Object-Oriented Design
Midterm Exam

Department of Electrical and Computer Engineering
University of Cincinnati

Student Name:

Problem Description: The Rev-Pro (Revenue-Profit) System

Overview

This is a case study of a Revenue-Profit System which involves the development of a software package to aid an arts administrator in a university in handling budget considerations related to concert series ticket sales at the university. The underlying problem is the same one faced by every business; it can be briefly stated as: "My costs are X dollars. If I can generate Y dollars in revenue by selling N widgets, then my profit will be Y-X dollars." An important facet of this problem is that different price strategies can affect sales. For example, pricing the widgets too high might reduce sales and result in lower profits. On the other hand, setting the price too low may result in increased demand, but the revenues will not cover the costs. Ideally, the entrepreneur should set up various "what-if" scenarios and pick the right pricing strategy to make a reasonable profit.

Detailed Problem Description

The sponsor of the case study project worked in a university environment and was concerned that the concert series be self-supporting, but not profit-making. Thus, the goal in this particular case was to obtain "breakeven" -- an even balance between costs and revenues. The sponsor wanted a system to help him make informed guesses about how tickets should be priced and how many tickets needed to be sold to obtain breakeven. The user wanted to be able to enter different ticket pricing strategies and different estimates of ticket sales and see how they worked together to produce breakeven.

To calculate the breakeven point for a concert series, two primary pieces of information are needed: total costs and total estimated revenue. Calculating the total costs is straightforward and simply involves totaling a series of cost amounts. In the university setting, total estimated revenue comes from two sources: estimated revenue from the sales of tickets and income from other sources (non-ticket revenues such as grants, subsidies, and donations). Calculating non-ticket revenues simply involves totaling up the amounts from each of the various sources. Calculating the estimated revenue from the sales of tickets is more complex.

To calculate the estimated revenue from ticket sales, the administrator must first do what is called "scaling the hall." Scaling the hall involves dividing up the theater seats into different price categories and assigning single-ticket prices to these seats. For example, the front row seats might be priced higher than the middle seats, the middle seats might be priced higher than the rear seats, and seats in the balcony might be the cheapest of all. Next, the administrator figures out the pricing for a series. In a series, a subscriber gets tickets for all the events in the series (a full subscription) or a subset of the events in a series (a mini subscription). Different levels of discounts apply on the series tickets. For example, an adult full-series subscription might involve a discount of 20% off of the single ticket price, while a student full-series subscription might involve a discount of 50%. Lower discounts might apply for mini subscriptions. Putting the discount pricing levels together with the price categories produces "pricing grids." Pricing grids are two-dimensional tables that show the price of tickets at each discount level and for each price category. For example, the table could be used to find the price a student would pay for a full-series subscription with a seat in the balcony section, or the price an adult would pay for a full-series

subscription with a seat in one of the front rows. A different pricing grid table would be used to find miniseries' prices.

In the next step, the administrator estimates the demand for each discount level and each pricing level. In other words, an estimate of the expected ticket sales is made for each cell of the pricing grids. By multiplying the estimates times the prices and totaling all of these products, the total estimated ticket revenues can be calculated. The total of estimated ticket revenues is added to the non-ticket revenues to give the total estimated revenues from all sources. This figure is then compared to the costs to see if breakeven will be achieved.

At the time the project was initiated, the sponsor was making all of these calculations using paper and pencil, a general spreadsheet program on an Apple IIe computer, and a hand calculator. When new data became available or if a mistake was made, the calculations had to be redone. If various "what-if" alternatives were to be considered, each scenario had to be done by hand. The sponsor wanted a software system that collected and integrated all the necessary information, allowing him to quickly update or change some information and see the effects of these changes throughout the system. The target computer was an IBM PC.

Space for Your Notes

1. [2 Points] Construct a Data Dictionary of the problem space. Include in this dictionary all elements of data, brief descriptions of the elements, and the attributes of the data.

2. [2 Points] Construct an Entity Relationship Diagram of the problem.

3. [2 Points] Construct a Data Flow Diagram of the problem.

4. [2 Points] Construct a diagram showing the class structure (the "kind of" hierarchy) of a design of a problem solution.

5. [2 Points] Construct a diagram showing the object structure (the "part of" hierarchy) of a design of a problem solution.