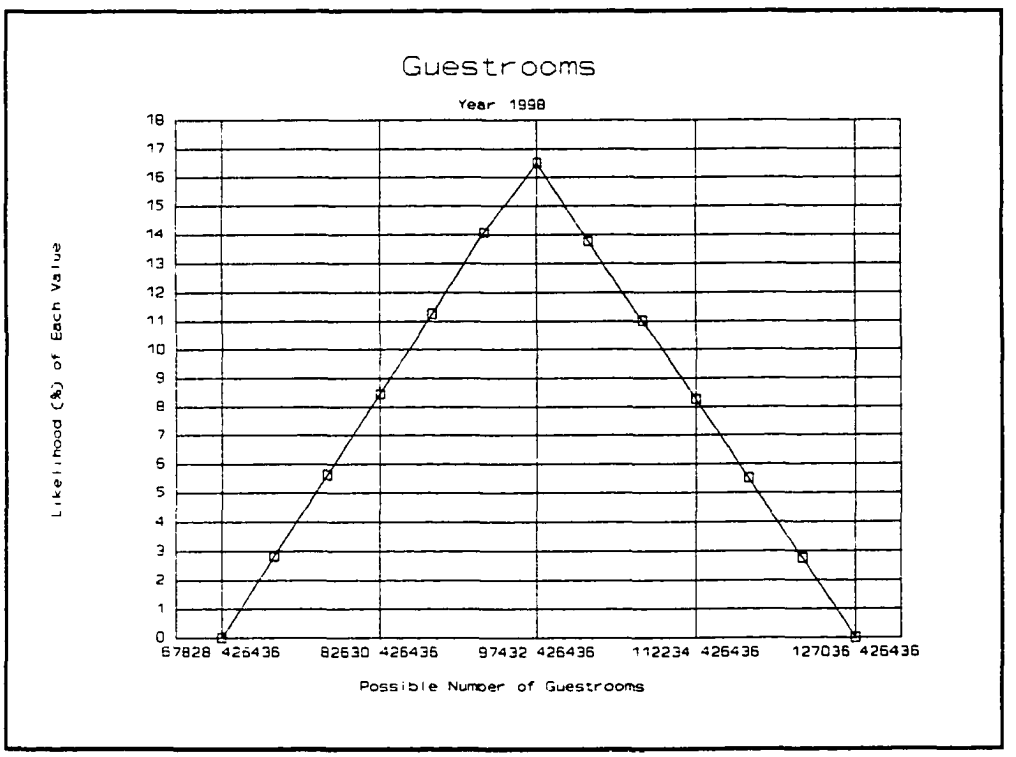
Appendix F11: 1997 Guestrooms and Room Tax Revenue Correlation



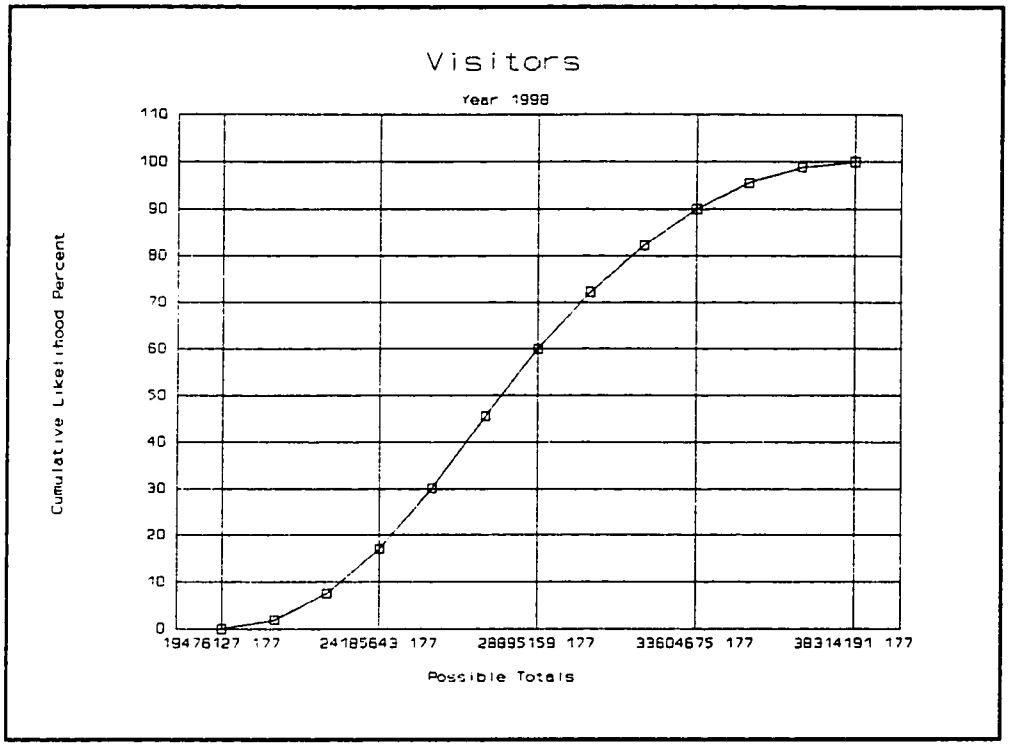


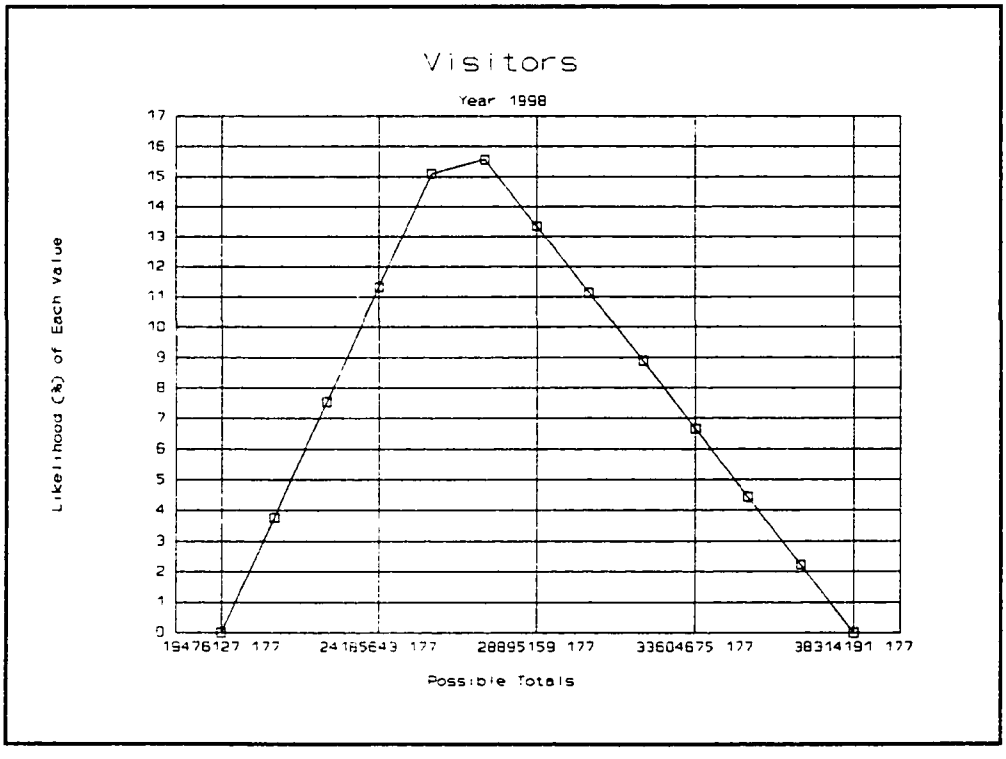
Appendix G1: 1998 Guestrooms



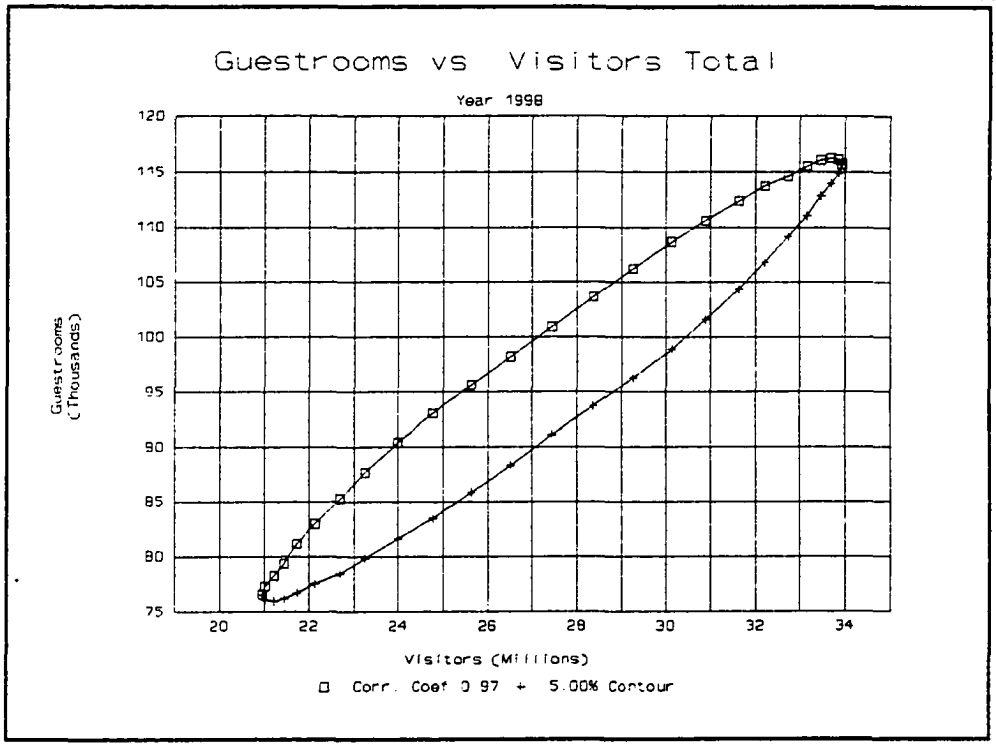


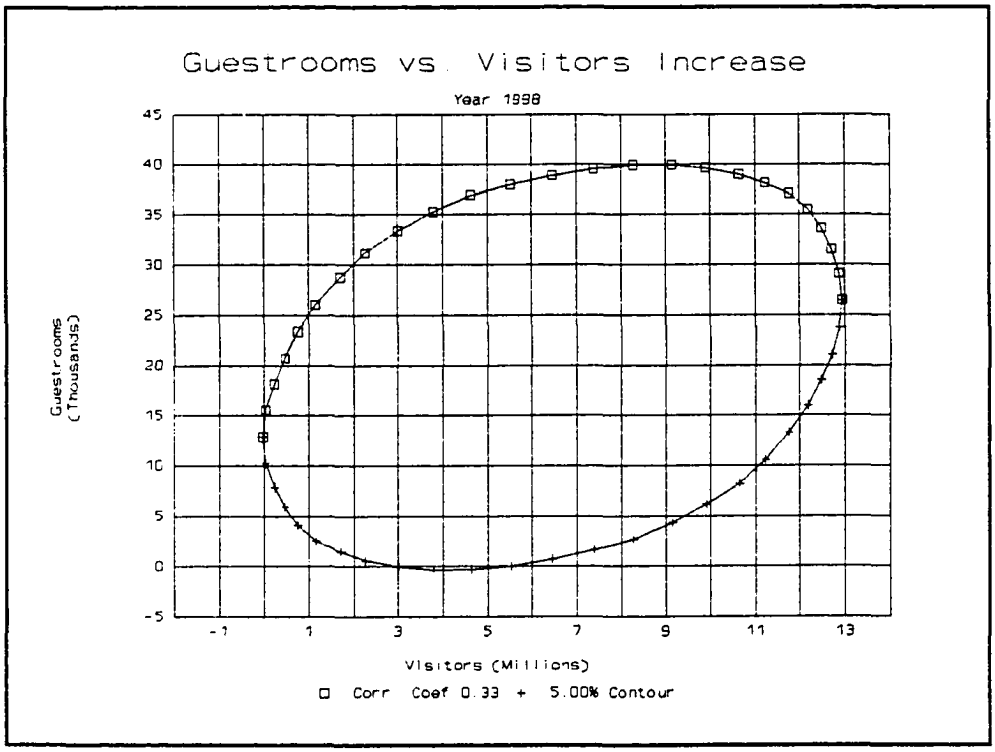
Appendix G2: 1998 Visitor Counts



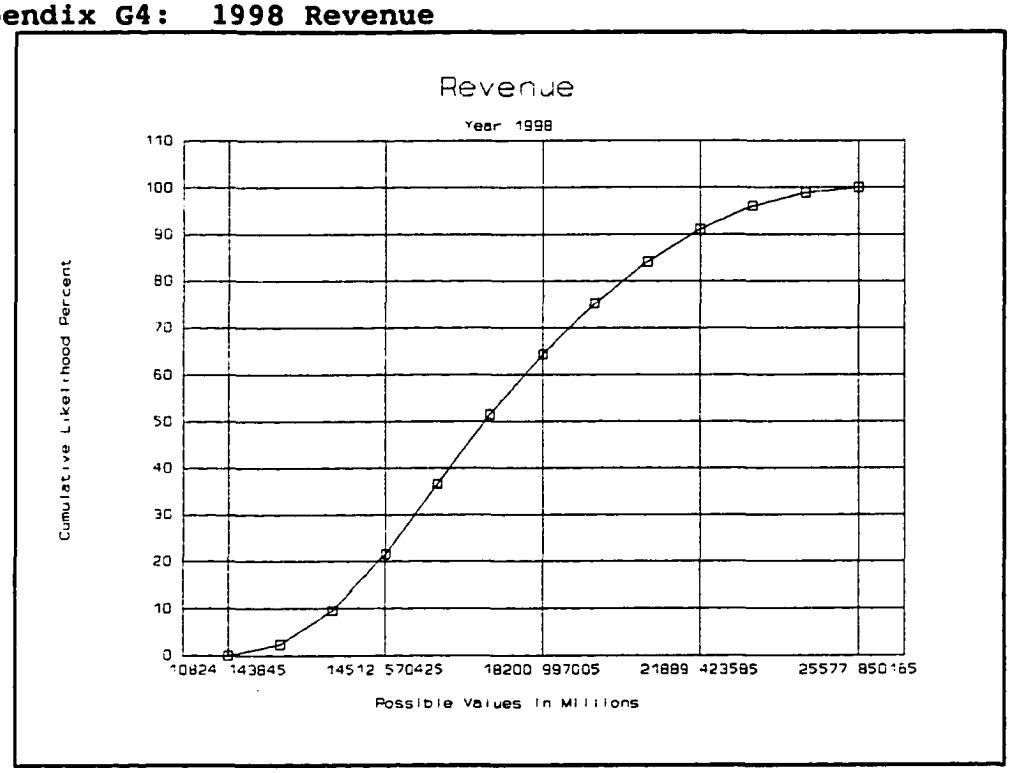


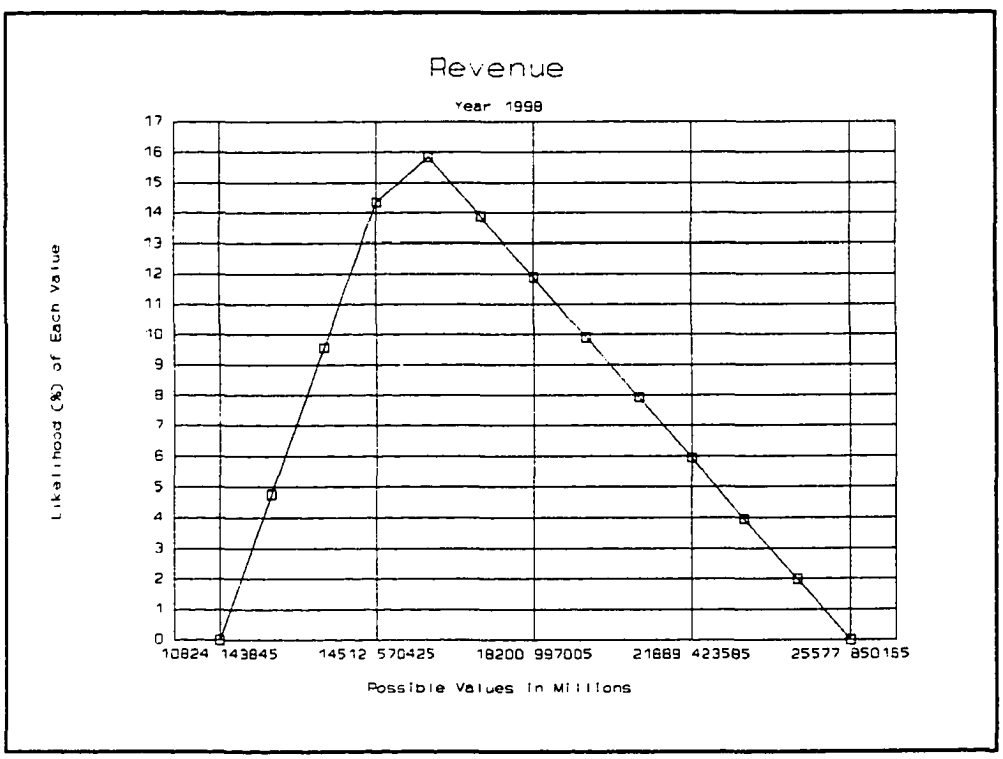
Appendix G3: 1998 Guestrooms and Visitor Volume Correlation



