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MONABUS - A Business Simulation Exercise

by

Walter Lewis Brown Jr.

B.S. Tri-State College, 1964

Presented in partial fulfillment of the requirements
for the degree of

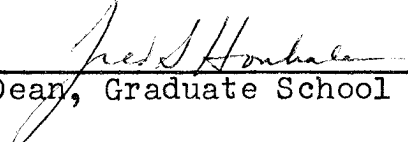
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1966

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ACKNOWLEDGMENTS

The idea to construct a business simulation exercise as my thesis project originated from an interest in gaming aroused during the 1965-66 academic year. During that period I had the opportunity to work with two business games used in the School of Business Administration and to do research in the area of business simulation. The construction of MONABUS offered an opportunity to become involved in two areas that are of interest to me: management development, and the construction of training aids.

I am particularly indebted to my thesis advisor, Professor Lawrence J. Hunt, for his inspiration and guidance in the construction of MONABUS. I should also like to extend appreciation to the other members of my committee, Professors Albert T. Helbing and Kent T. Adair.

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INTRODUCTION

Are good managers born or made? If it can be concluded that good managers are made, or at least developed, then we have found one reason why Schools of Business Administration exist. Of course, it can be said that not everyone who attends business schools does so because he intends to become a manager, but few such students would admit that they never hope to advance beyond their first job. Business School graduates take jobs as purchasing agents, accountants, junior executives and other areas with lower echelon responsibilities. As the young businessman moves up the ladder he is called upon to take an active part in management, at least within his own specialization. As he aspires to a bigger and better paying job, and is successful, he not only must manage, he must also develop the attitude of the generalist, as he becomes involved in areas outside of his narrow specialization. At the point where he leaves a narrow department position and moves further up, his jurisdiction spreads out. From this point on, too much specialization becomes a handicap because it prevents the aspiring manager from grasping the concept of total firm activities that is so necessary for successful decision-making.

This is not to say that specialization per se is not important, but only that a capacity for generalization, or an ability to deal in various specializations is more important in the ranks of top management. A top manager is a specialist; a specialist in the art or science of management. A company president, for example, must administer production, sales, accounting, research and so forth; he needs to know something, if not everything, about each of them. The book Management Games by Joel Kibbee et al. has this to say about business schools:

The concept of formally educating men for a career in business is not very old. It is less than eighty years since the Wharton School of Finance and Commerce opened its doors at the University of Pennsylvania to become the first collegiate school of business. Although a few others also emerged prior to World War I, their strong emphasis on specialized "how-to-do-it" courses such as accounting, insurance, and transportation indicated the lack of a conceptual framework within which the study of these independent areas could be coordinated. It is only within the last forty years that the study of business has become a significant educational discipline.¹

In teaching management, as in all complex subject matter, it becomes necessary to teach in parts. The training problem then grows out of the necessity to reintegrate these parts in order to develop conceptual skills. This matter of viewing all disciplines in the light of coordinating firm operations is a problem that is taken up in

¹Kibbee, Craft, and Nannus, Management Games (New York: Reinhold Publishing Corp., 1961), p. 34.

schools of business, particularly in the course area of Policy and Administration.²

Administration and Business Policies

The School of Business Administration at the University of Montana offers a senior course that seeks to present an integrated view of the firm--Administration and Business Policies.³

Administration and Business Policies, as it has been taught in the School of Business, encompasses three teaching techniques:

1. A review of the disciplines covered in previous college work in Business Administration.
2. The case method.
3. Business simulation.

A majority of the students have completed courses in each of the areas of specialization: accounting, finance, management, and marketing by the time they enroll in

²This discussion of the specialist vs. the generalist does not imply that this is the only problem in management. However, a more complete consideration of the manager's job is beyond the scope of this paper which deals with only one technique that is available in management training.

