

# Computer Simulation and Learning Theory, Volume 3, 1976

## TIME-SHARING BUSINESS GAMES

### AT THE FRESHMAN LEVEL

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The advantages of using time-sharing as the vehicle for umpiring management simulations have been reported on at previous meetings of NASAGA and ABSEL. BUSINESS DECISION SIMULATION (Reston Publishing Company) containing 20 time-sharing games, each designed to be played from start to finish in a two-hour period, was published in early 1975 and has been well received. The quick feedback of results made possible by time-sharing further enhances the interest and involvement that we have come to expect with business gaming, and playing a game from Start to finish at one time is particularly valuable from a Student's viewpoint. Thus the concept of using time-sharing and playing many different games in a course with students on different teams for each game is now a viable alternative to the traditional management simulation umpired in batch mode and played over a prolonged period.

The games presented in BUSINESS DECISION SIMULATION are designed for relatively advanced students, with some specialized knowledge called for in order to play well. The games have been played by students at levels ranging from sophomores to graduate students, and evaluations have been very good at all levels. It is noteworthy that graduate students with work experience have been the most complimentary, praising the realistic nature of the decision-making experience and the excellence of the games as a laboratory in human relations. Many students who have taken the course H their junior year have come to me the following year to say "I wish I had had the course I am now taking before simulation as it would really have helped me in some of the games." While this reaction is not necessarily bad, as the simulation games then become a motivator in the advanced course, it is probably unwise to overdo exposing the students to problem situations where they have not had the background necessary for good analysis.

Nevertheless, the excitement and interest generated by business games in the time-sharing mode indicate that the concept can readily be used to generate interest in the world of business at any level. A number of faculty members From various schools have indicated an interest in simulations designed for

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freshman students to be used in a revamped Introduction to Business course. At Clarkson's School of Management we have been deeply involved in finding a vehicle for generating increased interest in management on the part of first term freshman students.

To meet this need, we have developed a series of games designed for freshman students and they are now in the process of being tested. Twelve of these games will be published by Reston in the fall of 1976 under the title INTRODUCTION TO BUSINESS SIMULATION. It is contemplated that the games will be suitable for use in an Introduction to Business course where the students would be scheduled for a two-hour simulation period once a week for a semester. All of the games will permit being played by up to eight teams, making it possible to handle class sizes of up to 64 students, assuming space is available.

The standards developed for the games in BUSINESS DECISION SIMULATION were retained, with the most important of them being

1. Writeups should be concise and straight-forward, so that the nature of the decision making problem can be readily understood.
2. Students should be given complete information about the relationships in the games, with nothing being withheld from them.
3. Results should be returned to the students as quickly as possible, never taking over five minutes from the time the last decision is in until the results are all returned.
4. Decision-making should be concentrated in a relatively few decisions each period, with four decisions a period being the outside maximum.

In addition to these standards, three general criteria were established governing the development of the freshman-level games. These criteria are:

1. The games should be fun to play so the student will enjoy participating in the decision-making experience.
2. The setting of the games should be as familiar as possible to the student so that he will be able to understand the nature and effect of the trade-offs that need to be made in arriving at a decision.
3. Some basic principles should underlie the decision making so

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that the advantage of good analysis will be seen.

Following these criteria, games have been developed in a variety of areas familiar to most college freshmen, ranging from price-production type decisions about products familiar to college students to the management problems of running a big-league athletic team to deciding whether or not to hire a band to attract customers in a small-town cafe.

Reaction to the games tested to date has been tremendous. The freshmen have taken to gaming with a fervor and interest that matches or surpasses what we have experienced with upperclassmen. We observe very nearly 100% participation in the decision-making process and it is particularly satisfying to see all six or seven participants on a team standing up when the results are returned and grouped around the result sheet to see how they made out in comparison with other teams.

The freshmen tend to be noisier than upperclassmen and it is fascinating to observe and overhear comments virtually shouted, such as, in a pricing strategy game, one student unhappily saying, "We didn't make nearly as much profit as Team 3," while another retorts, "But we got twice as many customers as they did!" All in all, the interest shown and the involvement in the games on the part of the freshman students is everything we had hoped for when we started the project.

One of the games, TRACK, is a good example of what is being done. The game simulates a horse race in which students are given the probability of each horse winning and the amount bet on each horse. It is at its best when played using a television screen hooked up to the computer terminal for the presentation of data and results. Sufficient information is given to let the participants make an expected value calculation in arriving at a decision if they choose, and most get some feel for the concept of expected value during the game, as well as thoroughly enjoying the experience. The writeup of the game, which is what the student will have, follows:

### TRACK

TRACK is a simulation of a horse race in which you are asked to decide which horse to bet on. There are five horses in each race and, over a typical game of some 20 races, selecting the horse which is the "best bet" will usually pay off in a winning result.

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Thus, the game is one of deciding which of the five horses should be selected to give the greatest expected return in each race.

