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THE RESTAURANT GAME

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ABSTRACT

The Restaurant Game is a single-period simulation that provides students with the opportunity to plan and execute a strategy for operating in a competitive environment. The game includes an auction in which players must bid for raw materials. This auction can result in players changing strategies in response to market conditions. After the players have obtained the necessary raw materials, they allocate them to create menus which can be sold to generate profits. The allocation process is actually an application of integer programming, and the instructor can demonstrate how mathematical modeling can lead to optimal solutions.

INTRODUCTION

One of the most difficult aspects of creating a simulation or game is the development of a scenario that is realistic enough to be comfortable for the players and yet challenging enough to teach a useful lesson. Some games that seek to exercise a fundamental concept, like the free rider problem in economics, may be very simple in structure. In this case, multiple repetitions of a simple game must be conducted in order to illustrate the principle. Other games that seek to model complex operations, like the operation of a commercial bank, may have many aspects that must be mastered. Games like this can take many weeks to complete.

While both short and long games have their uses, for many instructors it is often desirable to have a game that takes a single class period and illustrates several different ideas. These single-period games have the advantage of being flexible in their application; instructors can change plans according to the needs of the class and move the game to a different time without causing major disruptions in the class schedule. Single-period games also have the potential of being rich enough to provide students with a real educational experience but not so rich as to be overpowering and confusing. When a single-period game is properly designed, it can become a valuable tool for the instructor, a tool that provides flexibility along with educational content.

LITERATURE REVIEW

The use of games, simulations, and role-playing situations has been popular at the college level. Economic games and experiments can enable the testing of theories and create artificial market situations that can be used in the classroom to examine alternative economic structures. Games and experiments make it possible to convey difficult concepts in an interesting and effective manner.

Chamberlin (1948) developed one of the first laboratory experiments in economics and wrote of the pedagogical benefits of market multi-period experiments and games. Smith (1962) conducted transactions by means of a "double oral action" in which bids and offers are made publicly and all transactions are cleared through a central auctioneer. Hoggat (1959) and Sauermann and Selten (1959) focused on development of multi-period experimental techniques. Fouraker and Siegel (1963) developed experimental multi-period techniques that are still being used in the classroom.

Over the past three decades, the number of economists testing theory by creating marketplaces in the laboratory has continued to increase, and the use of experiments in teaching economics has become more and more popular.

Joseph and Saunders (1970) published an extensive work on how to use multi-period games and experiments to teach basic economic concepts. McMillan (1992) presents an entertaining set of real-world observations and theory which is readily accessible through a variety of experimental techniques. Friedman and Sunder (1994) discussed methods and philosophy of experimental economics. Davis and Holt (1993) and Kagel and Roth (1995) are textbooks on experimental economics suitable for advanced undergraduate or undergraduate courses.

The most recently published articles focus on explaining the pedagogical advantages of games and simulations in teaching certain economic concepts and ideas. Modifying a lecture to enhance students' learning by using active laboratory market experiments has been advocated by many economists. Hester (1991) developed an extensive and time consuming simulation of a commercial banking system for use in large-lecture money and banking courses. Motahar (1994) reported on the use of software in the teaching of a course on modeling and simulation in economics. Zapalska and Brozik (1998) developed a market game that can be adapted to a wide variety of situations ranging from simple barter to highly developed supply and demand driven economies. This work continues to show the value of games and simulations as pedagogical tools.

PLAYING THE RESTAURANT GAME

The Restaurant Game is a single-period game that is designed to illustrate the complexities of operating a business and the types of decision making that accompany the operating process. Players must deal with a market for raw materials and then combine these materials into final products that can be sold. The market for raw materials is competitive, and the players must decide how to use a limited amount of capital to maximize their individual performance. The game includes an auction in which players must bid against each other for raw materials. Another aspect of the game is that optimal solutions can be obtained using integer programming techniques.

Initiating the Game

The game begins by distributing to the students a direction sheet as shown in Figure 1. This sheet provides students with the information they need to plan an overall strategy. Since the winner of the game is the player who achieves the greatest profit, there are many ways to approach the market. A player could choose to offer only low priced meals, only high priced meals, or a combination of low, medium, and high priced meals. The profitability of any strategy is unknown at the beginning of the game since the prices for the raw materials have not been specified. In fact, it is not possible to know the optimum strategy at this time since the interactions of the players in the auction will establish the relative profitability of each menu. This dynamic aspect of the game requires that players remain aware of the changing conditions and possibly modify their strategies to meet the evolving market conditions.