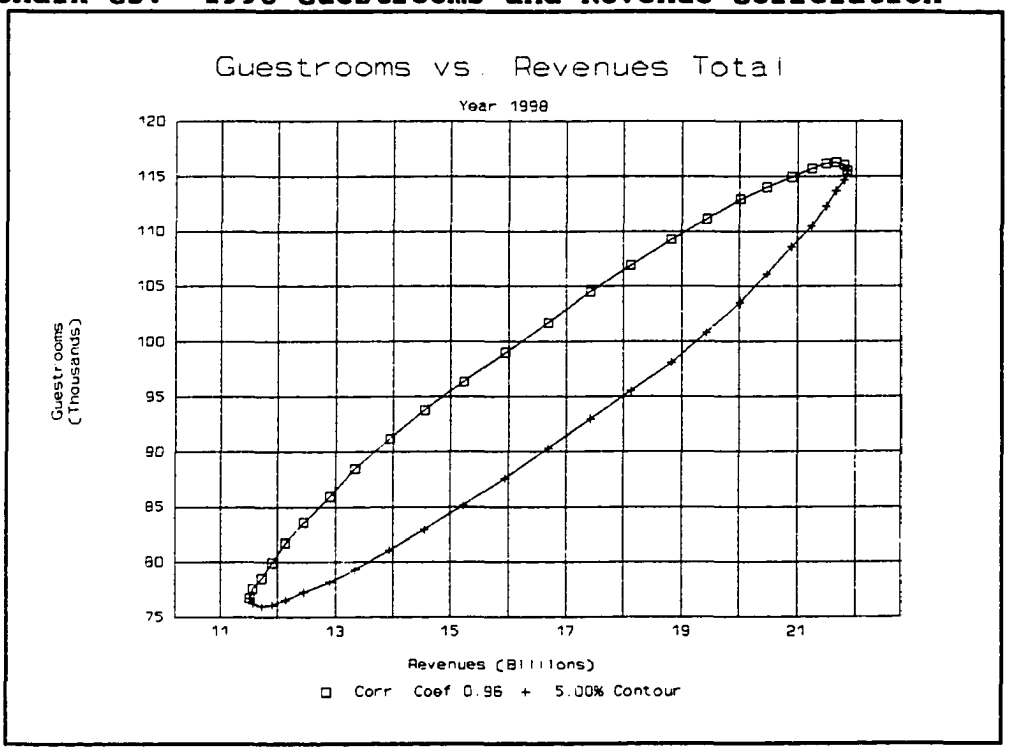


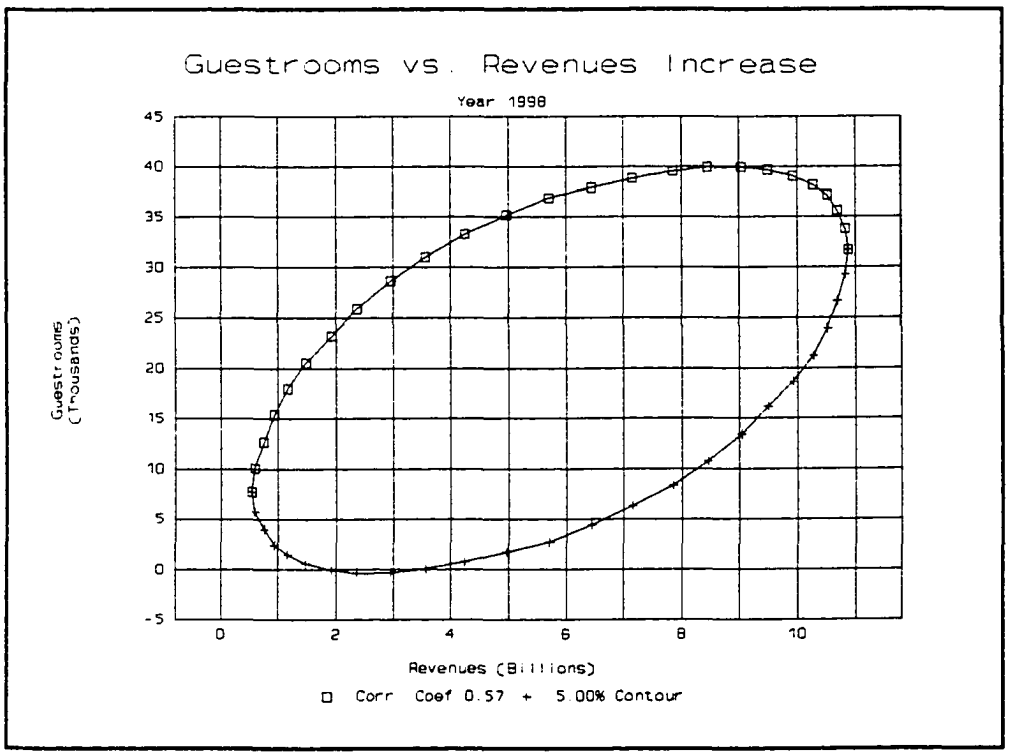
Appendix G4: 1998 Revenue



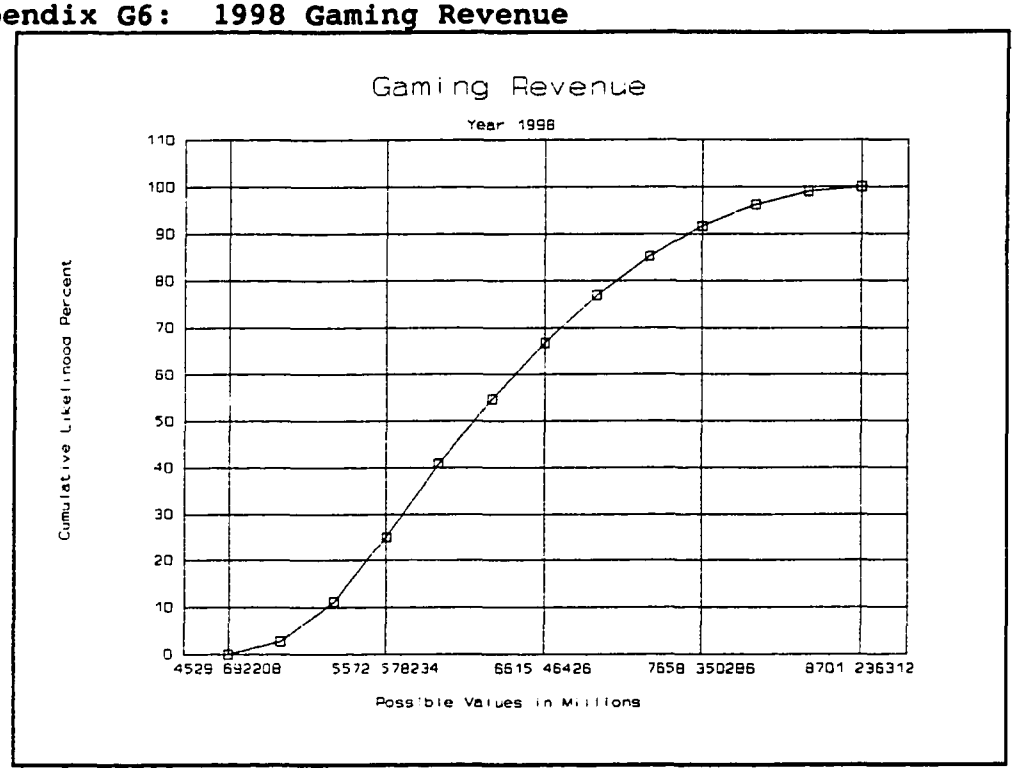


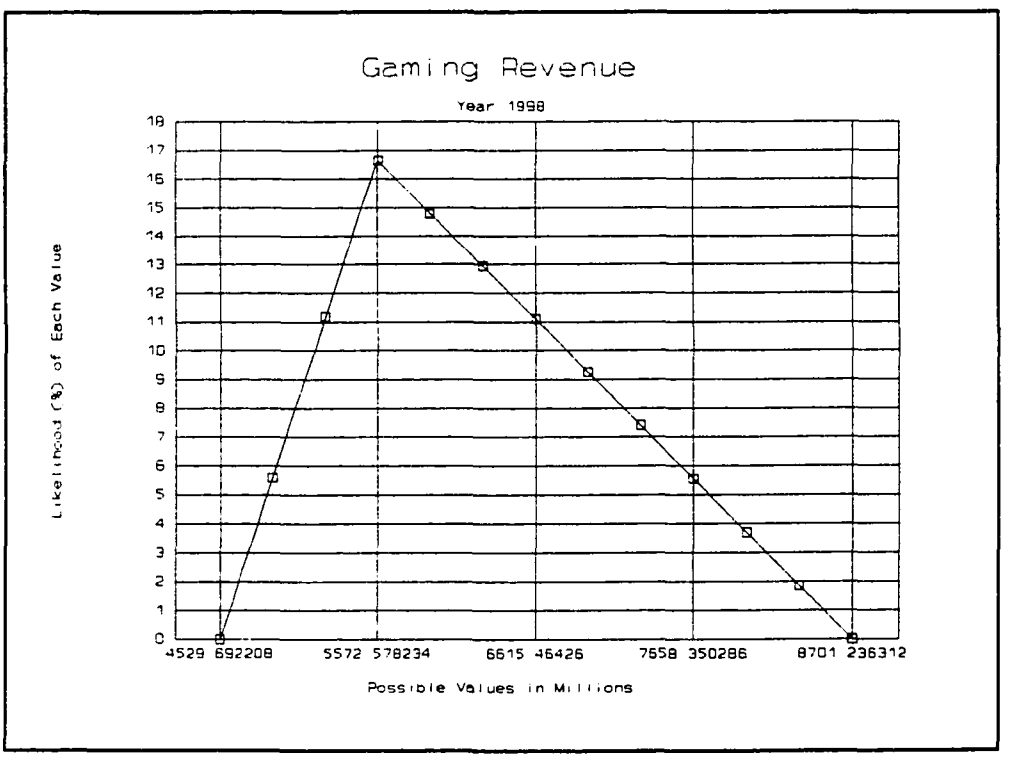
Appendix G5: 1998 Guestrooms and Revenue Correlation



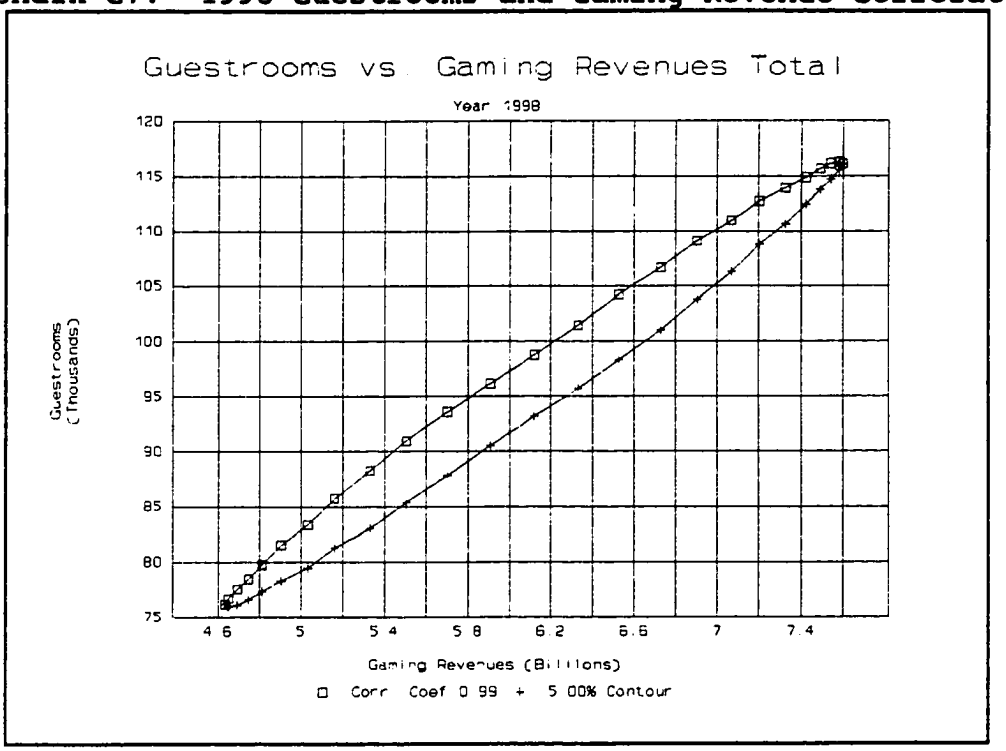


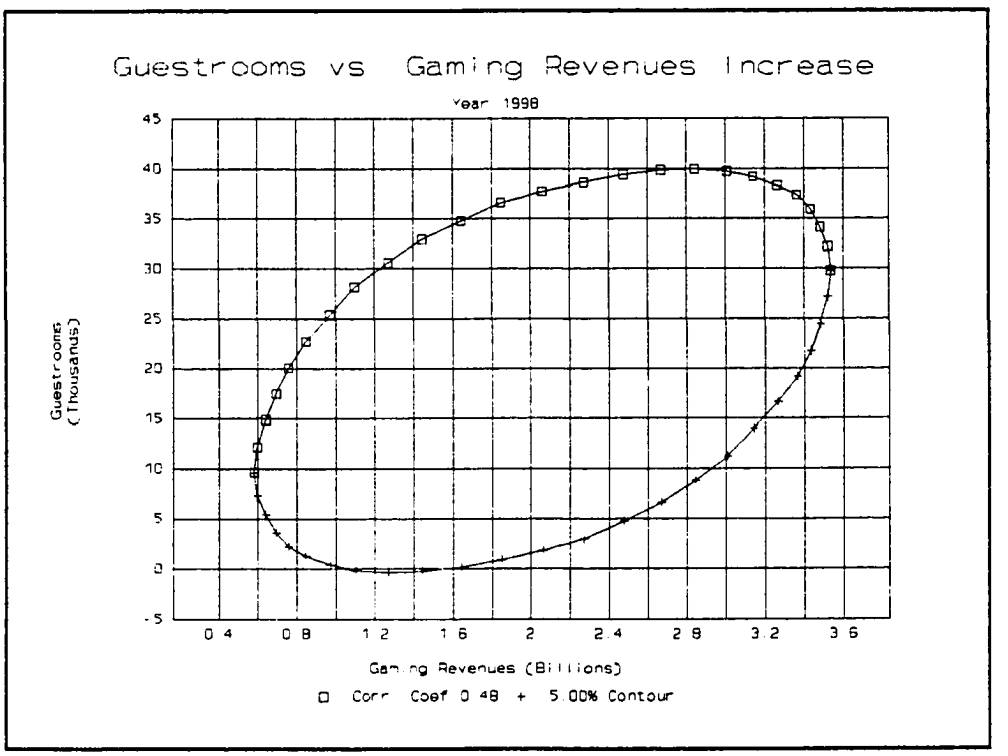
Appendix G6: 1998 Gaming Revenue



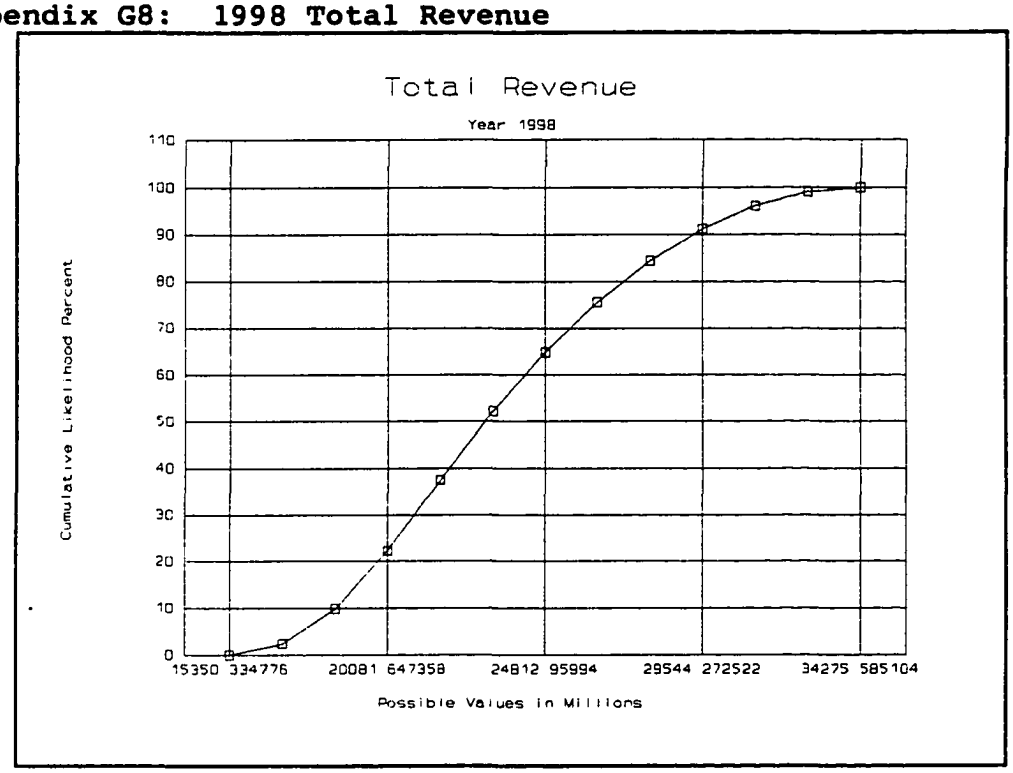


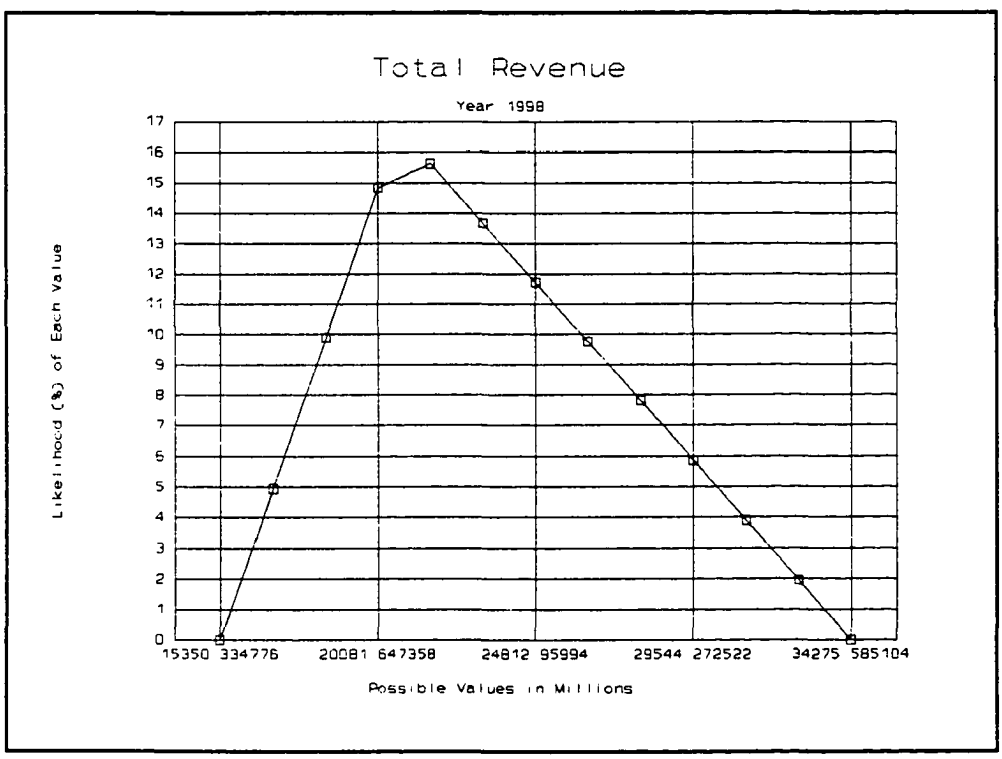
Appendix G7: 1998 Guestrooms and Gaming Revenue Correlation