³Quoted from the 1965-66 University of Montana Catalog -- 446 ADMINISTRATION AND BUSINESS POLICIES. "Top management oriented to develop an integrated view of the organic specializations. Practice in analytical tools involved in problem solving and in coordination."

"Business Policies." This course then serves as a catalyst to present an integrated view of the areas of concentration. A short review of each discipline is conducted early in the term to prepare the student for case study and business simulation.

In a case study, the student analyzes and discusses a written description of a specific business situation. It generally involves both an oral presentation of the "solution" and a written report. It is, however, a one-shot affair, and no matter how complex and realistic the problem may be, it does not offer objective feedback to the student.⁴ Nor does it provide any opportunity for making further decisions based on the results of the initial one. Thus, while the case method offers a worthwhile training experience, it does seem to lack one important element of management training--the opportunity to adjust current decisions in light of past experience.

In business simulation games, objective feedback is provided by a set of programmed relationships which transform the input decision into performance reports. This enables the student to analyze the actual response of a business environment (even though hypothetical) in terms of the reaction of his competition to his strategies. By

⁴"Feedback" refers to an evaluation of the decisions made, and can be either non-objective or objective depending on whether it is opinion or based on fact.

computerizing this process, it is possible to compress several years of simulated business operations into a short period of time.

During the past several years, considerable effort has been devoted to the development and use of problem-oriented educational tools. Management games⁵ are the newest and most advanced of these techniques. They have evolved from the need to simulate business problems for training purposes in a "laboratory" situation, free from the monetary losses and severe reprisals which often accompany miscalculations in the business world.

According to Greenlaw et al., "The first practical business game is generally considered to have been that developed by the American Management Association in 1957--the Top Management Decision Simulation."⁶ It was designed for use in the Association's Executive Decision-Making Program, held in New York in 1957. Although that game was constructed by and for industry, perhaps the first game was

⁵Business simulation has been defined as "an exercise in sequential decision making that utilizes a model of business operations to provide participants the opportunity to manage a simulated business firm in a competitive situation." The terms business simulation, management games, etc. are interchangeable. See Hunt and Brown, "Business Simulation--A Technique for Updating Management," Montana Business Quarterly, University of Montana Bureau of Business and Economic Research, Fall 1965, p. 12.

⁶Greenlaw, Herron and Rawdon, Business Simulation in Industrial and University Education (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962), p. 13.

used, if not designed, on a university campus. Albert N. Schreiber developed his Top Management Decision Game at the University of Washington in Seattle and it has been used by executives and students since 1957.⁷ In any event, it was not long before the universities sensed the advantages of business simulation and started to design games for the classroom.

The UCLA game by James R. Jackson and the IBM Decision-Making Laboratory followed soon after. Since then many games have been developed and used. When the Bureau of Business Research at the University of Texas conducted a survey of the American Collegiate Schools of Business in 1964, sixty-four of the ninety responding schools reported using business games in one or more courses.⁸ Apparently then, gaming is becoming an accepted tool of business education.

MONABUS⁹

In the spring quarter of 1965, Dr. Lawrence J. Hunt,

⁷There may be some question about who designed the first management game. Schreiber's game was first used in the summer of 1957 while the A.M.A. version was inaugurated in September of 1957. The latter simulation apparently received more publicity so perhaps that is why many consider it to be first.

⁸Dale and Klasson, Business Gaming--a Survey of American Collegiate Schools of Business, Bureau of Business Research, The University of Texas, Austin, 1964.

⁹MONABUS is a combination of the words Montana and business and is used as the name of the business game that serves as the subject of this thesis.

my advisor for the MS program in Business Administration, agreed that the construction of a business simulation game would be a suitable project for my thesis, since no such game had ever been designed especially for use in the University of Montana School of Business Administration. After considerable research into the background of simulation and in the usefulness of such a teaching tool, I worked out the game called MONABUS which is made up of two parts: 1) Information for Participants (information and background needed to play the game) and, 2) the Administrator's Manual that includes the game program itself.