The simulation is not like an actual horse race where the prospective bettor analyzes such things as form charts and jockey's credentials to estimate the chance of a horse winning. In this game you are given the probability of each horse winning the race and the computer randomly determines the order of finish according to the given probabilities. Thus, as an example, if horse Number 2, named MANAG, had a probability of winning of .15, the computer would calculate the winner of the race such that, in the long run, MANAG would win 15% of the races in which its probability of winning was .15.

For each race you are also given the amount of money bet on each horse, which determines what the payoff will be when a horse wins. Unlike a horse race in the real world, where some 17% or more of the amount bet is taken off the top before the payoff is determined, meaning that it is quite difficult to come out a winner, in this game 100% of the amount bet is returned to those betting on the winning horse. To illustrate, let us assume that the information generated by the computer for Race I was:

The first line represents the names of the five horses. These names stay the same while the probabilities and amounts bet change with each race. The second line gives the probabilities of each horse winning the race. The third line shows the total amount bet on each horse.

SIMUL	MANAG	SHARE	MARSY	DOATS
.130	.150	.200	.280	.240
10,000	20,000	18,000	25,000	35,000

Using the total amount bet on each horse, we can calculate what the payoff would be for any horse if it should win. Using MANAG as an example, we first sum up the total amount bet on all horses, which comes to \$108,000. Of this, \$20,000 was bet on MANAG. As 100% of the total bet is paid out to those betting on the winning horse, each bettor on MANAG would get back

$$\frac{108,000}{20,000} =$$

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\$5.40 for each dollar bet if MANAG wins. In the parlance of the track, the payoff for a \$200 bet would be  $(\$5.40 \times 200) = \$1,080$ .

It should be noted that a person betting \$200 on MANAG under the given conditions would receive a payoff of \$1,080 when he wins and nothing when he loses. To evaluate whether MANAG was a good bet for the given conditions, we might ask what the expected result would be if we were to duplicate the conditions many times over, and assume that MANAG actually wins 15 times out of 100. After placing a \$200 bet on each of 100 races, we would get 15 payoffs of \$1,080 for a total of \$16,200. However, we would have bet a total of \$20,000, meaning we would have a net loss of \$3,800. Thus, MANAG is not a good bet for the given conditions.

At the beginning of the game, each team will start with 12 times the amount of a bet in cash. Each bet will typically be for \$200 so that each team will start with \$2400 cash. A team can bet on only one horse in each race and only to win, and can bet up to one half its cash holdings. Thus, in the first race each team can place up to six bets ( $6 \times \$200 = \$1200$ ) on a horse of its choice. A team can always place one bet on the horse of its choice even though this exceeds half its cash holdings and may indeed go negative in cash as a result. A typical game will last for 20 races and keen analysis coupled with good luck should bring a team out a winner

### Sample Calculations

Assume there are 4 teams playing and that, after 9 races, they have cash as shown:

<u>TEAM</u>	<u>CASH</u>
1	\$10,423
2	3,460
3	147
4	1,800

Data generated for race 10 is:

<u>SIMUL</u>	<u>MANAG</u>	<u>SHARE</u>	<u>MARSY</u>	<u>DOATS</u>
.230	.270	.105	.075	.320
18,000	32,000	8,000	12,000	30,000

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The total amount bet, therefore, is \$100,000.

Assume

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Team 1 places 20 bets on SIMUL
Team 2 places 3 bets on MANAG
Team 3 places 1 bet on SHARE
Team 4 places 5 bets on DOATS
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We will further assume that SHARE wins the race.

The PAYOFF for a \$200 bet on SHARE will be

$$\frac{100,000}{8,000} \times 200 = \$2500$$

The new cash balances will be

Team 1	10,423 - 4,000	= \$6,423
Team 2	3,460 - 600	= \$2,860
Team 3	147 - 200 + 2,500	= \$2,447
Team 4	1,800 - 800	= \$1,000

Note that Team 4 was only allowed to place 4 bets as the 5 bets requested took it over one-half its cash.

This game has been tested this past summer with groups ranging from faculty members to visiting high school students, and all groups thoroughly enjoyed playing. In the first test with freshmen this fall, the enthusiasm for the game was very high. It was particularly gratifying that in the early runs, teams betting the horse with the highest probability of winning moved out ahead of other teams, even though the payoffs for a \$200 bet were typically between \$500 and \$800. The two teams who were essentially following a strategy of betting the horse with the highest expected value grew concerned about the strategy they were following as the other teams moved out ahead of them. However, in Race 9 a horse with a low probability of winning but with a very low amount bet on it came in and these two teams enjoyed a \$7000 payoff, moving them into first and second place. Later in the game other high expected value horses won and the two teams that were playing essentially an expected value game ended up first and second. Not all plays work out this well as the vagaries of a random generator cannot be predicted in the short run, but playing expected value will beat other strategies the vast majority of the time over a 20 race game. When it happens, nearly everyone in the group will

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get some feel for how the concepts of probability of success and payoff for success can be combined.

A demonstration of TRACK is being given later in this conference, and everyone is invited to come and participate on a team.