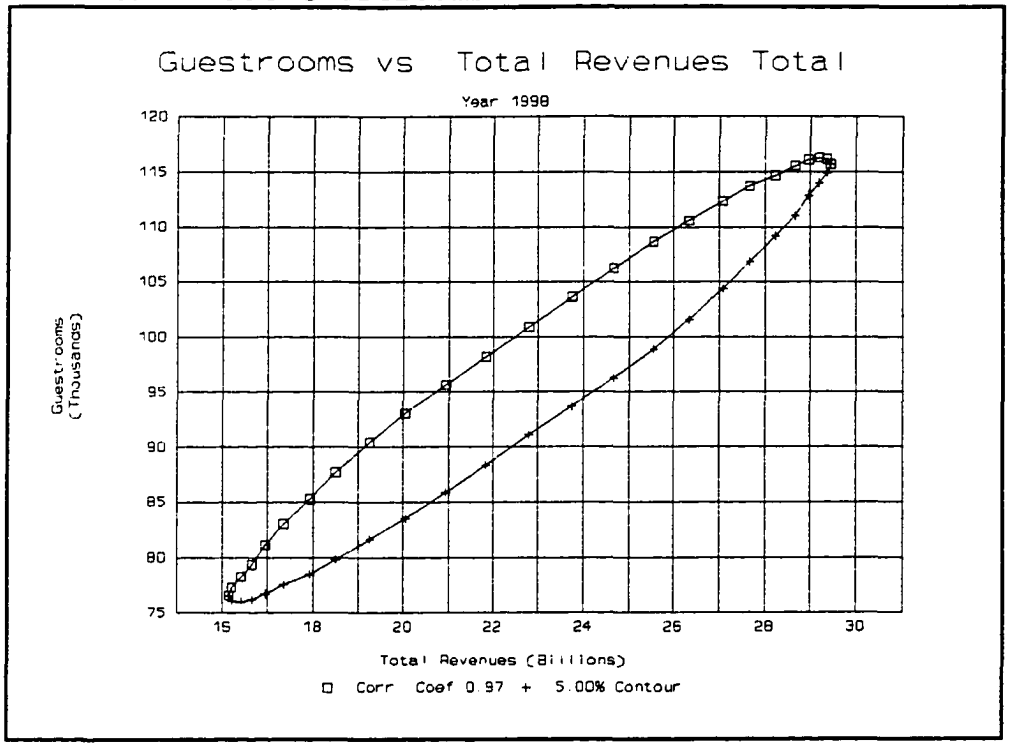


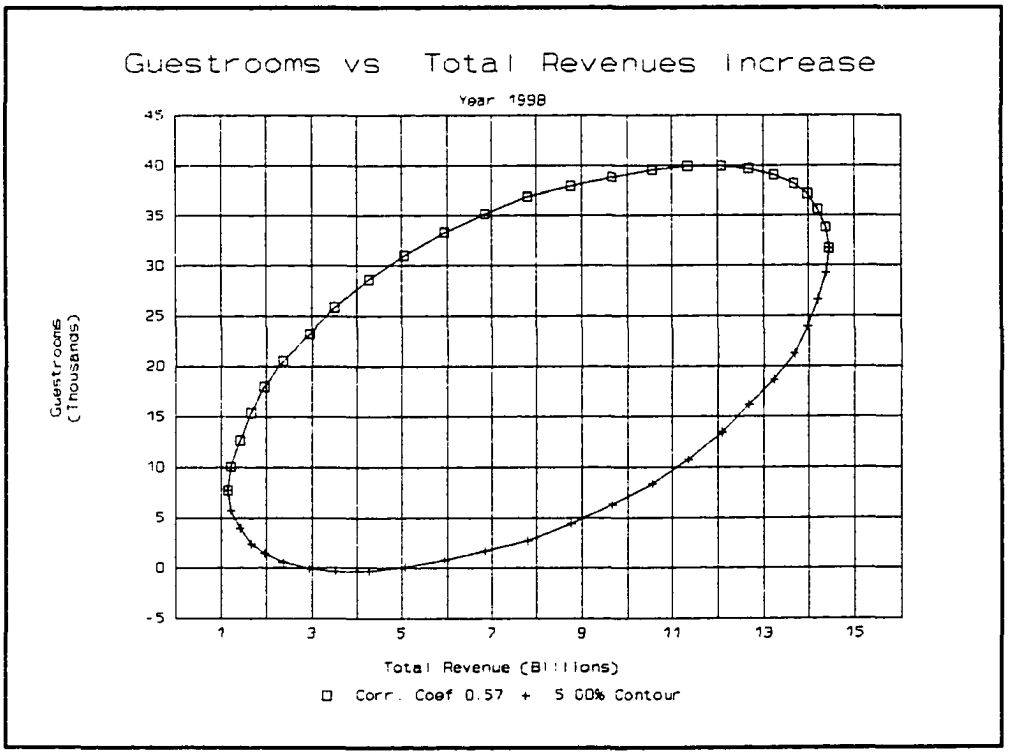
Appendix G8: 1998 Total Revenue



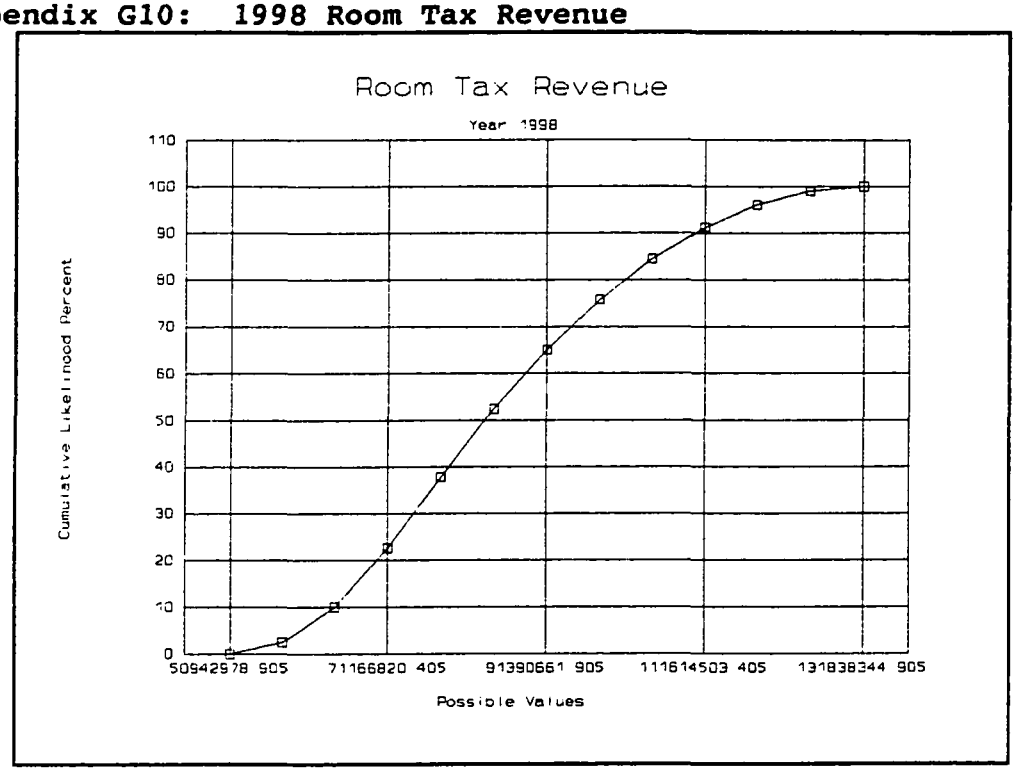


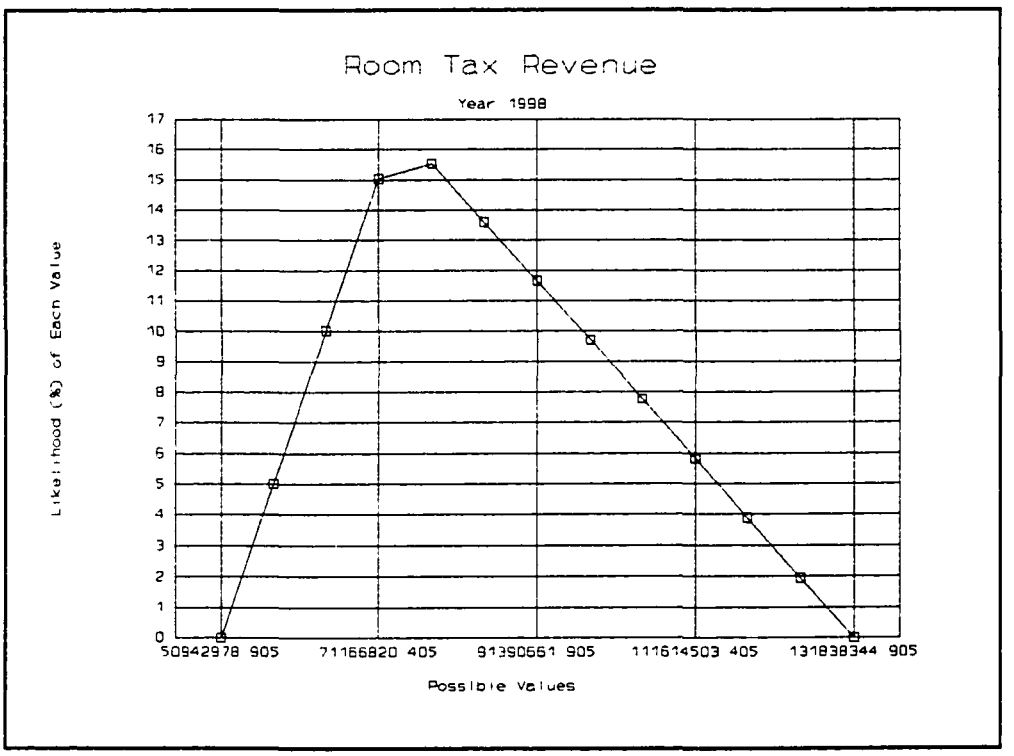
Appendix G9: 1998 Guestrooms and Total Revenue Correlation



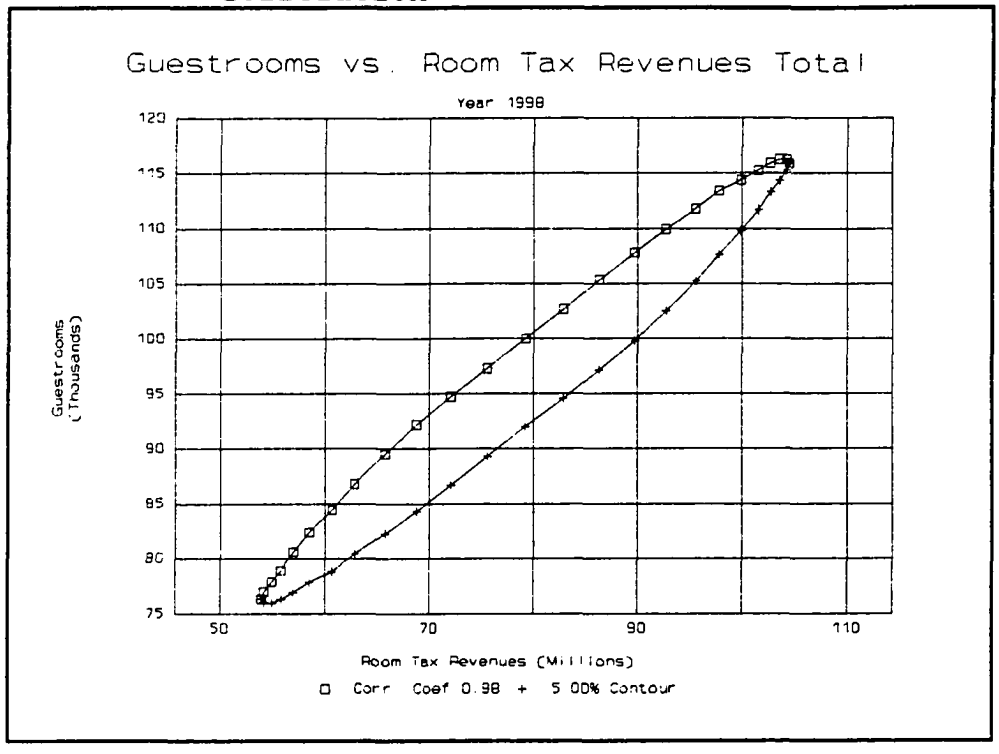


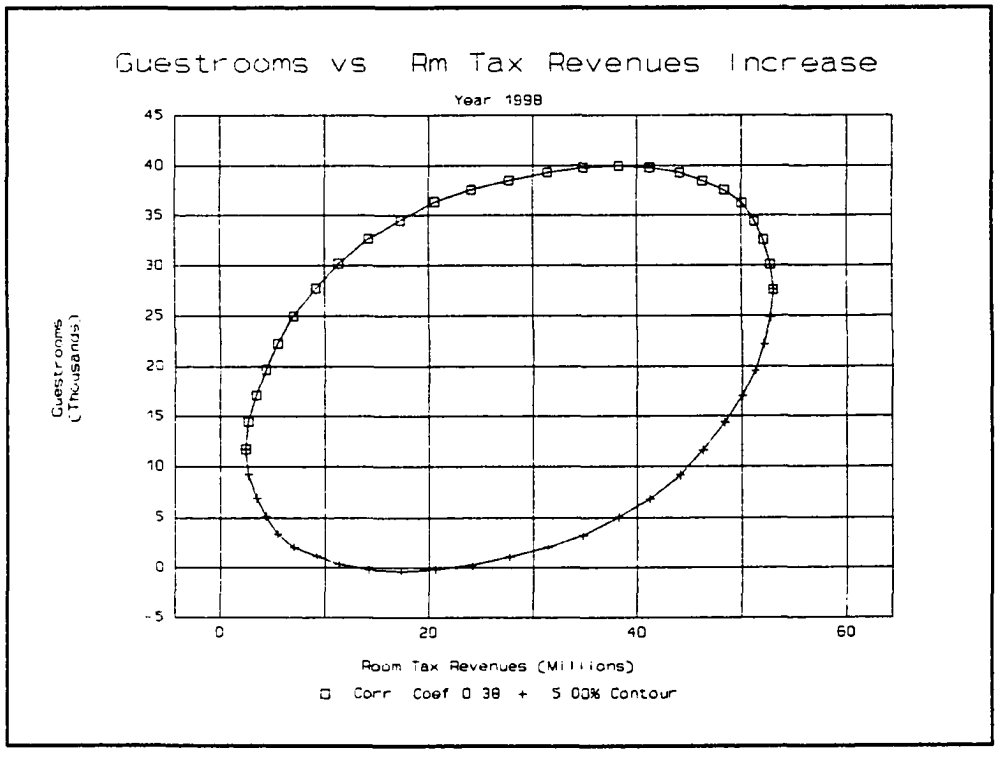
Appendix G10: 1998 Room Tax Revenue



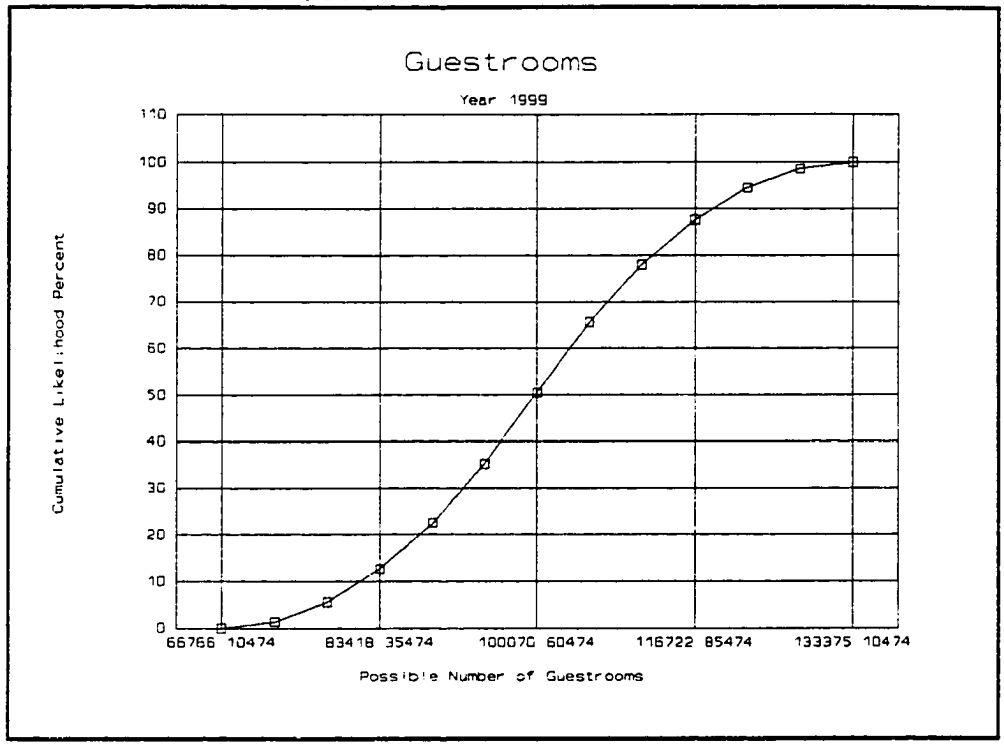


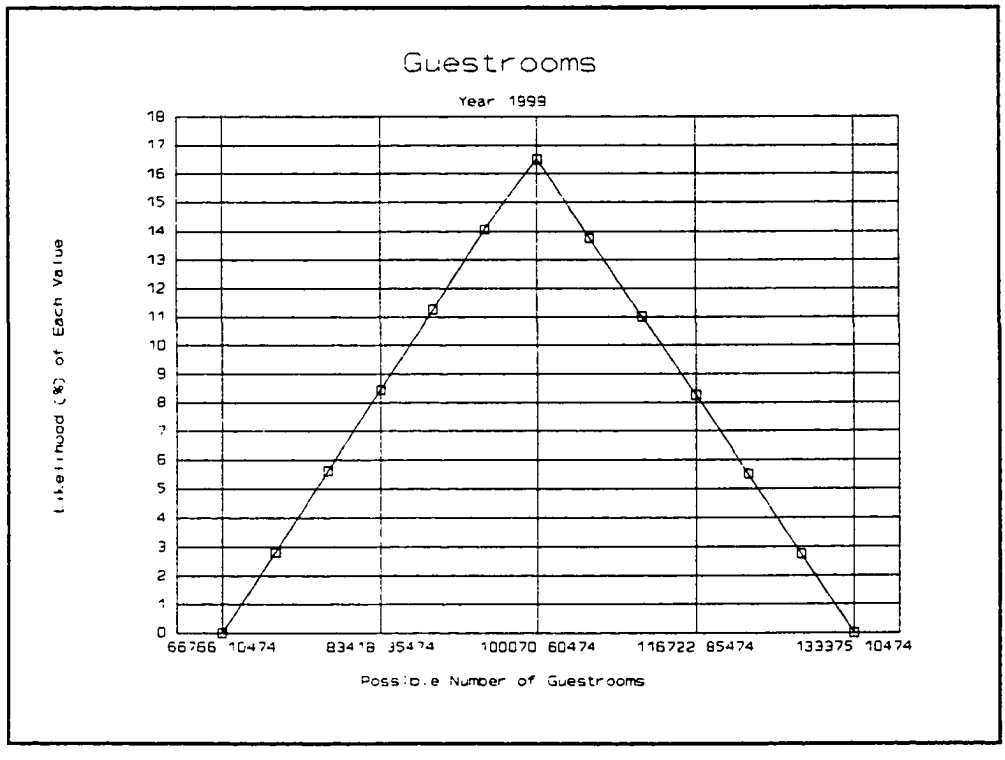
Appendix G11: 1998 Guestrooms and Room Tax Revenue Correlation