Perhaps one way to describe MONABUS is to show how the game can be used in an Administration and Business Policies course.

The professor assigns each student in the class the role of a member of top management in a simulated industry consisting of three firms which compete with each other in a hypothetical market involving a single product. Each company begins the simulation exercise in an identical position (cash available, beginning inventory and plant capacity). Decisions for each period of play represent those for a simulated quarter of a year's operations. From a limited number of available decision alternatives, each company prices its product, sets its product's quality; determines its expenditures for marketing, styling and design, and additional plant investment and decides on the number of

units that will be produced.

After decision results have been calculated by the computer for the current quarter, each company receives a statement from the game administrator containing profit and loss and balance sheet figures, production capacity for next quarter, the firm's debt position and other pertinent information on which next period's decisions can be based. At the end of each "year" of decision-making, the teams prepare annual reports which are exchanged with the other companies. Throughout the game the firm's general progress is reviewed and discussed in critique sessions. Quite often at the end of play, the teams may be required to submit a written report describing their success or failure and reasons for it.

The Process Involved in Constructing MONABUS

The first step in the construction of MONABUS was to define the educational and design objectives. The primary objective settled on was to provide a supplementary educational tool for use in university Administration and Business Policy courses that would point up the desirability of adopting the generalist point of view. In other words, the game should add to the course by providing the student with a dynamic experience in management decision-making, and offer a vehicle for developing skills in the analysis of policy oriented business data, planning and forecasting in

the face of uncertainty. It should foster a competitive situation and, most of all, deal with the interrelationships between the various business school disciplines.

Simplicity of participation in terms of a simple set of rules for play and the ability to arrive at decisions fairly rapidly become a prime objective. We felt that while the decisions themselves could be complex (in the sense that real business decisions are difficult to arrive at), they should not require the students to perform lengthy calculations or fill out complicated forms.

Simplicity of administration is related to simplicity of participation, and means that rules should be simple enough so that the initial briefing can be short, but adequate. It is also necessary that the students gain a thorough understanding of the game in a reasonable length of time. In addition, the game should be constructed so that a minimum amount of time is required to process the decisions and return the results to the players.

Simplicity of computation relates to the previous consideration--the time element involved in processing the game. In the case of MONABUS, it was requisite that the game be adaptable to the computer equipment available at the University of Montana: an IBM 1620 which does not have the storage locations required for most games that are currently

being developed on other campuses.¹⁰

After the objectives were set, an outline of additional steps to be taken was drawn up and followed during construction. More detail will be presented, but these are the steps taken by the author in constructing the MONABUS game: learn FORTRAN (a computer language used in programming), review literature, study existing games, determine input data (number and type of design), determine output information (P & L, balance sheet, etc.), develop game model and relationships, construct simple flow chart, write program, de-bug program, test runs (adjusting and more de-bugging), and write up Administrator and Participant's Manuals.

FORTRAN is a symbolic language used to communicate with computers.¹¹ Because the computer operates only on instructions and data in numerical form (called machine language) an intermediate language is often used to facilitate the coding of programs. The English-type language (FORTRAN in this case) is converted into machine language by the computer (a process called compiling) which results in an object deck that can be used in the actual running of

¹⁰Although manually scored games are used, only a computerized version was considered, because of the time element. Since a computerized game can be processed much faster, and more accurately, than one that requires human manipulation.

¹¹The word FORTRAN stands for FORMula TRANslation.

the program. After the translation process is completed, the machine-language deck (object deck) is put into the computer to execute the program using any required data to produce the answers.

Since the ability to handle programming techniques determines to some extent the manner in which a game can be constructed it was necessary to study FORTRAN first. In addition, one must have a knowledge of FORTRAN to analyze the existing games which have been written in that language.

