A COMPUTERIZED LOGISTICS GAME FOR MICROS

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ABSTRACT

This paper describes the use of a microcomputer simulation game that emphasizes warehouse location and shipment pooling.

INTRODUCTION

The history of computerized simulation games in the area of Business Logistics is a relatively long one. Graham and Gray (1969) describe a Transportation Management Simulation which was written in FORTRAN II for use on an IBM 1620 computer. Each of the four competing firms in the game had motor freight terminals located in four Eastern cities. Participants made decisions on 1) the number of salesmen, 2) advertising expense, 3) Local pickup and delivery of less- than-truckload shipments, 4) size of loading dock crews, 5) general management expense, a) safety, insurance and driver training expenditures, 7) maintenance expenditures, 8) hiring and termination of drivers, and 9) borrowing. Thus the scope of the game was quite broad; possibly it was too broad, as (to our knowledge) the game was no~ upgraded to run on modern- day mainframes.

The most popular logistics games (LOGSIMX used at Indiana University and Ohio State University, MSULOGA used at Michigan State University, and MULOGA used at the University of Michigan) are all based on a hand-scored game created in 1962 by James L. Heskett at Ohio State University. Dan DeHayes demonstrated his version of the game (DeHayes and Suelflow 1971) at the Bloomington ABSEL Conference in 1975. These games have a common format:

--each industry is comprised of four firms located 700 miles from a large, centrally located demand center. Each firm is 700 miles away from the home cities of two of its competitors and 1400 miles away from the other one.

--there are no pricing or advertising decisions.

--demand varies seasonally and is a function of product availability; stockouts in one period great- lj reduce demand in the area in the next period

---two modes of transportation are available for raw materials and finished goods

--vehicle load requirements vary by mode

--transportation rates vary by mode, by distance, and by quantity shipped (vehicle load or not)

--the product has three components, and the firms must schedule their production

--company raw materials warehouse capacity must be determined, and company and public warehouse capacity are available in all five areas. The optimal size of the warehouses is a function of the amount of product flowing through it.

The various games are batch games and are usually played for the majority of the semester.

While we have had positive experiences using various versions of the Heskett game, we have been somewhat perplexed by the lack of logistics simulation games available for use on micro-computers. In the area of channels of distribution, which has close ties to the logistics area, a number of computerized games have been developed which are appropriate for use on a micro-computer (Frazer 1977; Fritzsche 1983; Gentry and Pickett 1982). We believe that there is a need for a similar type of advancement in the area of logistics pedagogy. Recently, though, two new alternatives have been developed. One is Trains,” a commercial game produced by Spinnaker Software, priced at $39.95 and available for Commodore and Atari computers. This game simulates a small railroad system situated in the Midwest during the late 1800’s. Four products (food, lumber, fuel, and manufacturing) are to be transported. Demand is a function of stockouts. While there is no production scheduling, the player must schedule refueling (coal) stops. While the scope of this game is far narrower than the scope of the other games discussed in this paper, its use of graphics and sound make it much more recreational.