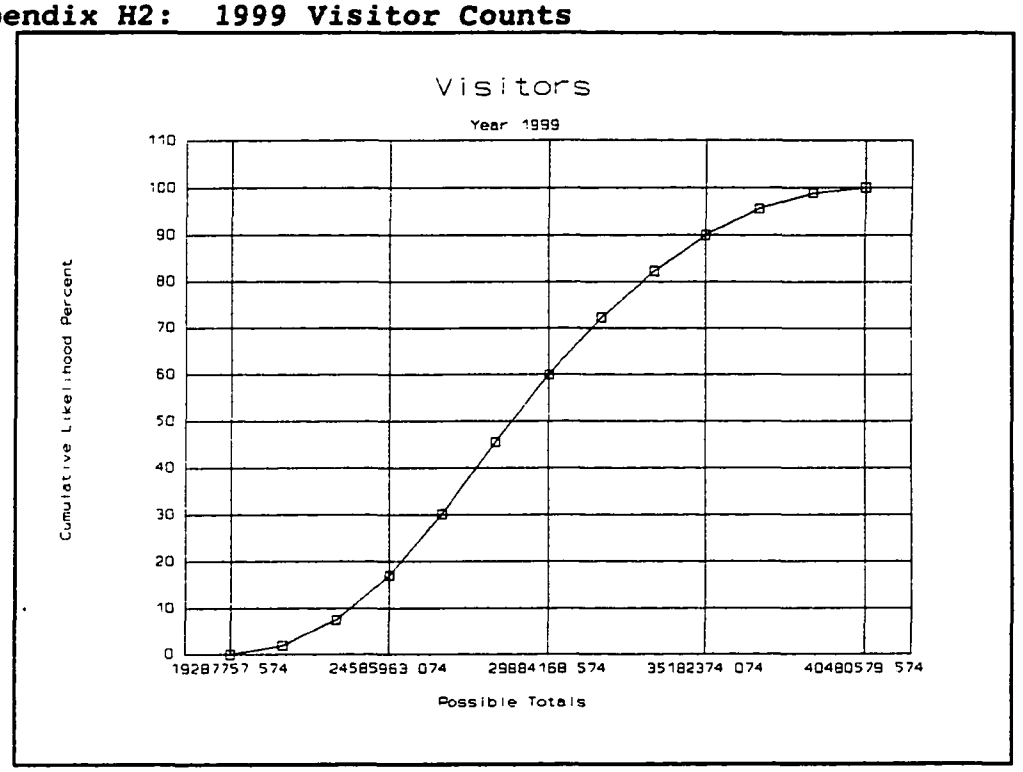


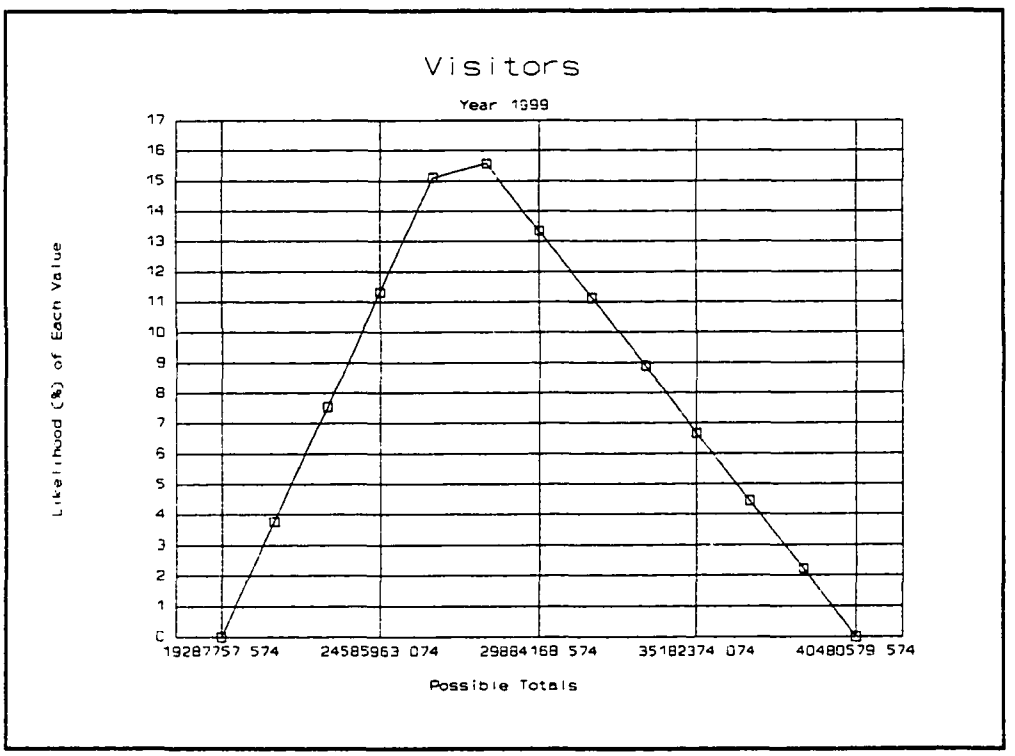
Appendix H1: 1999 Guestrooms



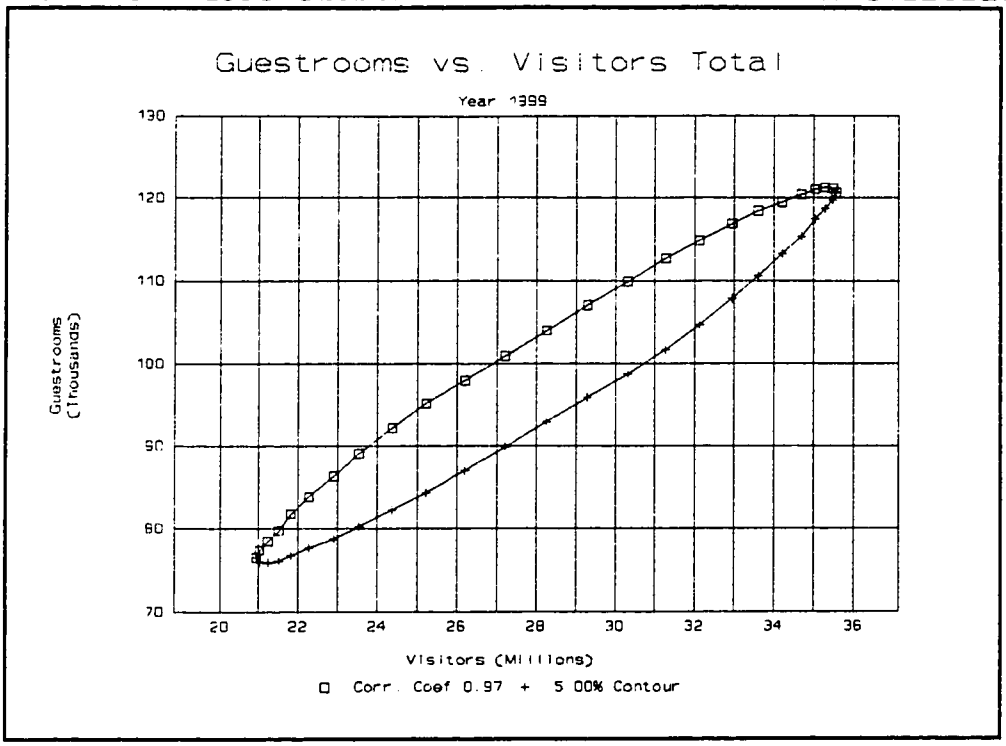


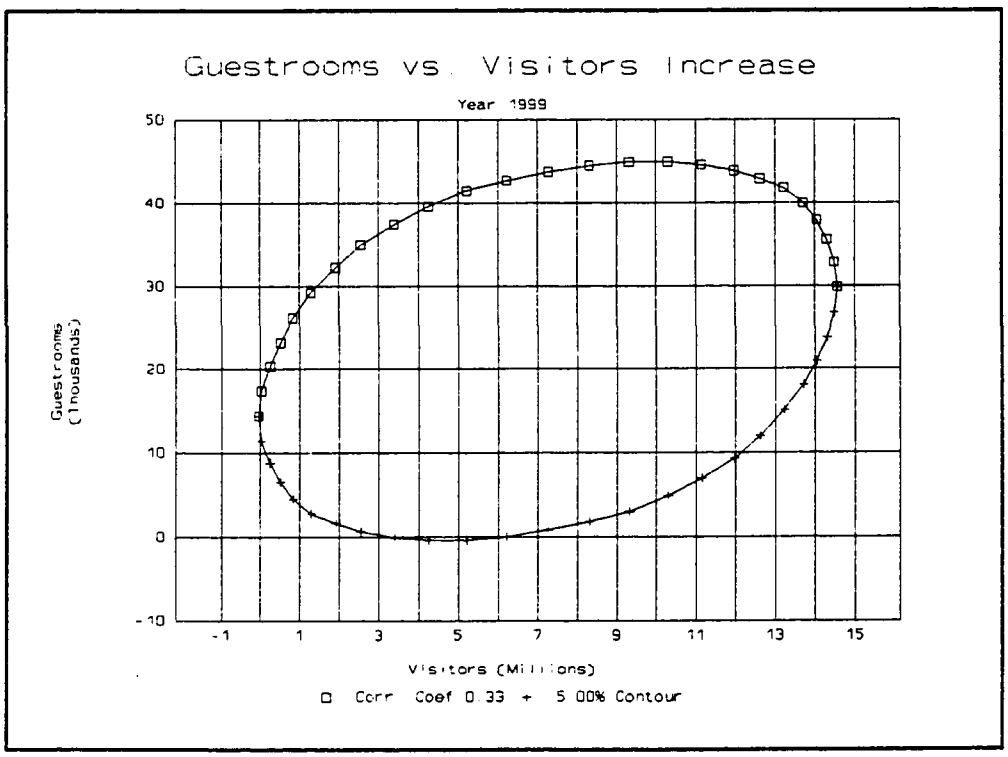
Appendix H2: 1999 Visitor Counts



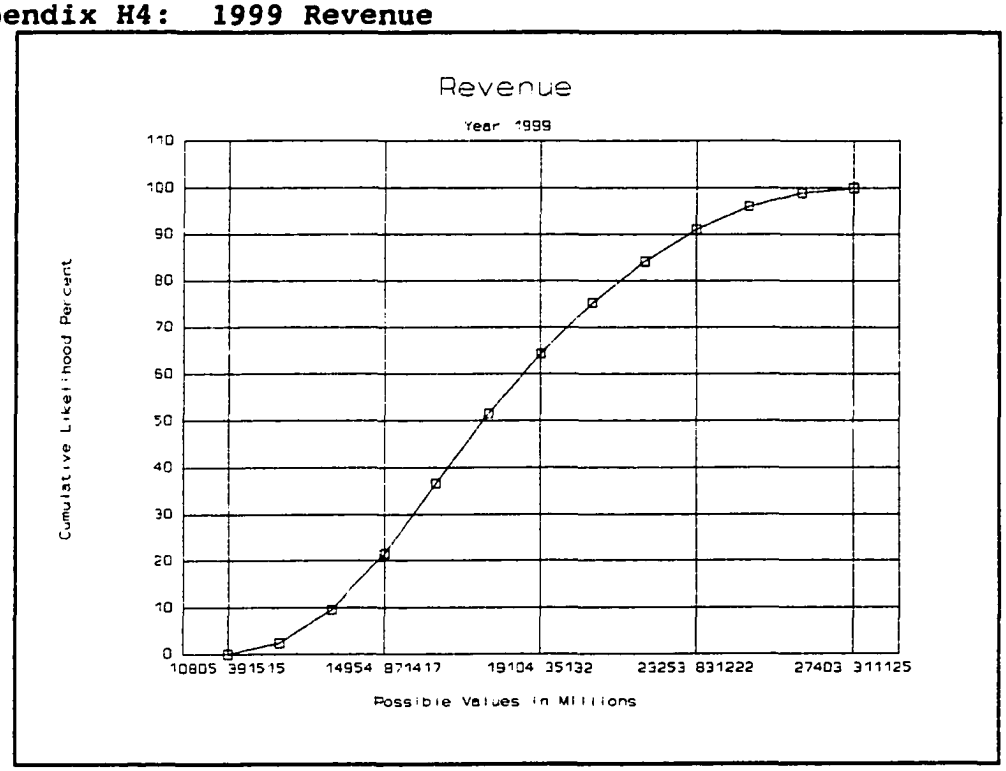


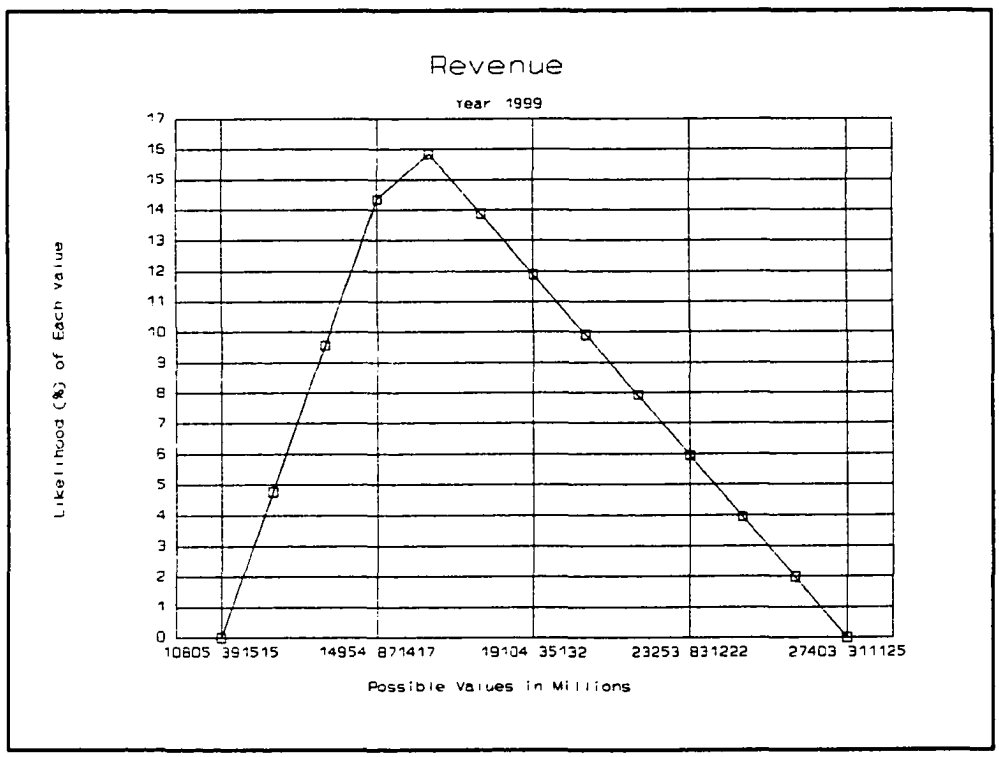
Appendix H3: 1993 Guestrooms and Visitor Volume Correlation



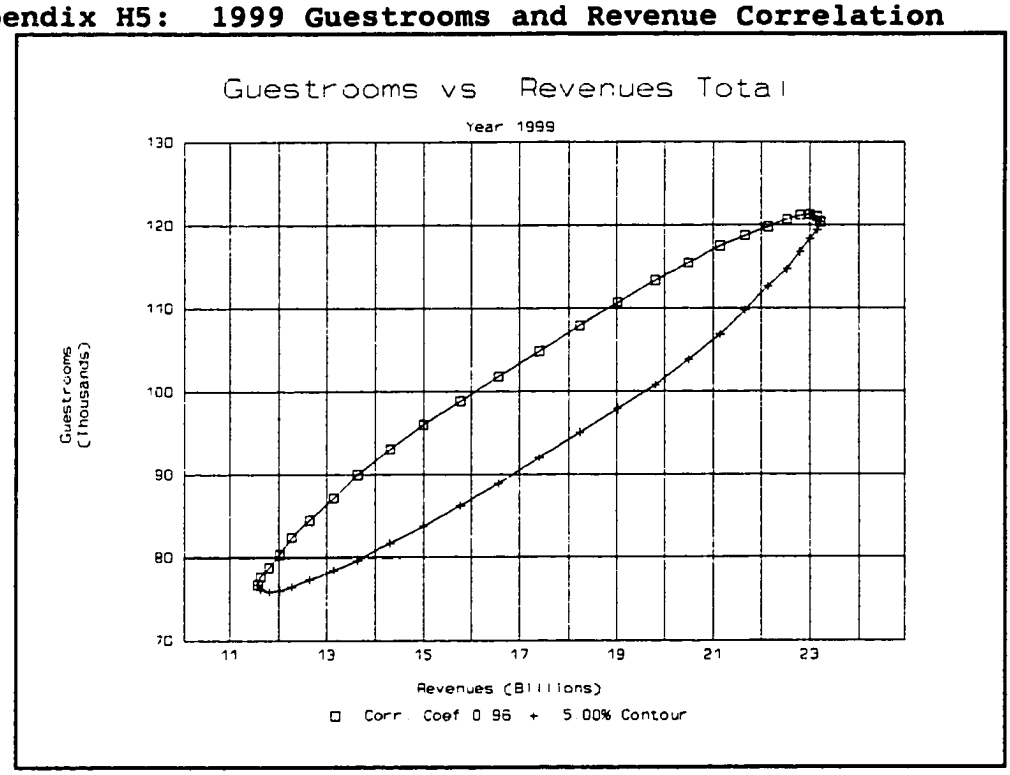


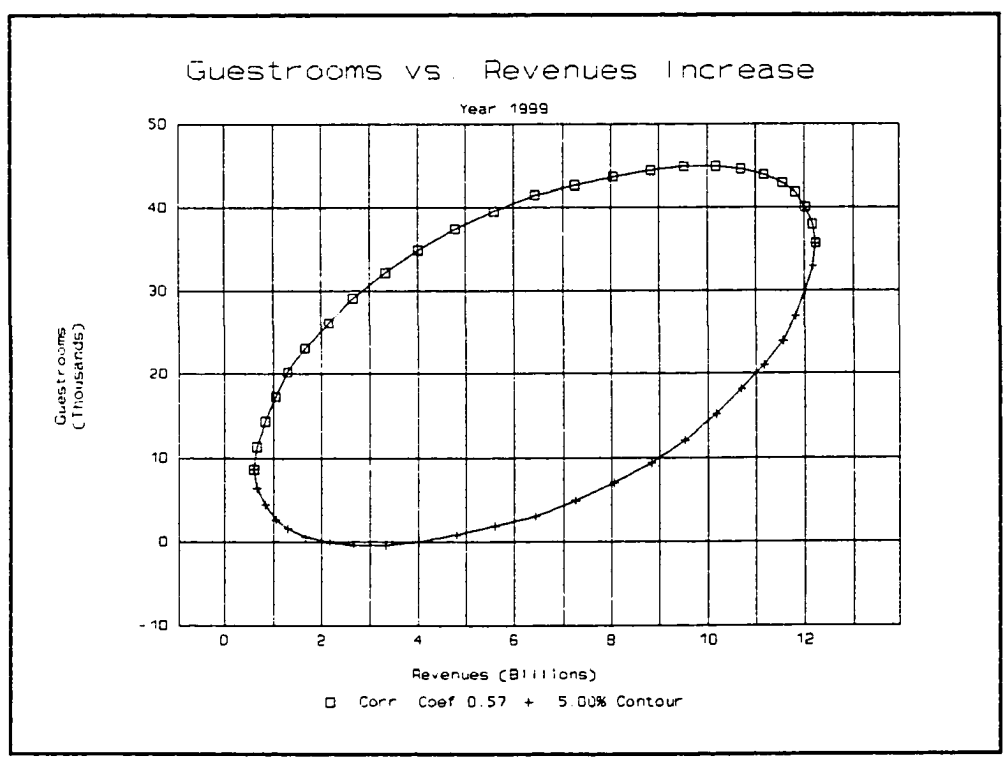
Appendix H4: 1999 Revenue



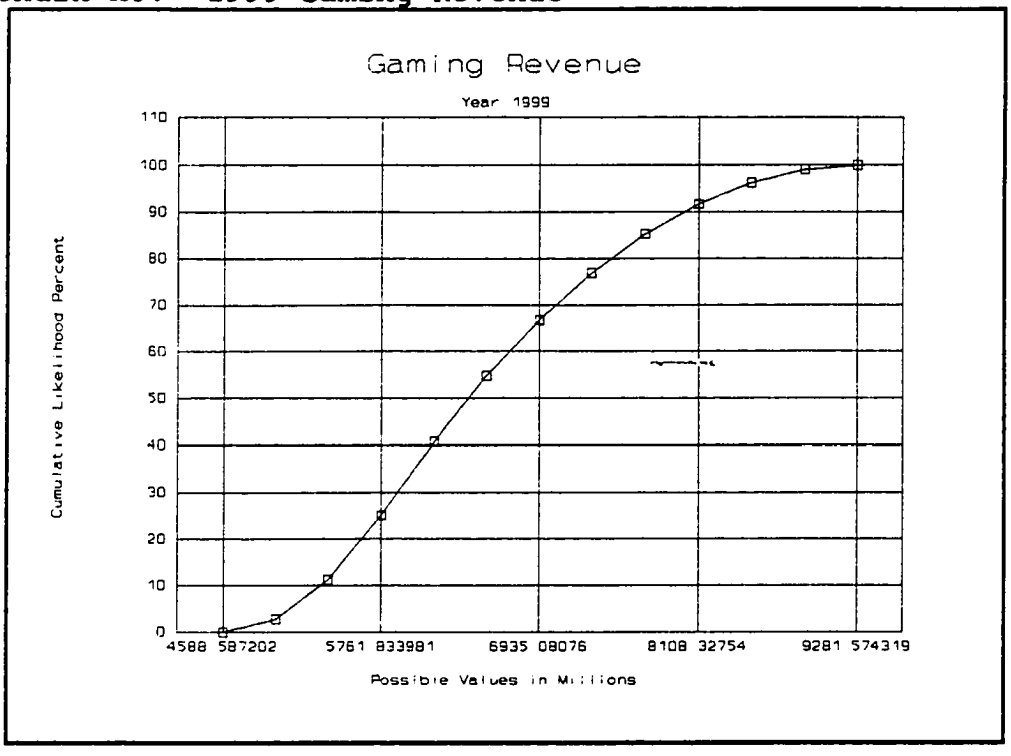


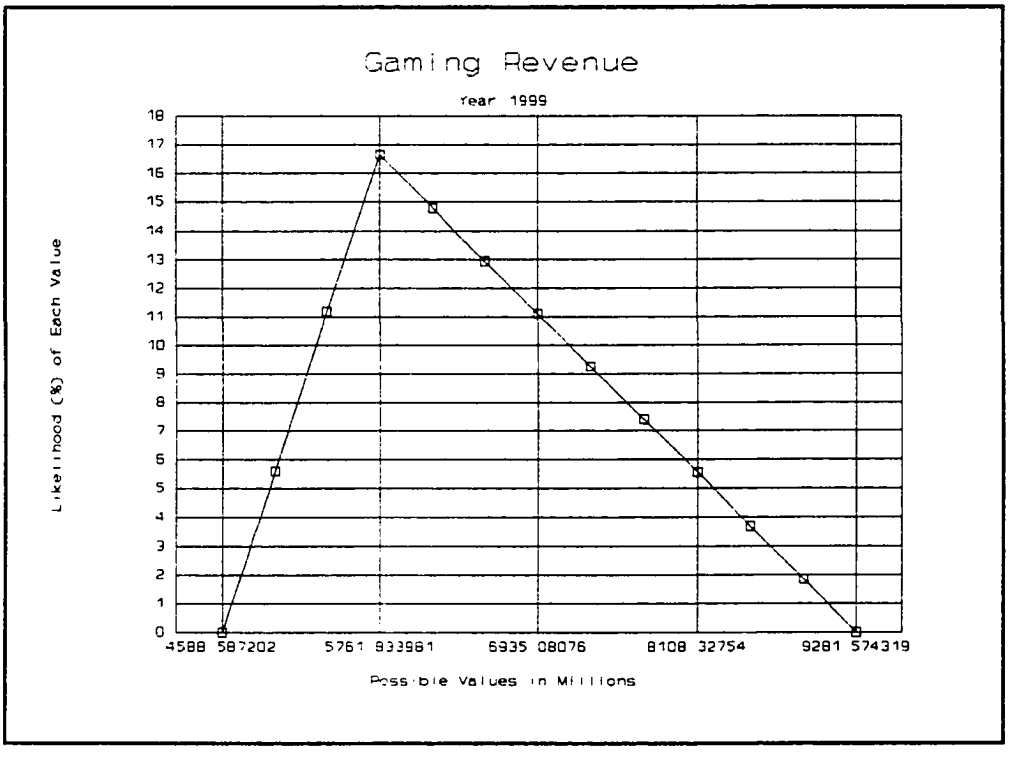
Appendix H5: 1999 Guestrooms and Revenue Correlation