Although there are two books available that deal with game design,¹² many different types of games can be constructed, using a multitude of different techniques, so there is no handy reference that outlines steps and procedures applicable to all situations. The books, and articles in periodicals, were helpful in a general way, but did not prove as valuable in learning the processes involved in constructing the market model as did the study of three business games.¹³ The IBM and UCLA games deal with total firm operations while MARKSIM emphasizes the area of

¹²Kibbee, op. cit. and Greenlaw, op. cit.

¹³Three games were chosen for study: MARKSIM, IBM, and UCLA #2.

IBM, Management Decision-Making Laboratory, 1959.

Greenlaw and Kniffin, MARKSIM A Marketing Decision Simulation (Scranton, Pa.: International Textbook Co., 1964).

Jackson and Wright, "UCLA Executive Game #2," Management Sciences Research Project Discussion Papers No. 66, 69, and 70, UCLA, 1958.

marketing. All of them are written in FORTRAN so it was possible to follow the techniques of construction used and to draw upon them for ideas that could be incorporated in MONABUS.

In determining the input data (decisions made by the participants) the primary consideration was to present a cross section of the decisions that would be made by a top manager in a real business firm.¹⁴ At the same time it was necessary to balance the decision areas so that undue importance would not be attached to any one particular item. When the students make decisions, they hope for positive results, such as increased sales volume, asset position, profits, and so forth. Besides the usual operating statements which include profit and loss and balance sheet items, additional information (industry sales, potential firm sales, etc.) is presented on the output form to provide a more concrete basis for decision making. All of these considerations must be incorporated into the game model.

The development of the game model (including both a means for simulating a market and handling the accounting procedures) was primarily a problem of constructing simple mathematical formulas which would produce "reasonable" results when viewed in light of the decision inputs. A form

¹⁴For a more complete discussion of the input data, output information, and internal features of the game, consult the Information for Participants and Administrator's Manual.

of flow chart, and the model decided upon is included in the game program which can be found in the appendix to the Administrator's Manual.

The process of "programming" includes all aspects of putting a game on a computer. This includes the overall system, the design of the decision form, the report format, the method of getting the decisions into the computer, as well as the computations made within the computer. A well programmed game is one which should accept any decision no matter how wild, strange, or unexpected, and still result in some sort of rational output. A number of these checks and automatic correcting routines were written into the program and still more were added during the de-bugging process (a process of modifying the original program). Kibbee et al. says, "There is no such thing as a completely checked out program. It can run successfully for years until some unusual combination of factors uncovers a new 'bug.'"¹⁵ De-bugging involved changing the constants in the model twice as well as inserting the checks described above and changing the format of the output. Quite some time was involved in getting the program to run on the computer initially, because no matter how much time and effort go into developing and writing the program, not all of the problems can be foreseen. In a program the length of MONABUS, these

¹⁵Kibbee et al., op. cit., p. 143.

unforeseen difficulties are bound to arise even though the game is computed manually many times before the first attempt at compiling the program on the computer is made. Test runs and de-bugging go on at the same time until a point is reached where the game performs the way one thinks it should. Finally MONABUS (or any game) should be checked by others to see if anything has been overlooked. MONABUS has been played by faculty members and graduate students in the University of Montana School of Business Administration, and at this juncture it seems to present a challenge and lend an aura of realism to the participants.

Advantages and Disadvantages of Gaming

Critics of business simulation point out that games do not allow for "quality" in decision making. They say that even though a certain amount of money is spent, on advertising, for instance, no provision can be made for judging how the advertising program appeals to the customer. This is not altogether a fair criticism because what makes a product sell does not necessarily lie in advertising. The salesman would say that he sold it, but the advertising man might not agree. Possibly the designer of the product or the production supervisor might feel that the product sold itself through quality. Actually it may have sold because it had an attractive container. The point is that quite often it is difficult to pin down one factor and point to

that as the reason for good sales. Even though a particular advertisement may look good, it might not have had too much effect.