The number of players is an important aspect of the game. With too few players, the auction can degenerate into a sharing of resources by mini-monopolists. With too many players, there is insufficient time to auction off enough goods so that complete menus can be formed by all players. An appropriate number of players for a single-period game is five or six. Large classes can be broken up into teams, and the teams can develop strategies. Teams actually perform better in the auction portion of the game since individuals can be given specific tasks like monitoring the inventory to see that it agrees with the planned menu offerings, keeping track of the team's money balance, monitoring the other bidders in the market and the prices they are offering, and actually doing the bidding. It is important that each team designate only one person to be the bidder; teams with multiple bidders often wind up confusing themselves about exactly what has been bought.

The Auction

The auction is conducted by the instructor. The Bid Sheet to be used during the auction is presented in Figure 2. The bid sheet contains all the items listed in the menus and contains enough raw materials to make each menu one time. This means that not all items are offered the same number of times, and this prevents players from detecting a pattern and waiting for later offerings. The length of the auction should be about 30 minutes, or until everyone runs out of money. The bid sheet should be repeated as necessary, probably four or five times to assure enough raw materials are available in the market. It is the responsibility of the instructor to conduct the auction at a brisk pace. While it is expected that the first bids will be slow due to players getting used to the pattern of the auction, it is necessary to complete a bid on an average of every 20-30 seconds. This might sound fast, but once the auction begins it is possible to achieve this rate without difficulty. The speed at which the auction runs is one of the more important factors in the game. The prices established by the bidding can have the effect of changing the players' previously established plans, and the players will have to adjust rapidly.

There are times when the instructor/auctioneer will need to take control of the entire auction process. At the beginning of the auction it will be necessary to solicit a few bids in order to get the momentum started. If players are slow in bidding, the auctioneer simply yells "Going, going, gone!", and the last bidder very likely got the commodities at a very good price. Towards the end of the auction, it is possible that some players will have exhausted their budgets. This could result in a single bidder buying large quantities of goods at extremely low prices. In this situation, the auctioneer can set a minimum bid of $50 or $100 per lot of goods to prevent excessive profiteering. Another problem that can occur late in the auction is that some goods will have no takers. This happens when players have purchased exactly what they need to produce a certain menu and are trying only to get one or two commodities that would allow them to offer a more profitable menu. In order to save time, the auctioneer can invoke the rule that if an item fails to reach the minimum bid at any time then it will not be offered again. For example, if the minimum bid is $50, and no player is willing to spend $50 for a lot of vegetables, no further vegetables will be offered. This rule has the effect of speeding up the end game during the auction because it limits the flexibility of players to change strategies too many times.

The bid sheet requires that the auctioneer record the name of the buyer and the amount paid for each lot of goods. This information can be used to audit the players to make sure that no one overspent the allotted budget. It can also be used to identify the market characteristics of the items offered for sale. It can be seen if the market clearing price changes and whether it increases or decreases. This type of information is often useful to review with the class after the game is completed in order to show how dynamic even a simple market can be. Since this information requires the name of the buyer, it is convenient to assign names to the bidders like "Left", "Right", "Front", "Back", and "Center" based on their position in the classroom. This will enable the auctioneer to identify each team quickly, easily, and unambiguously.

Allocating Raw Materials

Once the auction is over, the players are given time to create complete meals with the raw materials they have available. No partial menus are allowed. Since each of the raw materials is used in each menu, it is possible to create many different combinations of menus, each with its own unique level of profitability. This is the integer programming aspect of the game, but it is not necessary to require that students use such mathematical techniques. The menus are simple enough that students are usually able to create a

set of menus that is at or close to the optimal solution.

It may seem surprising, but players often achieve the optimal solution. This is not due to any particular mathematical expertise on the part of the students, though. The players often try to stick to their initial strategy and buy only certain quantities of the raw materials. There is one solution and no waste in this case. The instructor may choose to enrich the allocation experience by awarding each group one or two additional lots of each commodity. This often will have the effect of changing the optimal solution and requiring students to consider different allocation strategies.

After the players have determined their allocation of raw materials and found the profit they would make by selling the meals, a winner can be named. It is also possible to identify whether any or all groups have actually found the optimal mix of outputs. This can be done fairly easily with a portable computer and a spreadsheet package. Most spreadsheets include a linear programming module with the option for integer outputs. The authors have developed a small spreadsheet template that takes the inputs available and calculates the optimal final mix. This makes it possible to demonstrate to the class the uses and power of mathematical programming in "real-life" applications.