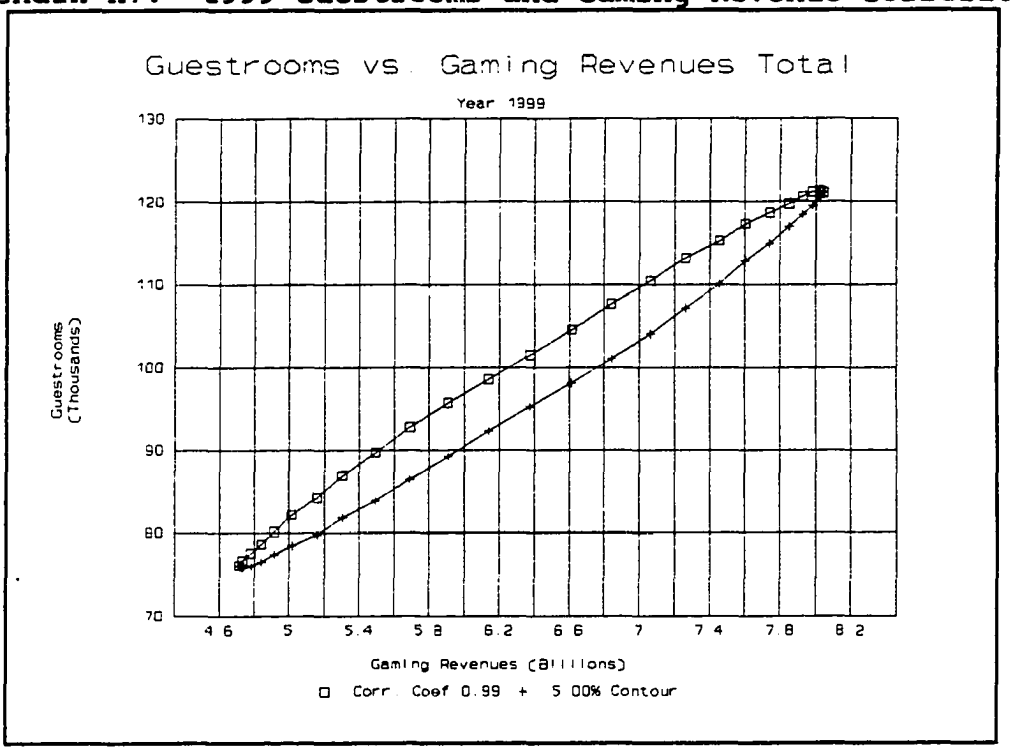


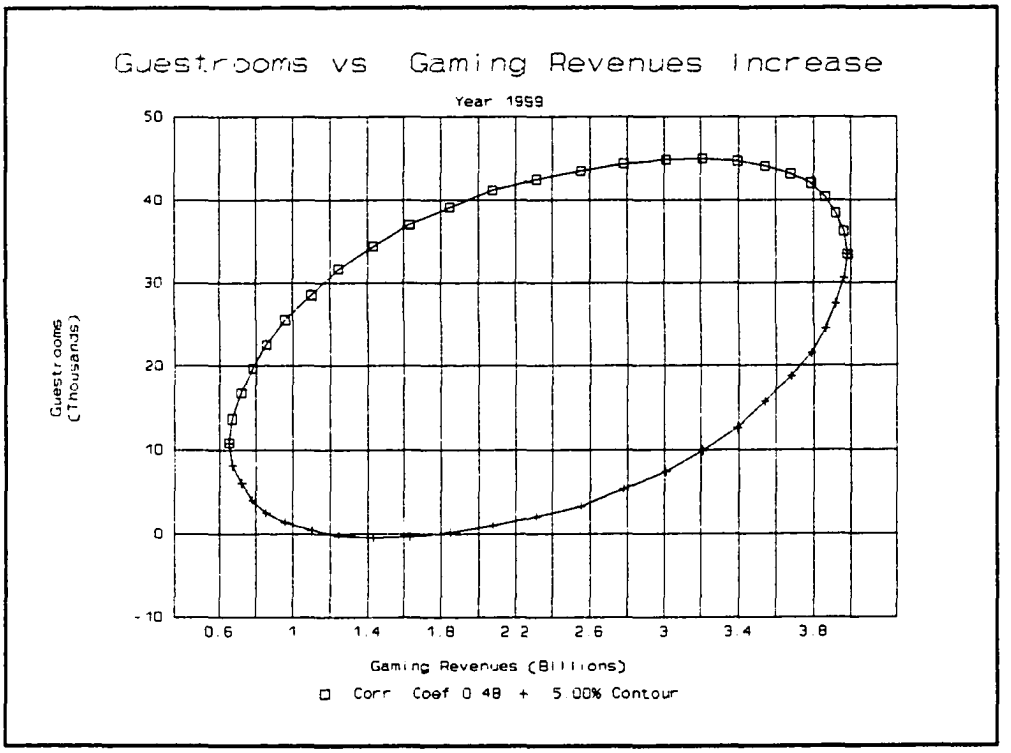
Appendix H6: 1999 Gaming Revenue



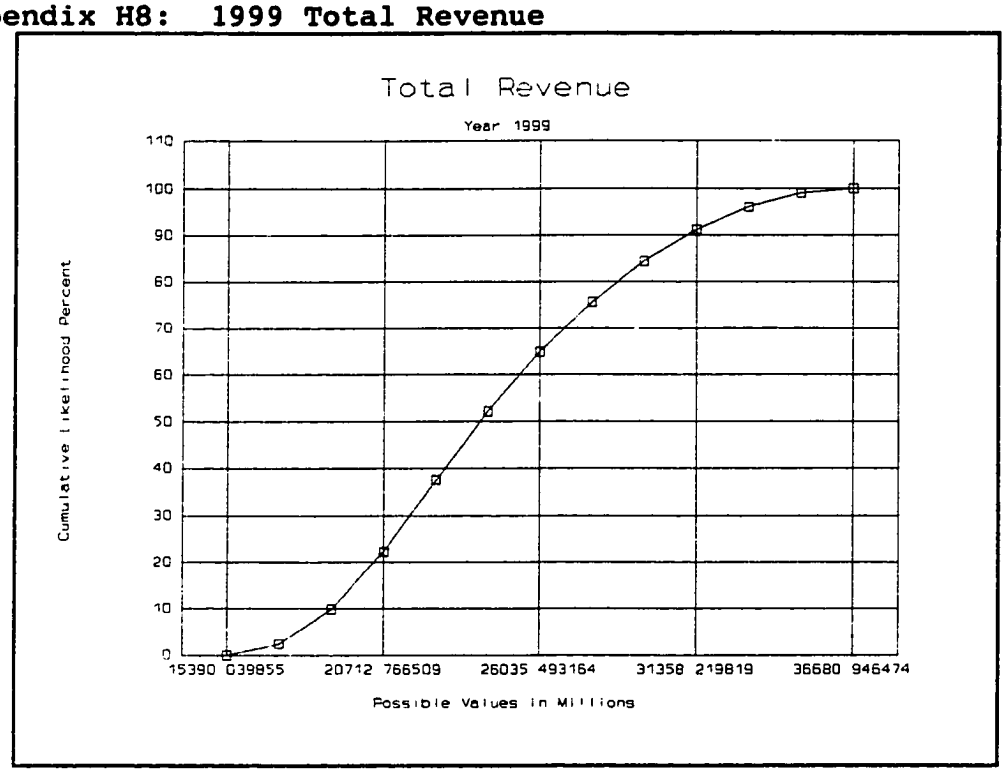


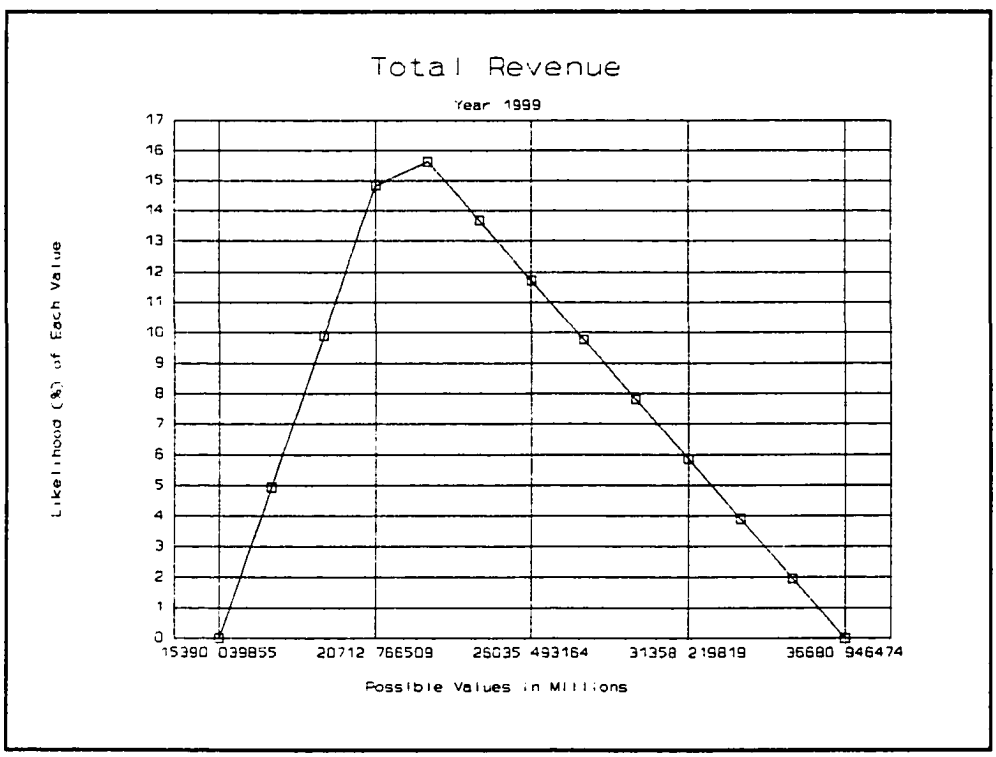
Appendix H7: 1999 Guestrooms and Gaming Revenue Correlation



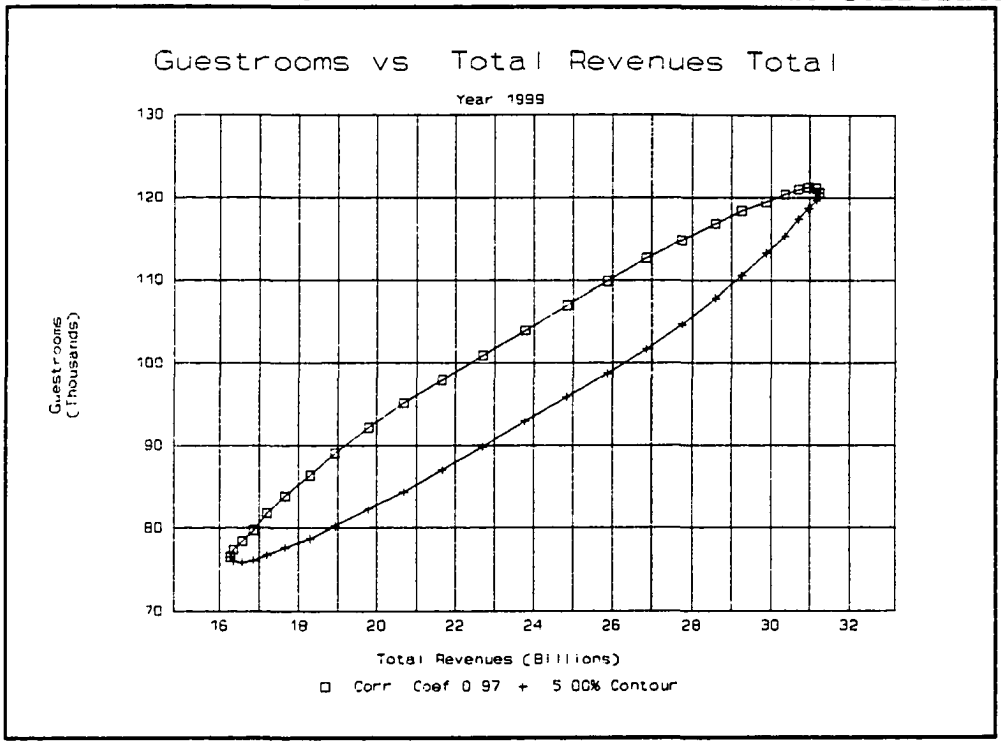


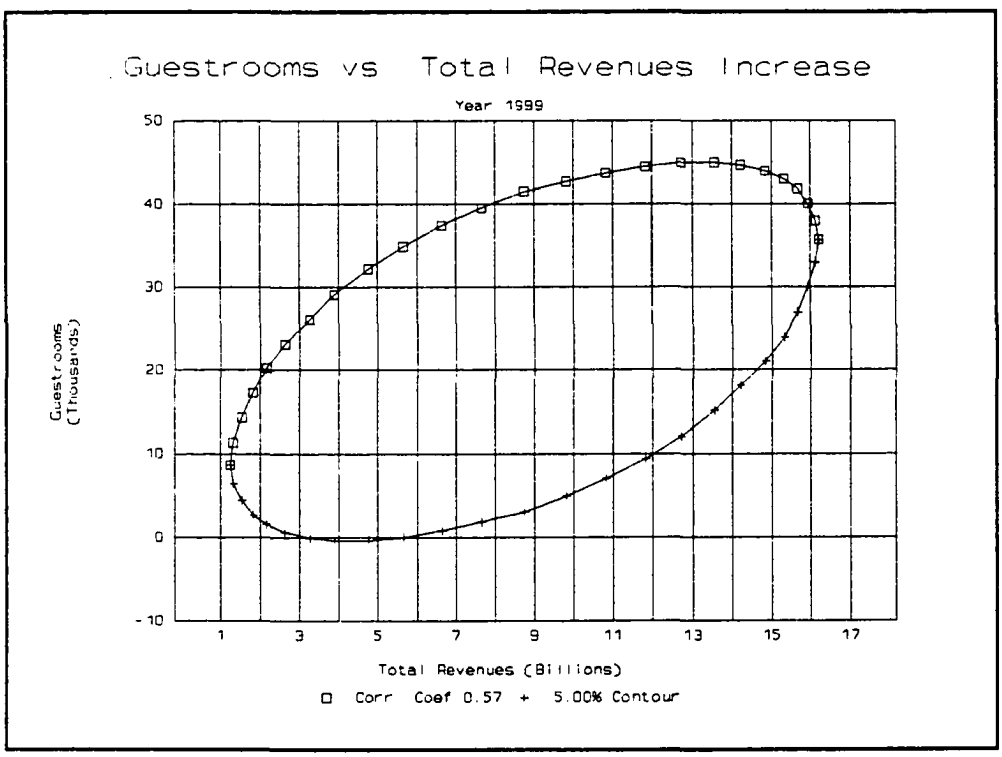
Appendix H8: 1999 Total Revenue



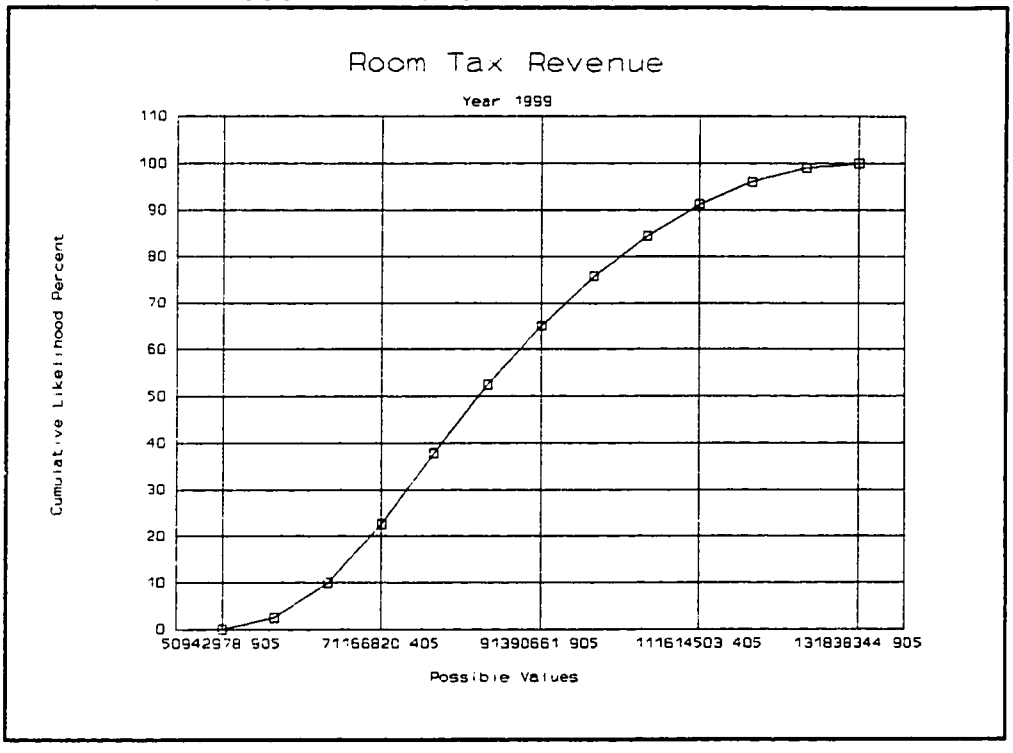


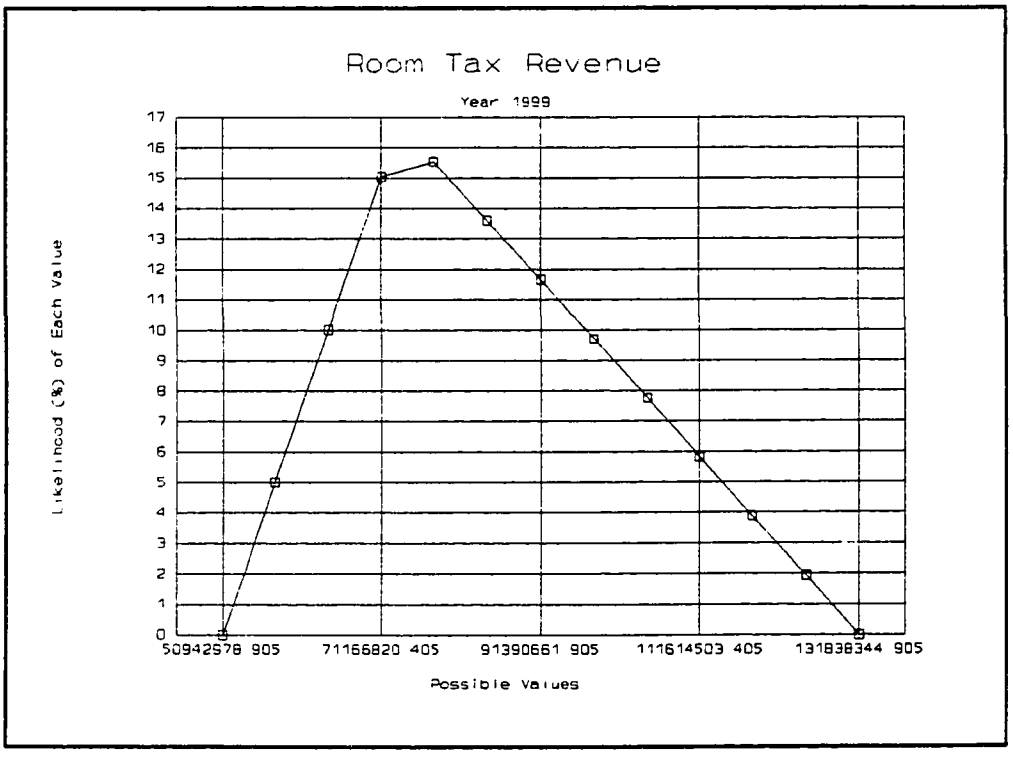
Appendix H9: 1999 Guestrooms and Total Revenue Correlation