A more reasonable criticism refers to validation--do games really do the job they are designed for? Kibbee et al. feel that this concern is well founded, but at the same time, they say, "It is unfortunate that few objective studies on any teaching technique have been made."¹⁶ As a further drawback, games may teach the wrong things; for instance, a student may feel that because styling and design was more effective in a simulation exercise than advertising, it would hold true in real life as well. However, as with other management training techniques, many of the inherent problems can be overcome by a skillful teacher directing his efforts towards sound educational objectives.

The main advantages of business gaming as an educational tool seem to stem from the benefits of objective feedback which can help to instill in the student the desirability of adopting the generalist point of view. In addition, through simulation a participant becomes aware of the necessity of short- and long-range planning and the need to develop his basic problem solving ability.

Because the conclusions arrived at by computers can be no better than the data that is fed into them, so it is

¹⁶Ibid., p. 44.

with business simulation. The successful application of gaming methods must include an overall training program directed towards specific educational objectives; for, in the final analysis, it is the instructor's teaching ability that will determine the value of MONABUS.

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M O N A B U S -

A Business Simulation Exercise

by

W. L. Brown Jr.

Information for Participants

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THE MONABUS ENVIRONMENT

You and your associates have been hired to take over the management of a manufacturing concern that sells a consumer product. Two other firms, both of which are in a financial position identical to yours, are in competition with your company. During the past several years your company has been able to retain its share of the market and show a small profit, but the Board of Directors feel that the potential for the company has never been fully realized. In your position as manager of the firm, you are free to set your own objectives and policies, but you will be responsible to the Board for the results achieved and the course of action chosen.

The setting of objectives is necessary to provide a conceptual framework in which to operate. Anything your company wants to accomplish is an objective, a goal, in other words. Your company might want to capture the largest share of the market, to maximize firm assets, or to earn a certain percent of profit on owner's equity, for example. A policy can be defined as a method or means that you will use to reach your objectives. If, for instance, your objective is to secure the greatest percentage of industry sales, your policy could be to offer a high quality

product for a fairly low price. This could result in attaining your goal, but chances are you will also need plans or strategies to spell out how the policy will be put into effect. Because planning deals with the future, and therefore with uncertainty, it will be necessary for you to forecast what the market conditions will be one year and possibly ten years hence. Objectives, policies, and planning all involve decision making. The executive decisions you make will determine the profitability of your operation over a simulated period of several years. At the end of this period you will be asked to submit a report justifying your actions in terms of your short and long-range objectives and the possible changes in policy that were necessary to reach your goals. The industry that you are competing in and the product you manufacture are unnamed because the market conditions under which you operate do not completely resemble any existing market.

THE MARKET

One of your first tasks as manager will be to become familiar with the characteristics of the market and determine how your resources can best be used to satisfy the demand. Experience gained by working in a particular industry will be helpful only insofar as there are common management functions that must be performed in all businesses.

But for example, specific lessons learned in the automobile industry would not apply here, because the market relationships of the MONABUS environment are different than those found in the automobile industry. As a MONABUS manager you will find that the consumer is very value conscious; that is, he will purchase the product that has the smallest price-quality ratio, all other things remaining equal. The market and the demand for a particular product will also be influenced by the marketing and the styling and design expenditures as well as general economic conditions. Your firm's effectiveness will be primarily determined by the relationship of your policies to those of your competitors and the reasoning with which you arrive at your decisions.

COMPUTER OUTPUT

The computer output represents the results of the current decision period and forms the basis for the decisions that you will make next quarter. For a quick check on the performance of your firm in relation to accepted yardsticks used by business in general, ratios such as current assets to current debt, net profits on net sales, and net profits on tangible net worth can be computed. You should not be overly concerned if a competitor earns more profit or makes more sales than you do in a particular

period. It is the long-run performance that counts. Perhaps he was sacrificing investing in plant and equipment or maintaining an inventory margin to make a good showing, but his short-run tactics may prove disastrous later on when his plant capacity is found to be too low to keep up with an expanding market, or potential sales are lost because of an inadequate inventory. In addition, your competitors' objectives may be entirely different from yours, and a course of action that would accomplish one set of goals may not be compatible with another. However, because you are operating in a competitive environment and the results of your decisions will depend to some degree on the decisions that the other firms are making, it is essential to become as knowledgeable as possible about the industry.