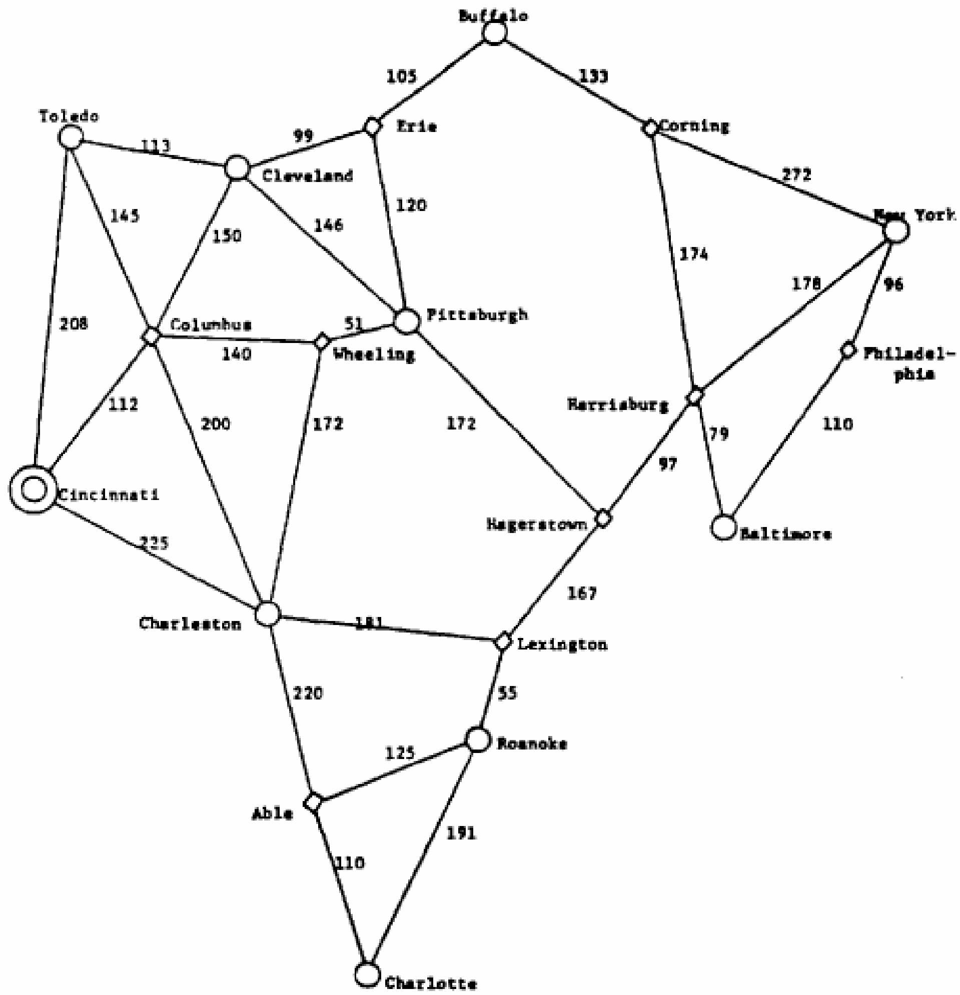
The second recent alternative was developed by Jackson and Morgan (1983) in the form of a hand-scored logistics game. The Jackson and Morgan (1983) game was a more sophisticated version of the physical distribution game developed by Morgan and Nelson (1980). In their game, the warehouse location decision was much more complex as students have many possible location sites for warehouses. This paper will discuss a modified and computerized version of this game, which we call BOY GEORGE. Its three primary differences with the various versions of the Heskett game will be discussed separately: (1) the dynamic warehouse location structure, (2) the availability for use on a micro-computer, and (3) the recommended modular approach to its use.

A MORE DYNAMIC DISTRIBUTION STRUCTURE

The Heskett game involves five demand centers and requires that public or company warehouses be located in each area. Our game’s structure consists of a plant in Cincinnati, nine demand centers (Toledo, Cleveland, Buffalo, Pittsburgh, New York, Baltimore, Charleston, Roanoke, and Charlotte) and nine other alternative warehouse locations (Columbus, Wheeling, Erie, Corning, Philadelphia, Harrisburg, Hagerstown, Lexington, and Able). Figure 1 presents a map of the market area, Originally, the players are to schedule production (there are two components) and then are to ship the goods from Cincinnati to the demand centers by truck. A demand history is presented for each of the demand centers; in general, the demand is much wore variable in this game than in the Heskett game. There are several means of routing the product to the demand centers:

FIGURE 1

MAP OF THE GAME'S MARKET AREA



--Each demand center may receive a separate shipment.

--Shipments may be pooled in order to achieve the vehicle load economies of scale.

--Goods may be shipped by rail to a (or several) warehouse(s) and the demand centers may be supplied from the warehouse(s) either by separate or pooled shipments.

A summary of the similarities with and differences between one game and the games derived from Heskett's hand-scored game Is shown in Table 1.

The summary indicates that our game offers more complicated warehouse location decision making and more complicated transportation decisions. On the other hand, the planning horizon is much simplified, making production scheduling simpler. In the Heskett game, the material handling costs are very high in the early part of the game if (1) the firm produces a relatively large amount and/or (2) the firm does not expand its warehouse capacities early. Our game does not consider material handling costs, as we wanted to emphasize warehouse location and transportation decisions.

One of the major differences in the games is that our game does not involve competition with other firms. Our observation has teen that much of the dynamic nature of the LOGSIMX game (DeHayes and Suelflow 1971) is due to competitors' decisions; market share increases In one's home market unexpectedly because one competitor dropped out of the market (intentionally or unintentionally). In classes where there are more than four teams (more than one LOGSIMX world), it is often difficult to compare performances across worlds due to the different histories of competitive actions. Our game involves only one firm, and performance can be compared across firms since they will get the same pattern of random numbers for their first run (after loading the game disk).