In classes where the instructor wishes to use the game to demonstrate integer programming, the students can be given until the next class period to find the optimal solution. In this case, each student should submit an inventory of available goods to the instructor before leaving class. This will allow the instructor to verify the inventory against the bid sheets and calculate the optimal solutions prior to the next class. In order to demonstrate the sensitivity of solutions to the mix of inputs, students can be required to find the optimal solutions for different combinations of inputs. The instructor can thus use the game to set up the lectures for following classes.

CONCLUSION

The Restaurant Game is a single-period game that incorporates an auction as the allocation process to obtain food and prepare meals to be sold. The goal of the game is for the players to maximize the profit earned from the sale of meals. The setting of the game is sufficiently familiar to all students to make it believable, and this allows the instructor to demonstrate how markets for raw materials and finished goods operate. It also provides the opportunity to demonstrate the uses of mathematical programming to find optimal solutions. The game thus has both practical and theoretical aspects, and instructors can use the game to establish the bases for future classroom work. Though designed as a single-period exercise, the Restaurant Game can be used in a multi-period mode to demonstrate mathematical programming.

As a medium for instruction the Restaurant Game has several unique properties. It enables students to engage directly in an interactive process in such a way that the students have some control over the outcome of the process. In the game, students are allowed to try out behavior, to learn from experience ("learning by doing"), to predict consequences, and to use feedback to achieve goals. The Restaurant Game helps students learn to acquire information through listening and observation. The game also allows students to practice skills of organizing and evaluating information. Student oral skills may become more accurate because of greater potential for developing student critical thinking skills among many others. The Restaurant Game provides classroom instructors with a dynamic exercise that can be used to demonstrate multiple aspects of economic activity.

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FIGURE 1

THE RESTAURANT GAME

You are the owner of a restaurant, and you can select to offer any combination of the menus listed below. Due to price competition from other restaurants, you will only be able to sell each meal for the given price, but you will be able to sell all meals that you offer. You need to obtain the food for these meals in a competitive market, and the food will be offered at auction to the highest bidder. Any food that you obtain which cannot be used in these menus in the specified proportions will be regarded as waste and thus cut into your profits. It is your goal to obtain the food you need to offer those meals which will result in the maximum profit for your restaurant.

MEAL PRICE	**CALORIE COUNTER** $10	**MODERATE MEAL** $20	**WAIST WASTER** $30
Salad		(1) Vegetable	(1) Vegetable
Entree	(1) Meat (1) Vegetable (1) Bread/Pasta	(1) Meat (1) Vegetable (1) Bread/Pasta	(2) Meat (1) Vegetable (1) Bread/Pasta
Dessert		(1) Sweet	(1) Sweet (1) Fruit
Beverage	(1) Beverage	(1) Beverage	(1) Beverage

The structure of the game is as follows:

1. Examine the structure of the menu(s) and determine which menu(s) you will offer.

2. Purchase the food you need to offer the menu(s) you have chosen. The food will be offered at auction, and you will be bidding against other restaurants. Each type of food will be offered several times during the auction. You have a budget of $2,500. If you purchase $2,500 worth of food, you have run out of money, and you must stop bidding.

3. After the auction is closed, use the food you have purchased to construct the combination of meals that will make you the most money. You can sell all complete meals at the price indicated. Meals may come from more than one of the menus. Food that cannot be used in preparing a meal is considered waste. Waste food cannot be resold or transferred to another restaurant.

4. Calculate the value of the meals that you sold in Step 3. Add any of the original $2,500 that you did not spend to purchase food. Subtract the original $2,500 to calculate your total profit. The restaurant with the highest total profit wins.

FIGURE 2

RESTAURANT GAME BID SHEET

ITEM	QUANTITY	BIDDER	PRICE
BREAD/PASTA	100		
VEGETABLE	100		
MEAT	100		
SWEET	100		
VEGETABLE	100		
BEVERAGE	100		
MEAT	100		
BREAD/PASTA	100		
VEGETABLE	100		
BEVERAGE	100		
MEAT	100		
SWEET	100		
VEGETABLE	100		
BREAD/PASTA	100		
FRUIT	100		
MEAT	100		
BEVERAGE	100		
VEGETABLE	100		