General Recap of Current Conditions

Industry Sales--The total sales in units for the current period.

Potential Firm Sales--The total sales in units that could have been made, provided there was sufficient inventory and current production to meet the demand.

Actual Firm Sales--The sales in units actually made.

Ending Inventory--The inventory in units available for sale in the next period.

Inventory Unit Value--The value of one unit of current inventory computed by averaging last period's inventory

unit value and the current manufacturing cost per unit.

Capacity Next Quarter--The maximum number of units that can be produced next quarter.

Price through Debt Payment--A review of the decisions made during the current quarter.

Profit and Loss

Sales--The dollar volume of sales made in the current period (sales revenue).

Expenses

Manufacturing Costs--The number of units produced multiplied by quality per unit after adjustment by Styling and Design effectiveness.

Administration & Selling--The amount of fixed or semi-fixed expense incurred each quarter whether anything is produced or not. The basic fixed charge is \$400,000 plus a certain amount depending on plant size and operations. Selling expense is included under this heading and is computed at 4% of sales revenue.

Marketing--The marketing budget including advertising and related expenses.

Styling and Design--The styling and design budget that affects the sales appeal of your product through design improvements and that also lowers the cost of manufacture through improved production techniques.

Depreciation--The amount (at the rate of $2\frac{1}{2}\%$) that

plant and equipment depreciates each quarter.

Reduction in Inventory Value--The difference between the units in beginning and ending inventory multiplied by the inventory unit value. Reduction in inventory value is added (in the algebraic sense) to total manufacturing costs in order to arrive at the cost of goods sold. A negative value means that the inventory has increased and that manufacturing costs have been deferred to a future period. If reduction in inventory is positive, it means that goods valued at that amount have been sold from inventory and must be added to the cost of manufacturing to arrive at the total cost of the products sold during the current period.

Inventory Carrying Charge--The amount (6%) that is charged on current inventory representing insurance charges, warehousing costs and so forth.

Interest on Debt--The cost of loans outstanding at the beginning of the current quarter. The charge (if positive) at 6% represents interest and costs associated with financing. If negative, it results in a reduction in expenses. (See Debt Payment under Decisions on page 10.)

Profit Before Taxes and Net Profit--The income tax rate is 50%, and a net loss, in effect, results in a tax rebate because only one half of the loss is charged against owners equity.

Balance Sheet

Cash--The amount of cash on hand.

Inventory--The current value of inventory.

Net Plant--The value of plant and equipment based on a standard evaluation of \$20.00 per unit of plant capacity.

Debt--The debt account serves a dual purpose. It is the amount of debt outstanding if positive and the amount of your investment if negative. (See Debt Payment under Decisions on page 10.)

DECISION AREAS

The decisions that you arrive at during a current quarter (a quarter represents three months in the life of your company) should reflect your long-term objectives and set operating policies. The decisions made in one quarter will have a carry-over effect and will influence the profit or loss to be realized in future months or years of operation.

Price--The price charged by your outlets during the current quarter, when related by the consumer to quality, will to a large extent determine the attractiveness of your product. Since the consumer is looking for the best quality for the least amount of money, he will immediately react to a wider spread between price and quality by buying less,

but he will be slower to respond to a more narrow spread (a better buy). You will find that a price increased past a certain point will not be accepted by the consumer with the result that you must lower the price to conform to the market. This could result in your receiving less for your product than you had counted on.