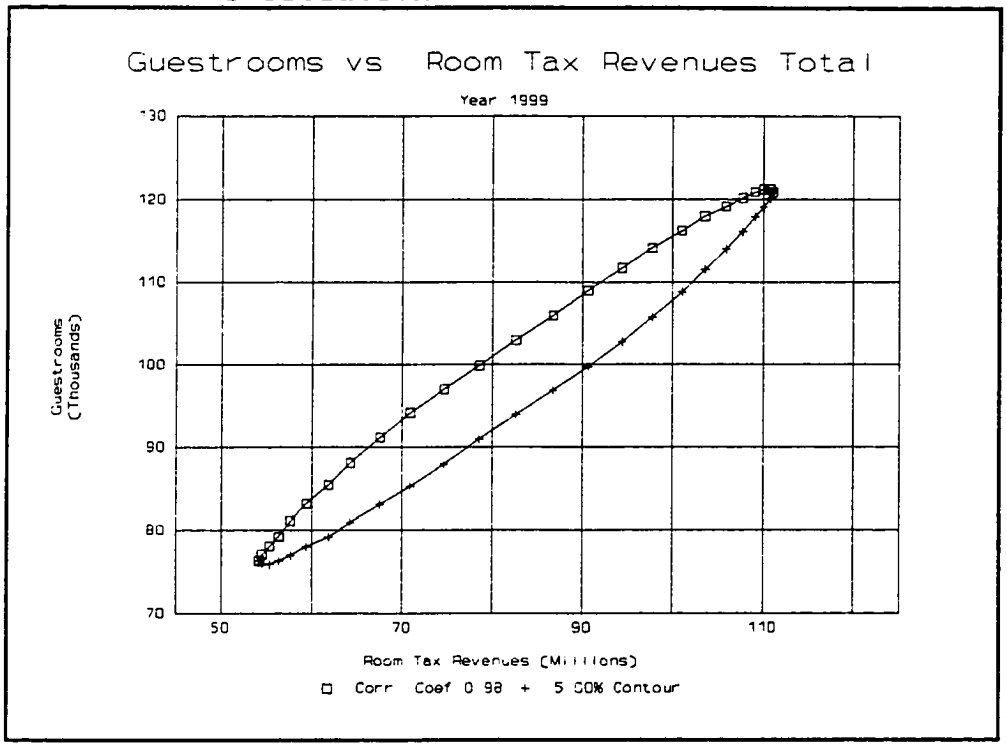


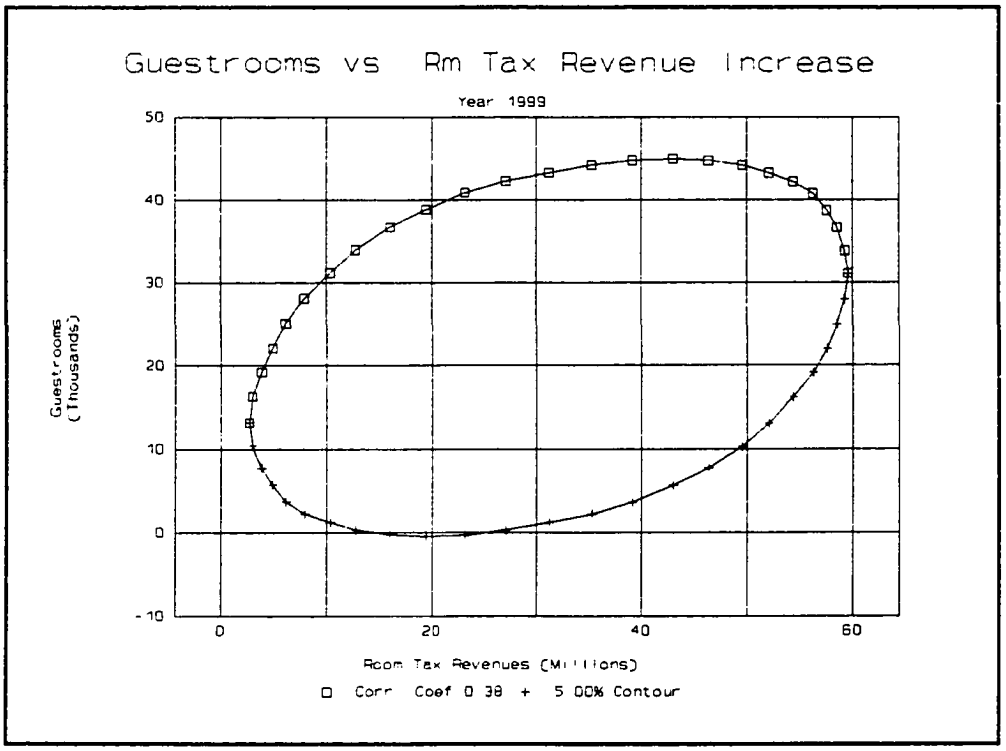
Appendix H10: 1999 Room Tax Revenue



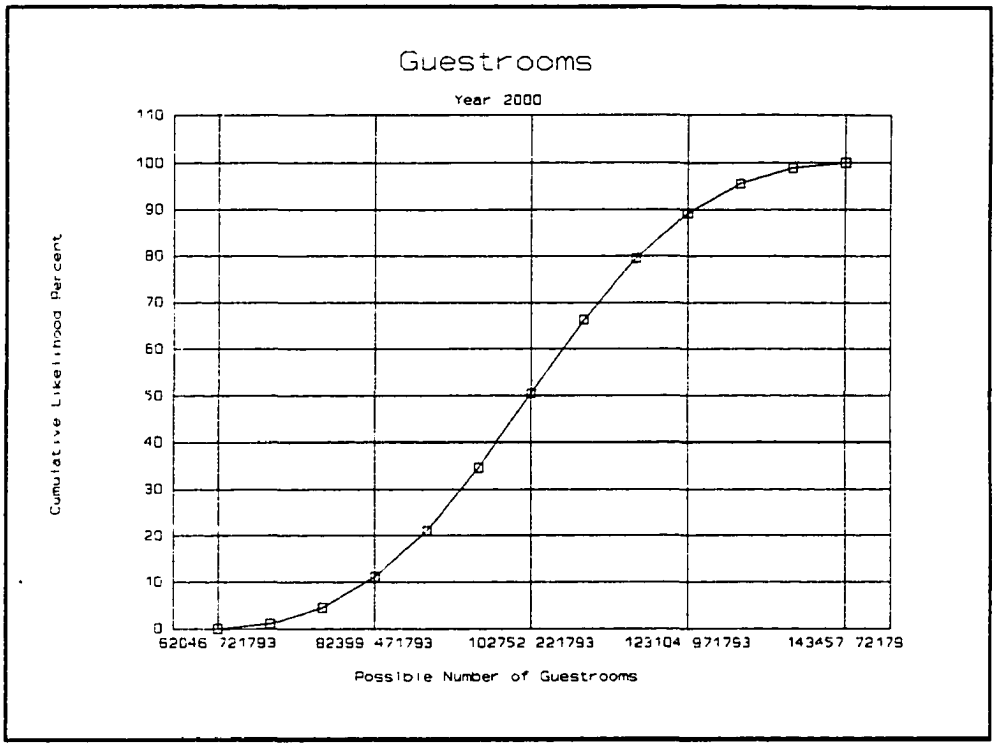


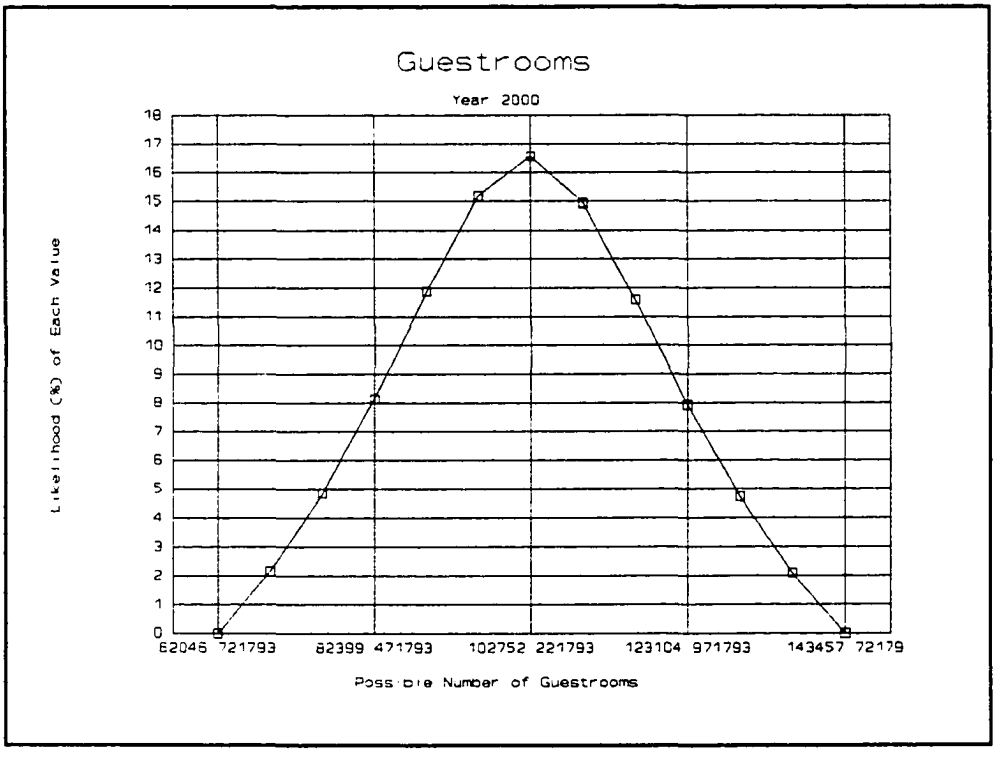
Appendix H11: 1999 Guestrooms and Room Tax Revenue Correlation



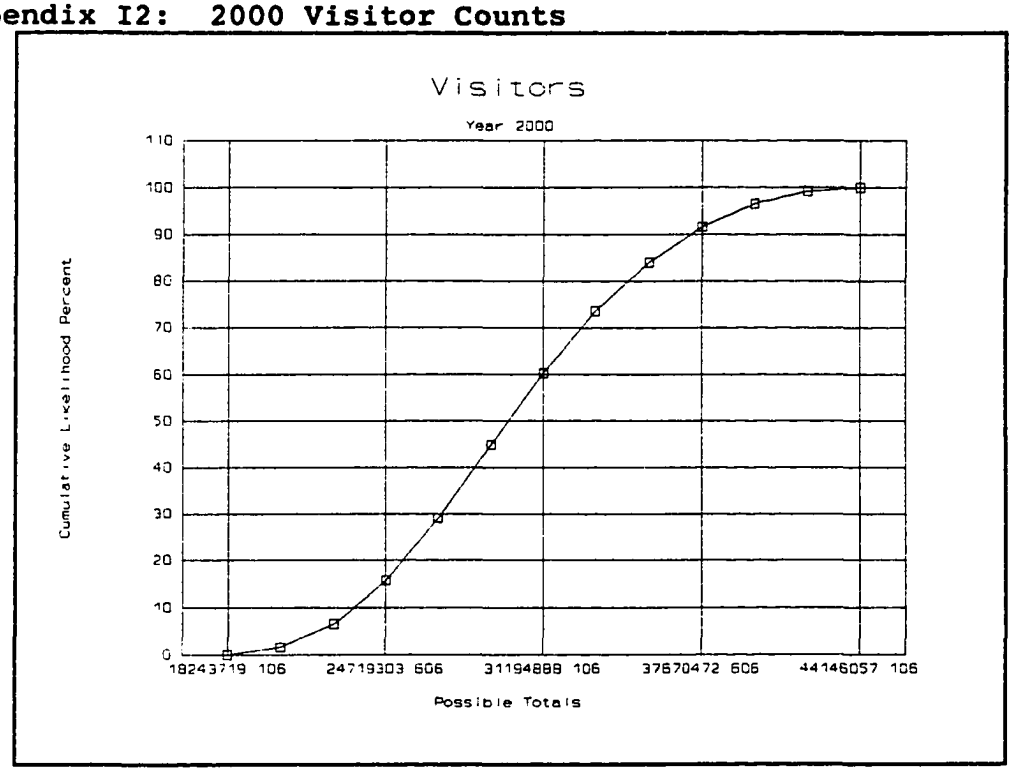


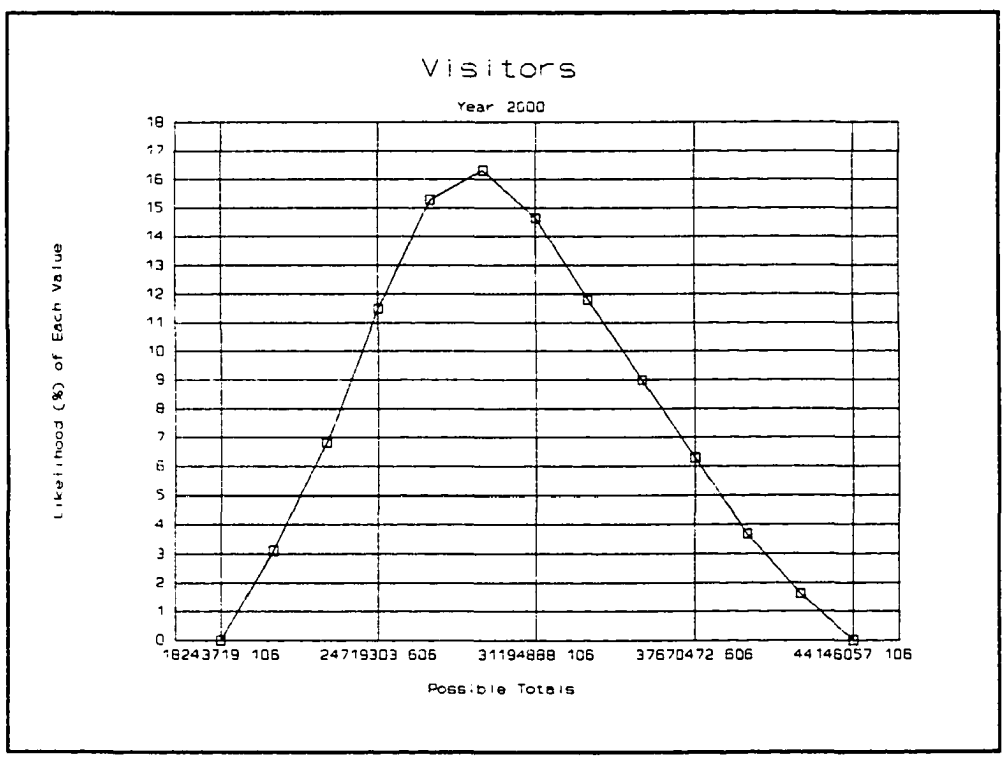
Appendix I1: 2000 Guestrooms



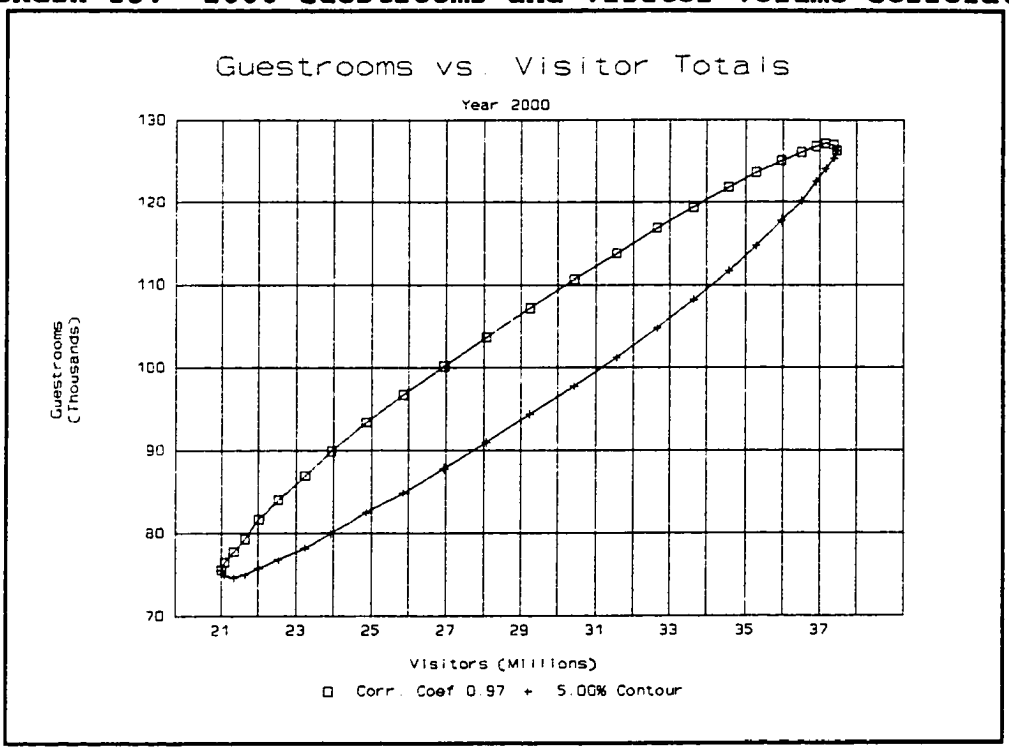


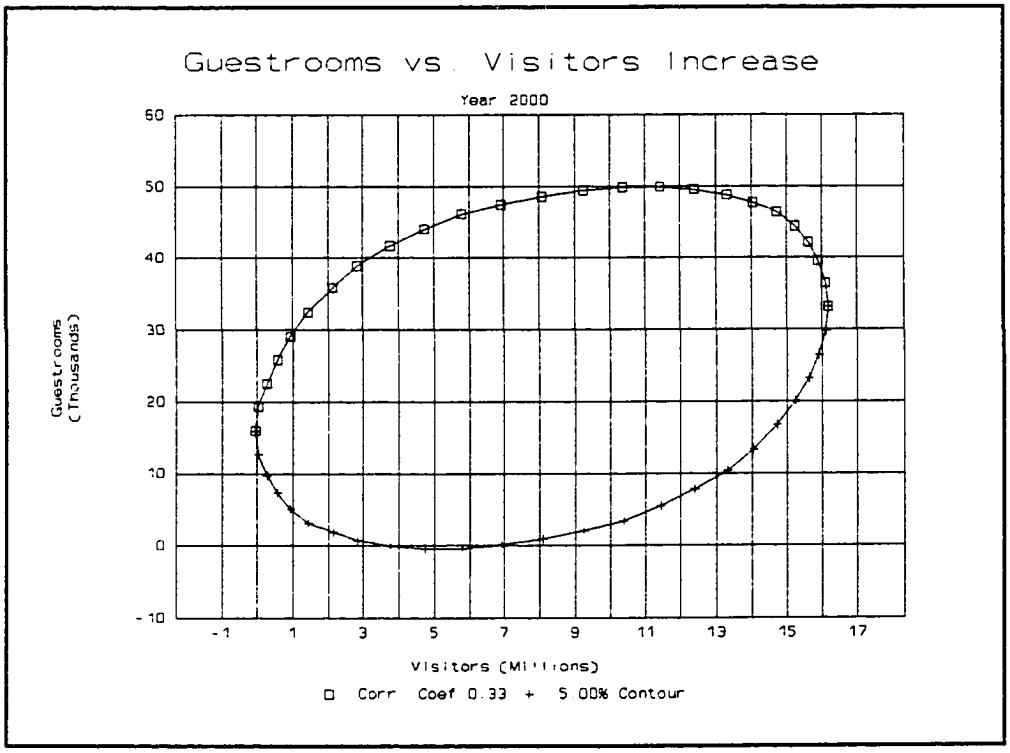
Appendix I2: 2000 Visitor Counts



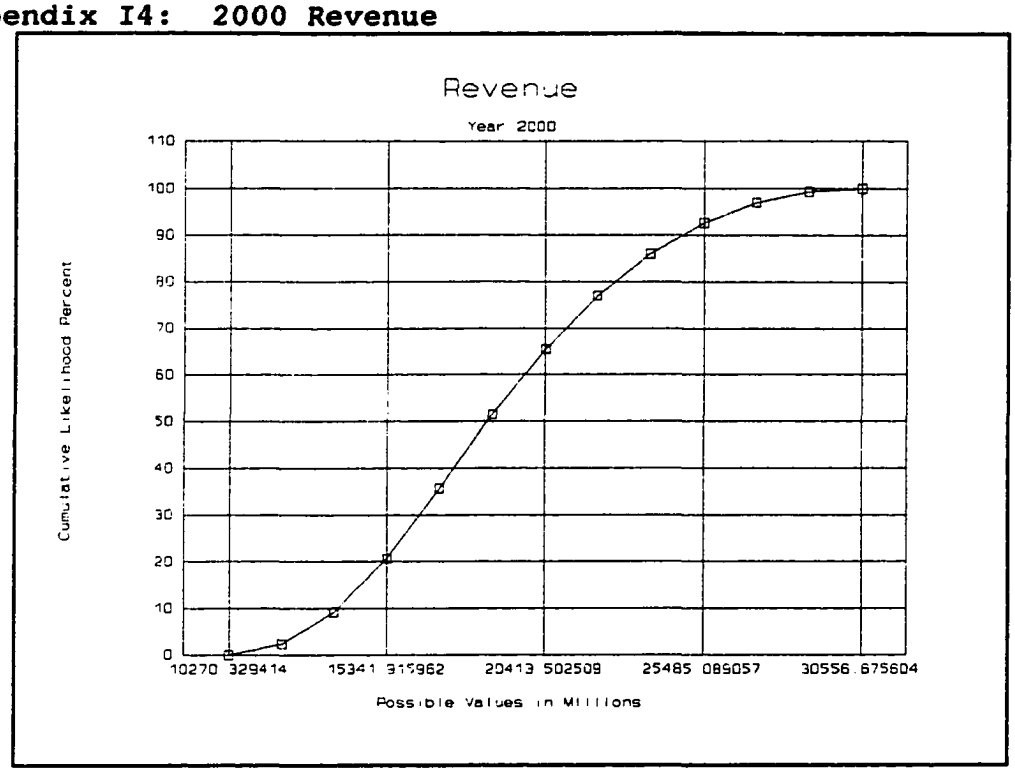


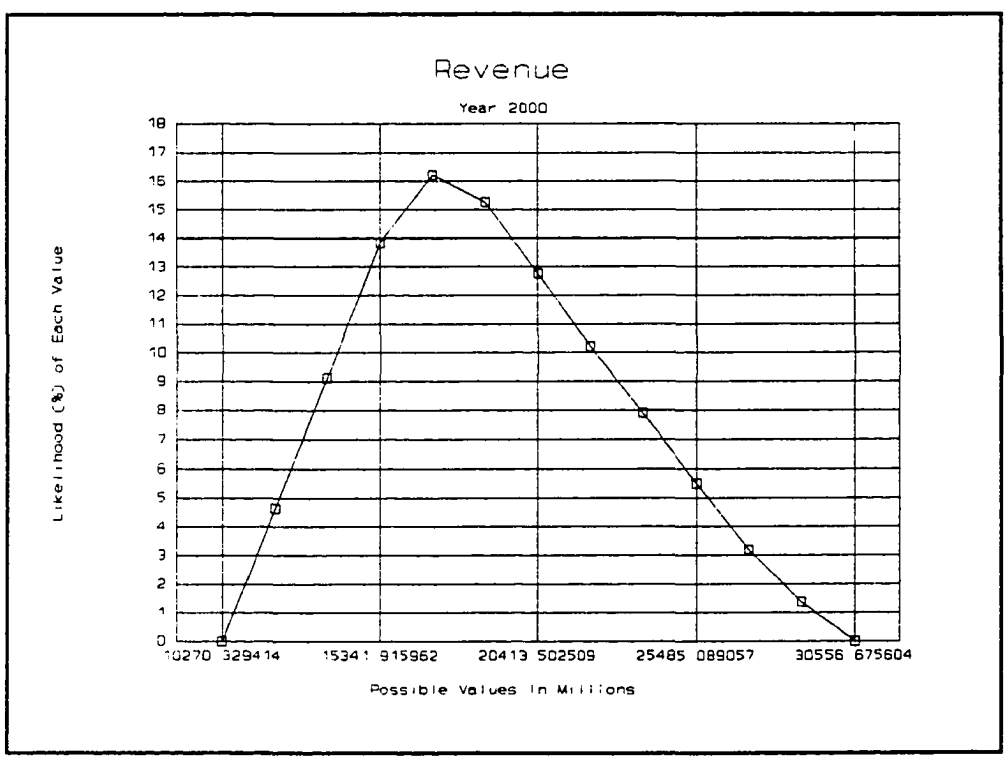
Appendix I3: 2000 Guestrooms and Visitor Volume Correlation