A MICRO-COMPUTER GAME VS. A BATCH GAME

As mentioned earlier, the various versions of the Heskett game are batch games. Our game is written in Apple Basic and is available for use on the Apple II series of computers. Only minor modifications (changing HO!€ statements and the random number generator) would be required in order for the program to run on

TABLE 1

SIMILARITIES AND DIFFERENCES BETWEEN THE STRUCTURE THIS GAME AND THE HESKETT GAME

	HESKETT GAME	OUR GAME
PRODUCTION SCHEDULING	--three components --more variable lead times	--two components --simpler decision process
RAW MATERIAL WAREHOUSE	--company only --capacity can be changed with two weeks' notice	--company only --capacity fixed after the first week
TRANSPORTATION MODES	Regular and premium	Rail and truck
FINISHED GOODS WAREHOUSE DECISION	--company and/or public in each of five areas --sizing decision early is critical	--can locate public warehousing in one or more cities; 18 possible alternatives --sizing decision is of lesser importance
DEMURRAGE AND DETENTION	Yes	Yes
STOCKOUTS	Affect demand	Opportunity costs; show up on financial statement
COSTS FOR PRODUCTION CHANGES	Yes	Yes
MATERIAL HANDLING COSTS	Based on warehouse or plant throughput	Not considered explicitly
POOLING AVAILABLE	No	Yes
COMPETITIVE STRUCTURE	--Four firms in an industry --Typically two to four students per firm	--The firm is not in direct competition with other firms --The game may be played individually or by a group making joint decisions

other micro-computers. A listing of the program is available from the authors.

The relative advantages of micro-computer games over batch games have been discussed elsewhere (Biggs and Smith 1982; Burns and Sherrell 1981; Fritzsche 1983; Good 1979). However, some of those advantages ~nay not apply to this specific application. The primary advantages which we see are summarized below.

--Transportability of the game into the classroom, as a demonstration requires only an Apple El computer, a disk drive, a monitor, and the game disk.

--Since the game can be played individually, there is no need for the game administrator to collect decisions and input them all at once. There is no need to substitute old decisions for new ones should some group not turn in a decision. Further, the game inputs are made by the students and not the administrator.

--The game can be played in a much shorter time span. Batch games typically are played for a long duration (usually the length of the semester) and it may be that they are played long after the intended learning has taken place (Gentry and Brown 1974). The use of our game emphasizes simpler concepts such as pooling and warehouse location, rather than a complete logistics system. Its availability on a micro-computer means that it can be used for a short period (one to two weeks) to demonstrate the material covered in recent lectures.

--The relatively short amount of time needed to run one period of the game allows the students to experiment. This advantage will be discussed in greater detail in the next section.

Thus, the primary advantage which we see for our game can be summarized as its ease of use in demonstrating some specific concepts (warehouse location and pooling).

A RECOMMENDED MODULAR APPROACH TO THE USE OF THE GAME

Discussions at ABSEL conferences (Frazer 1980; Gentry and Brown 1974; Low 1980) of guidelines for simulation game design have pointed out that students need to learn the structure of the game itself before they can learn the substantive material incorporated in the game. Laughery (1984) and Myers (1984) point out that most game players learn the game rules by playing, not by reading the instructions. As such, we recommend that our game be used in a modular fashion.

First module. Students should be urged to play the six-period game as simply as possible during their first run. As in later runs, they will still need to schedule production and to size their plant, raw material warehouse, and finished goods warehouse in Cincinnati. However, they should not poor any shipments (in other words, they should send separate shipments to each demand center), nor should they add warehouses. This run will go very quickly and should familiarize them with the operation of the game. Furthermore, the output from this run will provide them with a standard for comparison for pooling and for the use of warehouses.

Second module. Students should be allowed now to pool truck shipments from Cincinnati to the demand centers in order to achieve vehicle load quantities. The six-period run will take longer, but the pooling should result in reduced transportation costs.

Third module. Students should to allowed to arrange for the use of public warehouse space in various locations and to ship units by rail to those warehouses during the first week of play. In weeks two to six the demand centers may be supplied from the warehouses by sending separate shipments or by pooling. Given the vast number of possible warehouse configurations, students will need to play the game several times in this module. In order to experiment efficiently, they should be advised not to pool shipments from the warehouses to the demand centers until they have found a very good warehouse configuration. Lecture material covering approaches such as that of Kuehn and Hamburger (1963) should make the student's search for *a* good warehouse configuration much easier.

CONCLUSIONS

This paper introduces a new micro-computer business logistics game. The game is designed to emphasize warehouse location and transportation decisions. We recommend that students play the game (for six periods in each instance) in a modular fashion. The first run is for the purpose of familiarizing the student with the flow of game play and should not involve pooling of shipments nor the use of public warehouse space. A second nodule would introduce the student to the benefits of pooling, while the third module involves the determination of a satisfactory warehouse configuration.

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