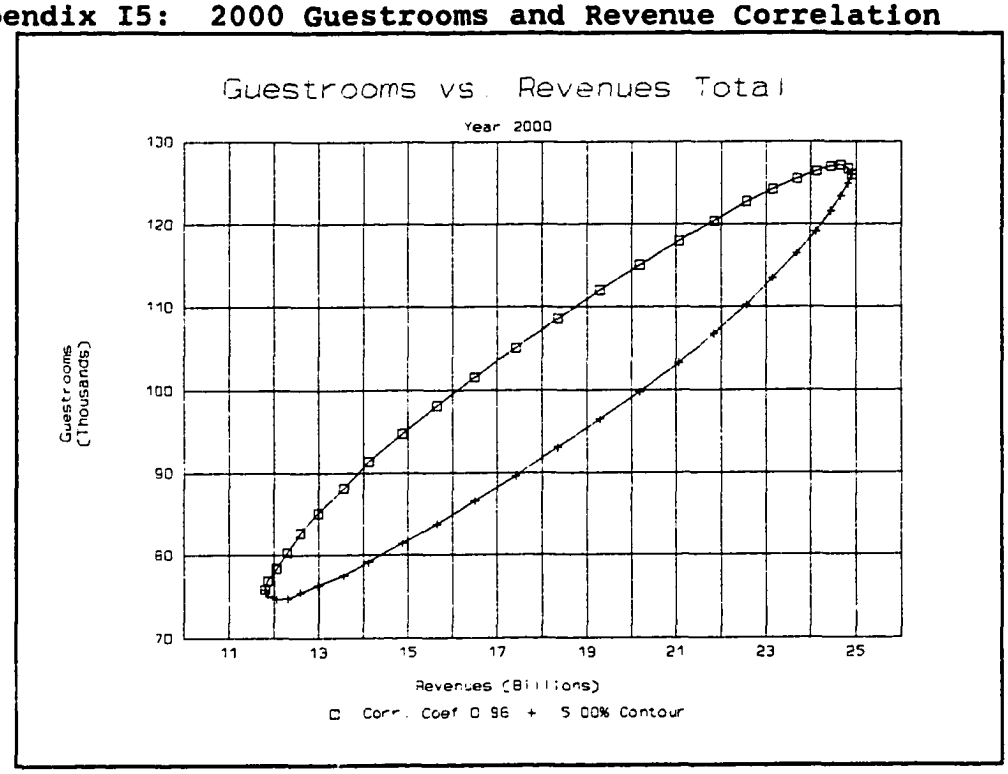


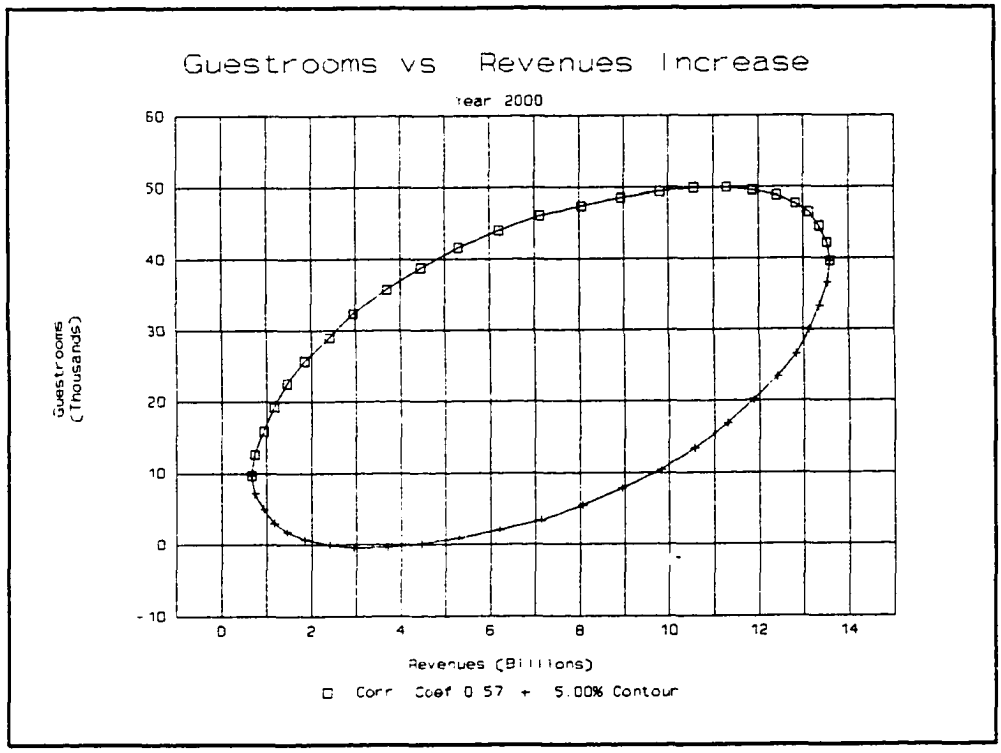
Appendix I4: 2000 Revenue



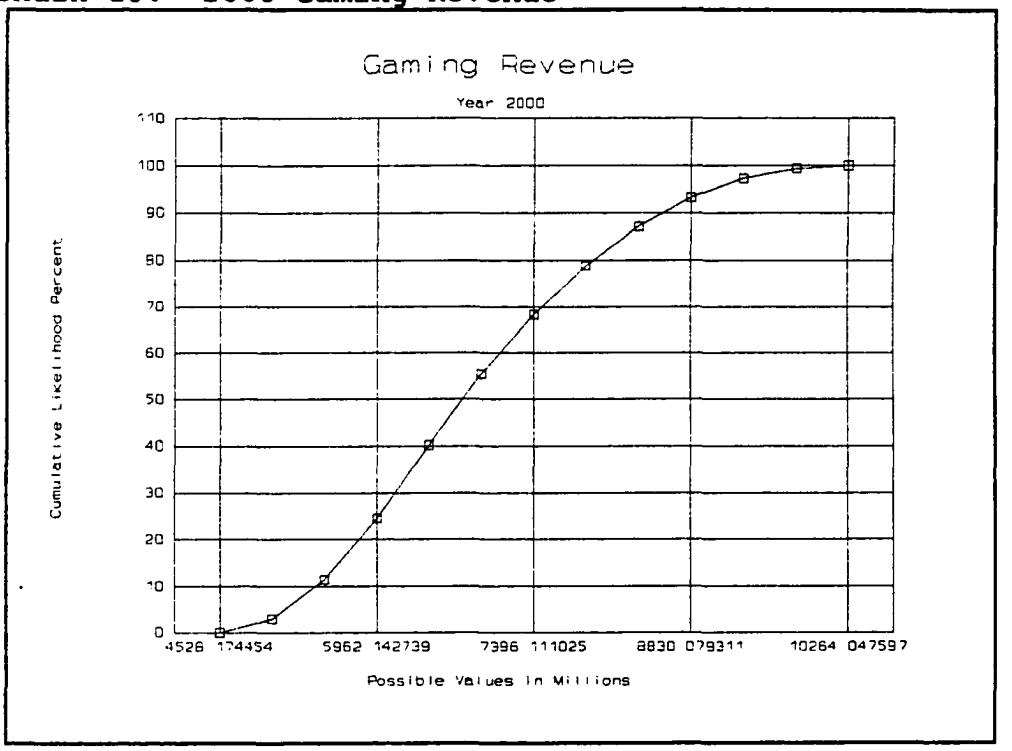


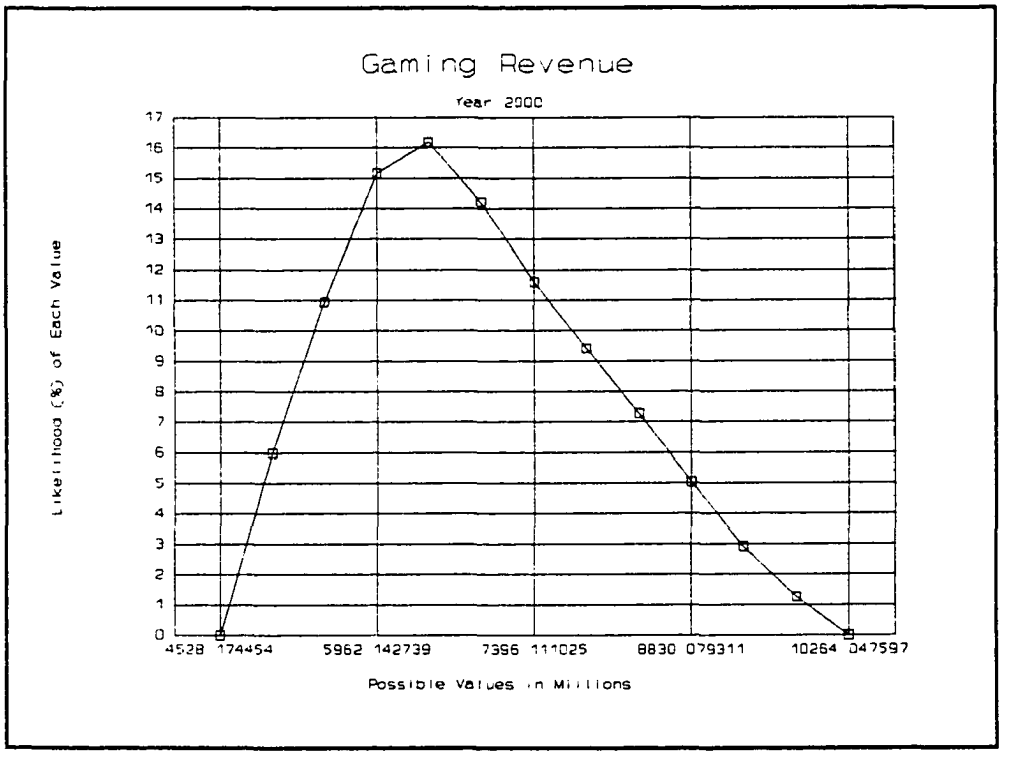
Appendix I5: 2000 Guestrooms and Revenue Correlation



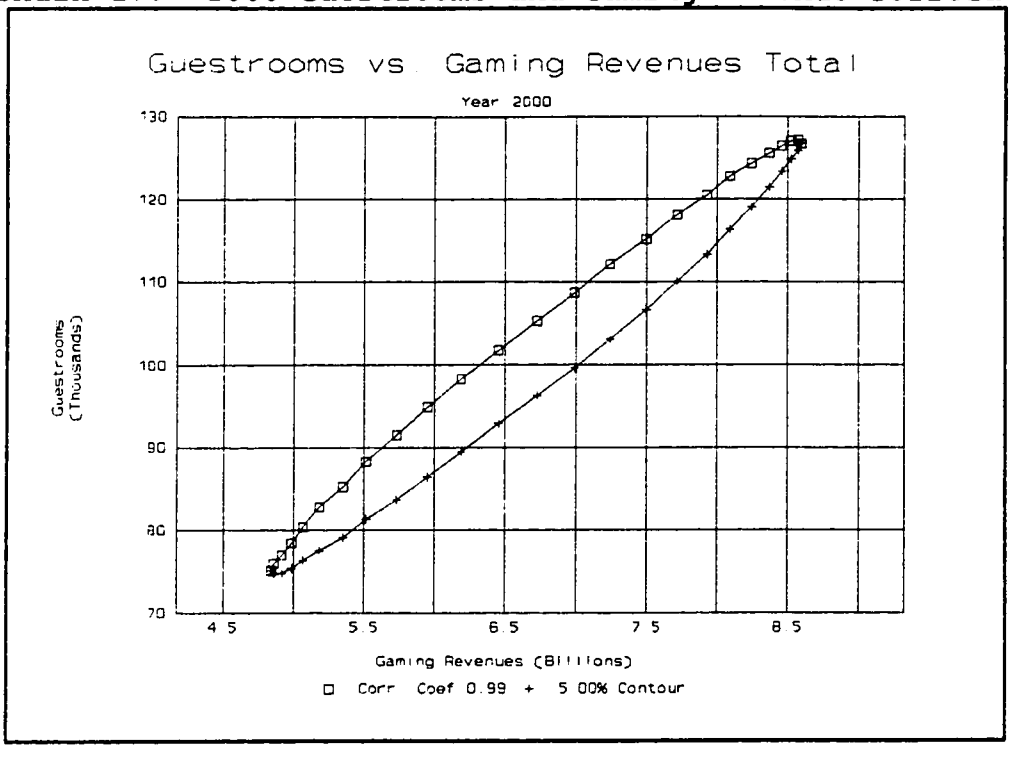


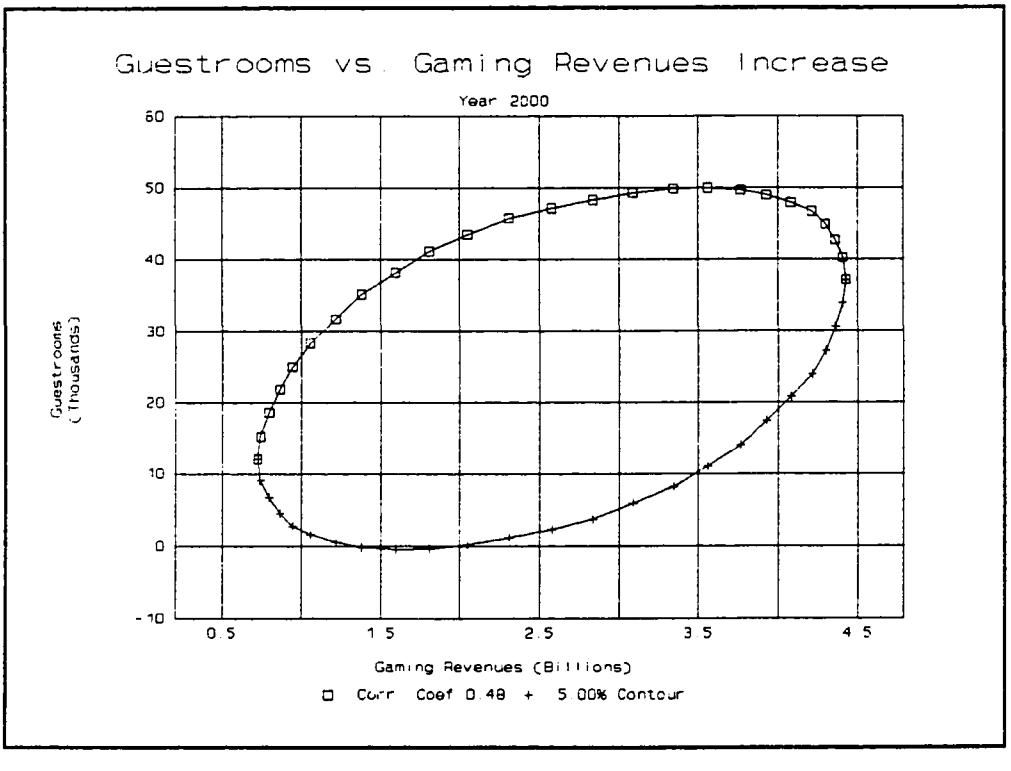
Appendix I6: 2000 Gaming Revenue



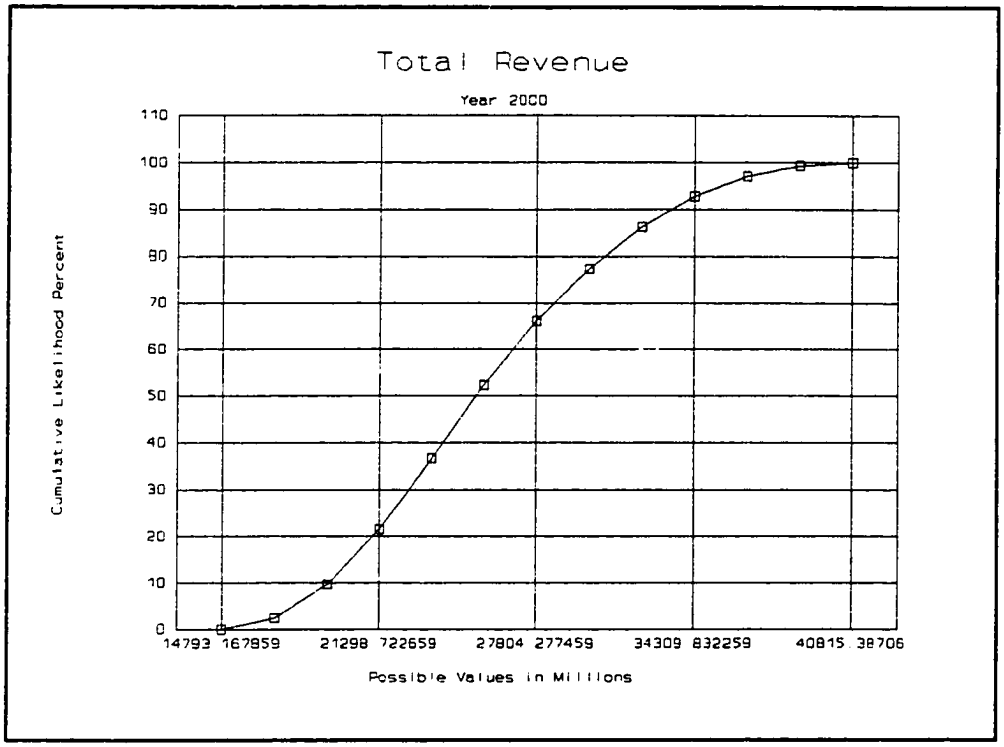


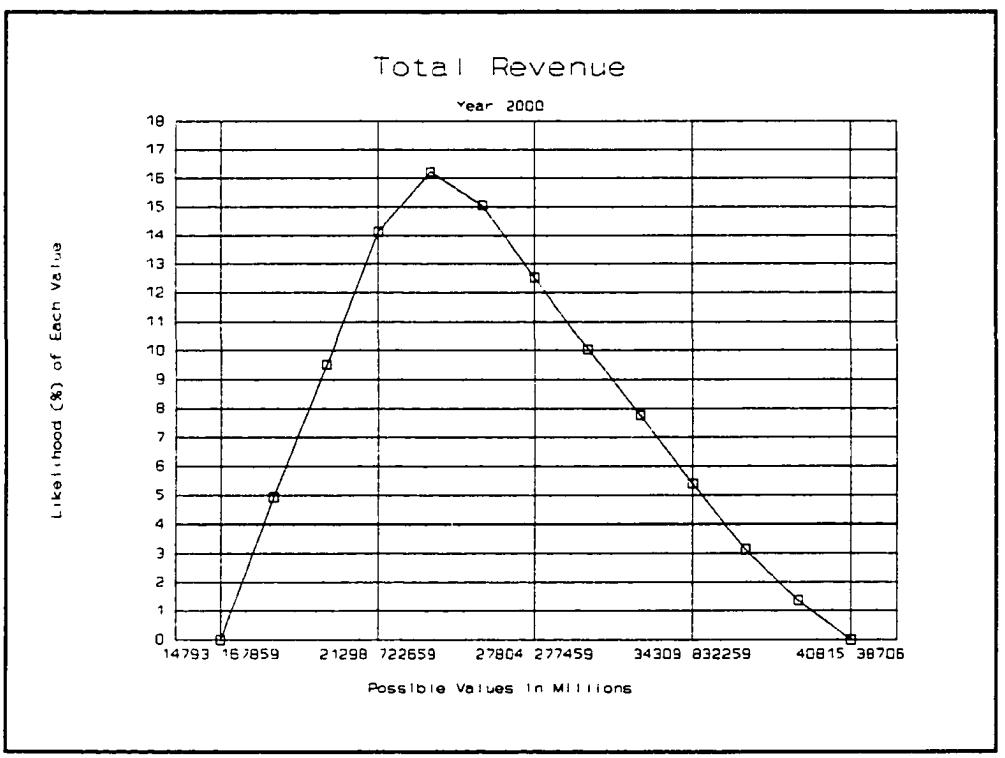
Appendix I7: 2000 Guestrooms and Gaming Revenue Correlation



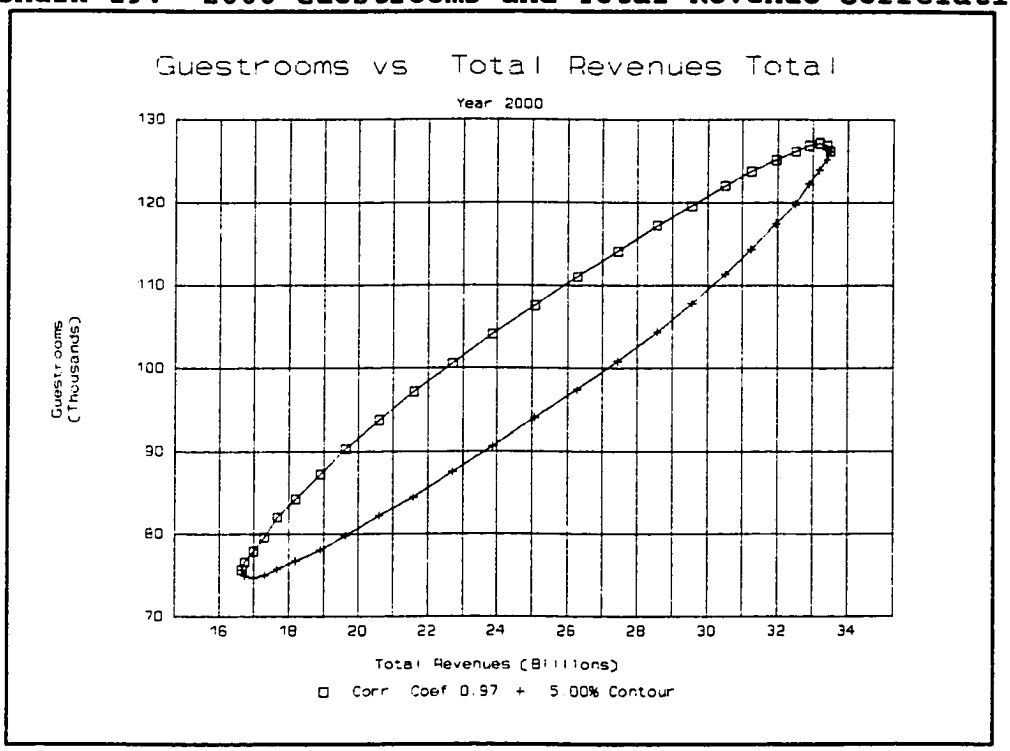


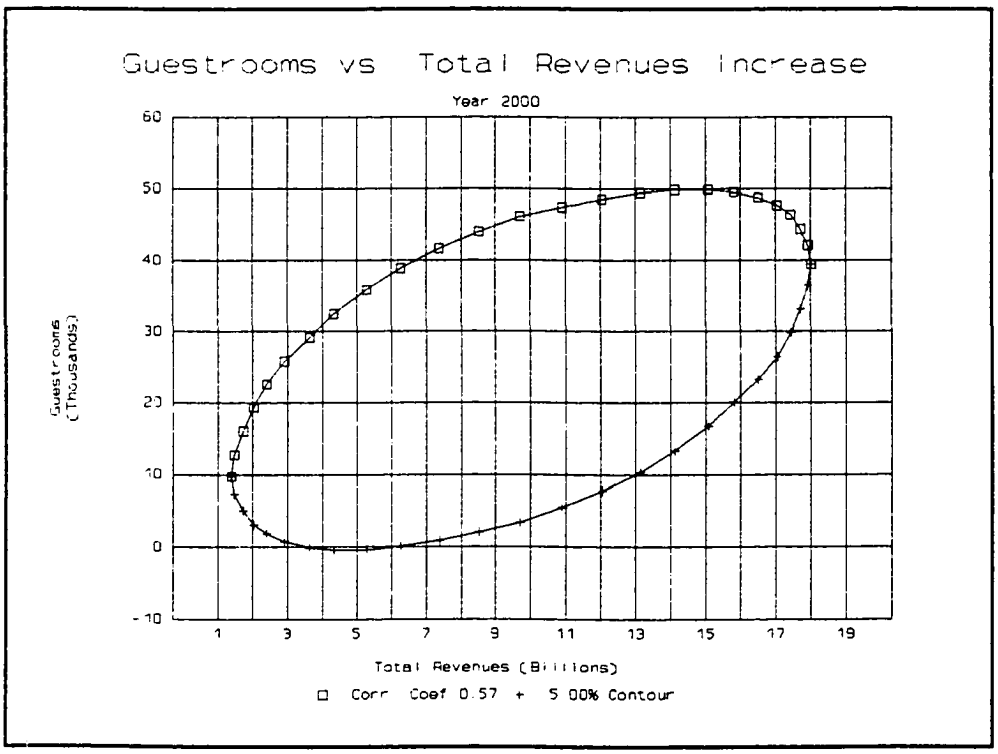
Appendix I8: 2000 Total Revenue



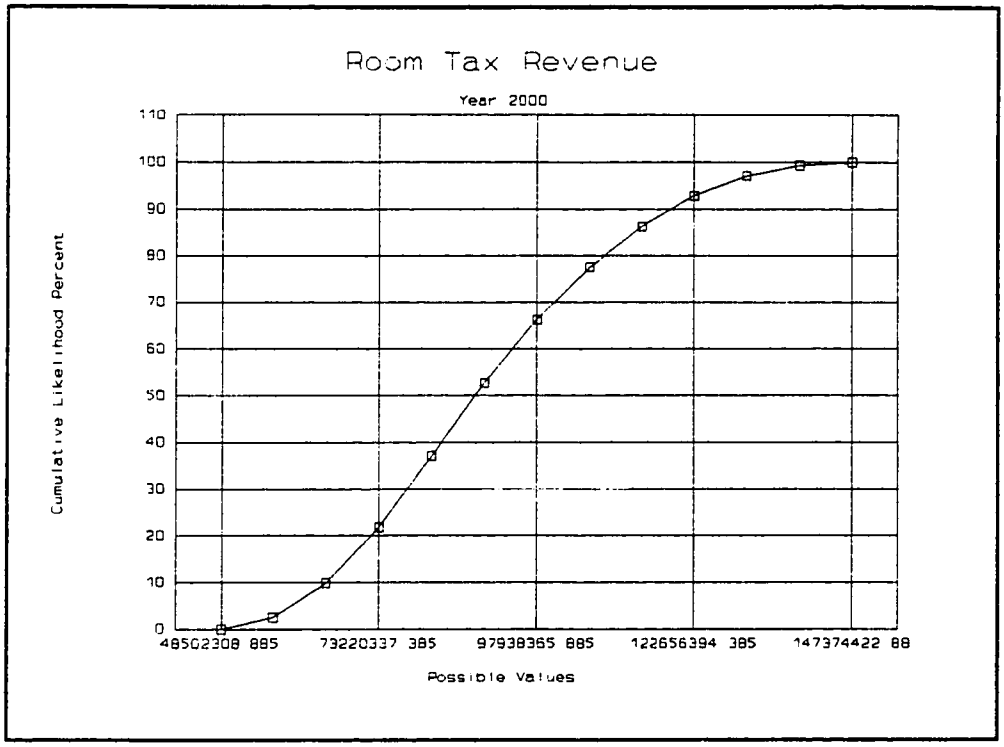


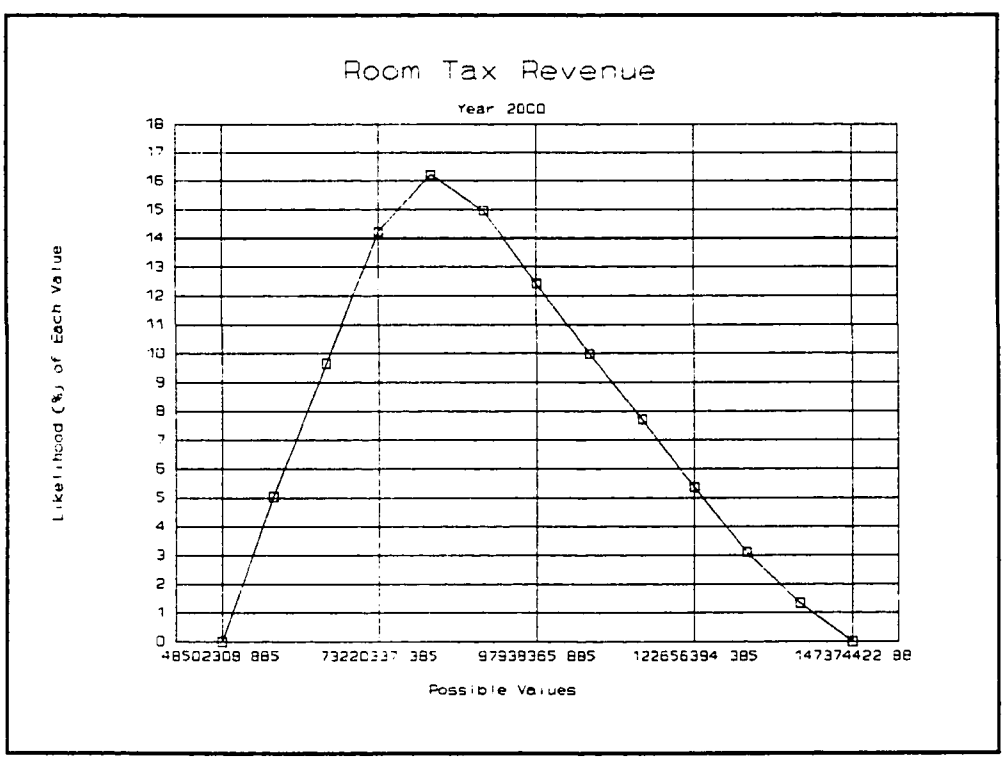
Appendix I9: 2000 Guestrooms and Total Revenue Correlation



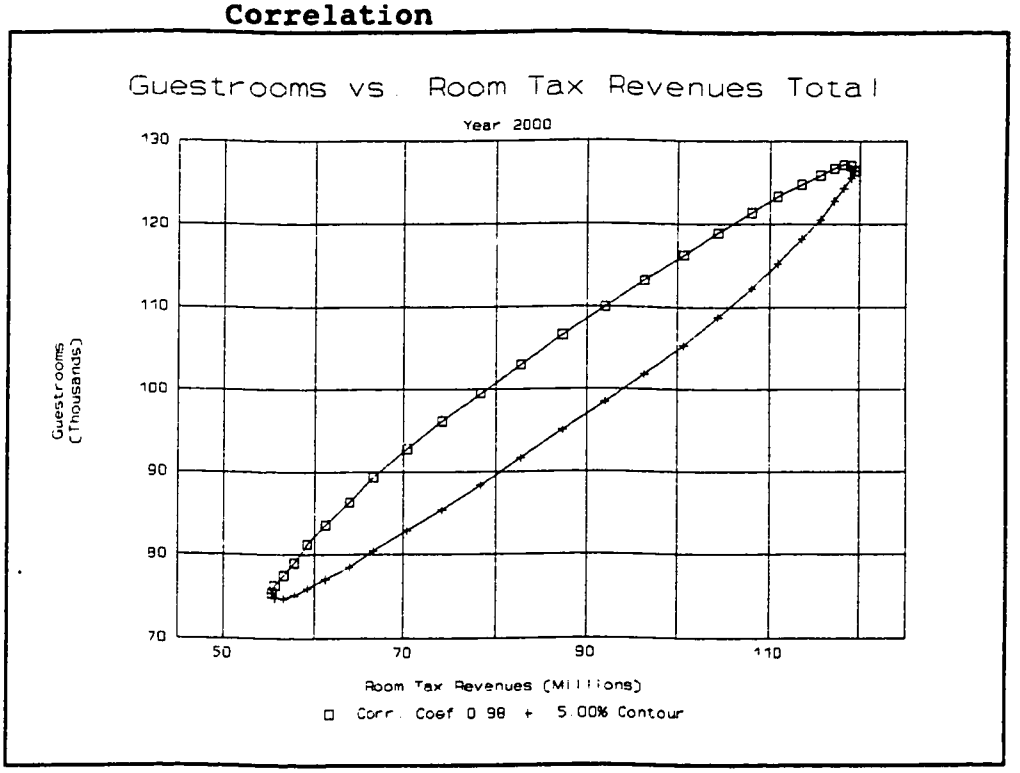


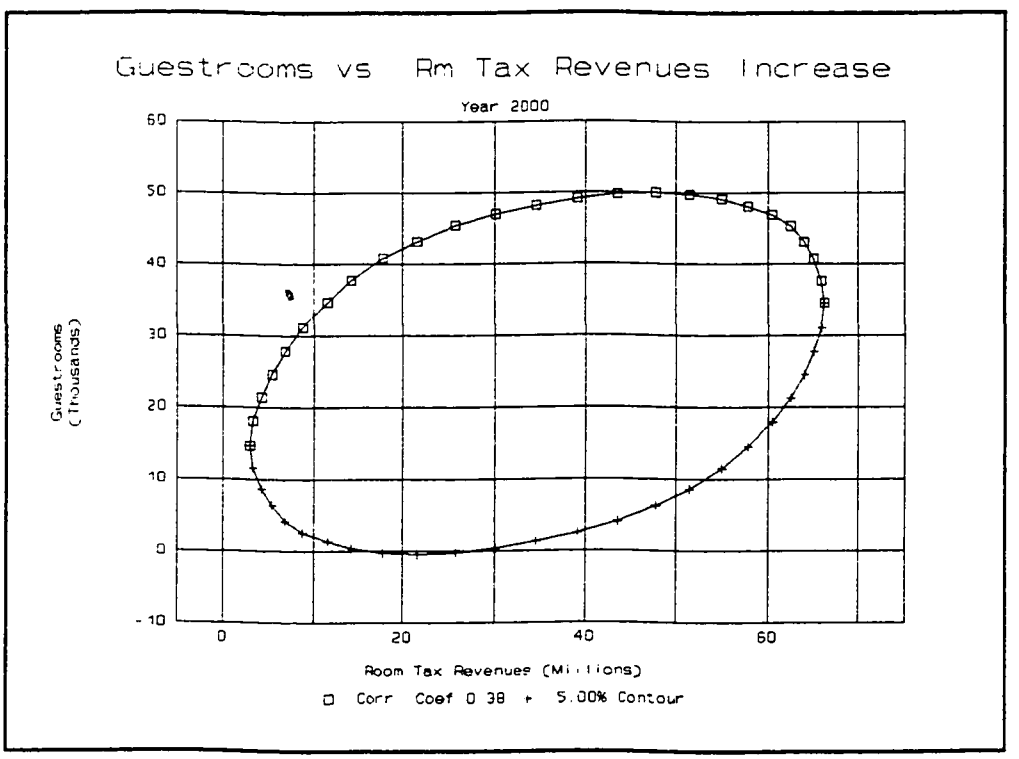
Appendix I10: 2000 Room Tax Revenue





Appendix I11: 2000 Guestrooms and Room Tax Revenue Correlation





Appendix J: Curvilinear Regression Results-Actual Guestroom Data

Year	X	Y(forecast)	Y(actual)	Difference
1972	1	27,765	26,980	785
1973	2	30,004	29,198	806
1974	3	32,242	32,826	-584
1975	4	34,481	35,190	-709
1976	5	36,720	36,245	475
1977	6	38,958	39,350	-392
1978	7	41,197	42,620	-1,423
1979	8	43,436	45,035	-1,599
1980	9	45,675	45,815	-140
1981	10	47,913	49,614	-1,701
1982	11	50,152	50,270	-118
1983	12	52,391	52,529	-138
1984	13	54,629	54,129	500
1985	14	56,868	53,067	3,801
1986	15	59,107	56,494	2,613
1987	16	61,345	58,474	2,871
1988	17	63,584	61,394	2,190
1989	18	65,823	67,391	-1,568
1990	19	68,061	73,730	-5,669
1991	20	70,300		
1992	21	72,539		
1993	22	74,778		
1994	23	77,016		
1995	24	79,255		
1996	25	81,494		
1997	26	83,732		
1998	27	85,971		
1999	28	88,210		
2000	29	90,448		

Regression Output:

Constant		0.00000
Std Err of Y Est		2158.04250
R Squared		0.97303
No. of Observations		19
Degrees of Freedom		17
X Coefficient(s)	1	t"
Std Err of Coef.	.04038	24.76696

Y = Actual Data
X = Estimated Data

Appendix K: Curvilinear Logarithm Regression Results-Actual Guestroom Data

Year	X	Y(forcast)	Y(actual)	Estimated	Actual	Difference
1972	1	4.42243	4.43104	26,450	26,980	-530
1973	2	4.47005	4.46535	29,515	29,198	317
1974	3	4.51140	4.51622	32,464	32,826	-362
1975	4	4.54711	4.54642	35,246	35,190	56
1976	5	4.57787	4.55925	37,833	36,245	1,588
1977	6	4.60432	4.59494	40,209	39,350	859
1978	7	4.62713	4.62961	42,377	42,620	-243
1979	8	4.64694	4.65355	44,355	45,035	-680
1980	9	4.66443	4.66101	46,177	45,815	362
1981	10	4.68025	4.69560	47,891	49,614	-1,723
1982	11	4.69505	4.70131	49,551	50,270	-719
1983	12	4.70950	4.72040	51,227	52,529	-1,302
1984	13	4.72426	4.73340	52,998	54,129	-1,131
1985	14	4.73998	4.72482	54,952	53,067	1,885
1986	15	4.75732	4.75200	57,190	56,494	696
1987	16	4.77695	4.76700	59,834	58,474	1,360
1988	17	4.79951	4.78813	63,025	61,394	1,631
1989	18	4.82568	4.82860	66,939	67,391	-452
1990	19	4.85610	4.86764	71,796	73,730	-1,934
1991	20	4.89143		77,881		
1992	21	4.93234		85,574		
1993	22	4.97949		95,387		
1994	23	5.03352		108,024		
1995	24	5.09511		124,483		
1996	25	5.16490		146,184		
1997	26	5.24356		175,210		
1998	27	5.33175		214,659		
1999	28	5.43012		269,228		
2000	29	5.53933		346,202		

Regression Output:

Constant		-223.52189
Std Err of Y Est		1170.76301
R Squared		0.99206
No. of Observations		19
Degrees of Freedom		17
X Coefficient(s)	1.00502	t"
Std Err of Coef.	0.02180	46.09666

Y = Actual
X = Estimated

Appendix L: Goodness of Fit (R Squared) Results of the ten time series forecasting models in Quantitative Systems for Business Plus

1. Simple Average R Squared = 0;
2. Weighted Moving Average R Squared = 0.9290230;
3. Moving Average with Linear Trend R Squared = 0.9636343;
4. Single Exponential Smoothing R Squared = 0.9290230;
5. Exponential Smoothing with Linear Trend R Squared = 0.9748236;
6. Double Exponential Smoothing R Squared = 0.9290230;
7. Double Exponential Smoothing with Linear Trend R Squared = 0.9749275;
8. Adaptive Exponential Smoothing R Squared = 0.9290144;
9. Linear Regression R Squared = 0.9486736;
10. Winter's Model R Squared = 0.9748236.

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