Quality--This is the amount of quality per unit that is built into the product at the time it is manufactured. It is the value that the consumer sees in your product and, while your actual production costs may be reduced somewhat by investing in styling & design, quality is one of the considerations in the customer's decision to buy. Your quality figure cannot fall below \$3.00 per unit; and, past a certain point, a further reduction in the price/ quality ratio has no beneficial effect.

Marketing--Marketing creates demand and the amount of money expended for marketing will affect sales potential not only in the current period but in the future as well. Marketing expenditures have a carry-over effect and even though the greatest impact is evidenced immediately, the marketing effort expended in the past will influence current sales to a marked degree. However, a saturation point may be reached beyond which further expenditures for marketing will have little effect.

Styling & Design--Much the same that has been said

about marketing also applies to styling & design: except that past expenditures carry more weight in determining current sales than do present expenditures. The amount of money invested in S & D should remain fairly constant or increase through the years if its full benefit is to be realized. Therefore, a decision not to invest in S & D might have a detrimental effect that would take some time to alleviate. In addition to its effect on sales, S & D also will tend to reduce manufacturing costs which in turn could be reflected in a smaller inventory carrying charge and increased profits.

Production Volume--This is the number of units that will be produced in the current quarter and can be any amount, in multiples of 1,000, up to plant capacity. Because of fixed costs the total cost per unit tends to become lower as the capacity figure is approached. Over-production leads to higher inventory carrying charges and under-production may result in lost sales due to a stockout.

Investment in Plant--The plant and equipment physically deteriorates at the rate of 2.5 percent of plant value per quarter. This will immediately result in reduced capacity if an amount equal to the depreciation cost (amounting to \$.50 for each unit of present capacity) is not invested each period. Plant and equipment cannot be sold, but a reduction in value and capacity can be effected by allowing depreciation to take its course. Additional plant and equipment can be purchased by investing \$20.00 for each

additional unit of capacity desired, over and above the investment required to offset depreciation. New facilities paid for in one period are not available for use until the next quarter.

Debt Payment--Whenever cash is depleted to the point where total expenditures in any quarter are greater than the sum of sales revenue and the beginning cash balance, your firm will be required to borrow enough money to avoid having a negative cash balance. In this case, borrowing will be automatic and the computer will print out the amount of the loan under DEBT on the balance sheet. It is possible to negotiate a loan yourself, however, if you decide that you want to budget more funds than you have available. The game administrator will determine your firm's line of credit and the amount of the loan (the difference between total budgeted expenditures and cash on hand) will go into your debt account. Interest at the rate of 6% per quarter will be charged on all debt outstanding and will be computed at the beginning of the following quarter for inclusion in expenses during that period. Outstanding debt can be paid off partially or totally by entering the repayment amount on the decision form. However, money borrowed in one quarter cannot be repaid until the following period (in other words, you cannot borrow a sum of money and pay off that same loan in a current period). The debt account

also serves another purpose: it allows you to invest unneeded cash so that interest can be earned on otherwise idle money. To accomplish this you may enter the amount you want to invest under debt payment; this will show up as a negative Debt Outstanding (provided you have no debt). The interest earned will be represented by a negative entry in Interest on Debt. This will result in a reduction in the total expenses. The only way to liquidate your investment, however, is to incur a debt. No tax is paid on interest income and the investment can be thought of as something like a municipal bond.

DECISION FORM

It is important to fill out the decision form correctly, because errors that are not detected when the decisions are transferred to the punched cards could result in a financial reversal that might take several periods to recover from. Fill in the MONABUS Decision Form furnished by the administrator as follows:

1. The industry, firm and current quarter numbers are recorded on the top line in the spaces provided.

2. The decisions, Price and Quality, may be carried out to two decimal places; in other words, dollars and cents. When you enter the Price and Quality decisions, record them in the righthand position without decimal

points (example: 625).

3. The remainder of the decisions (Marketing through Debt Payment) are all to be made in even units of one thousand. They must also be entered in the right-hand position without decimal points (example: 100000).

APPENDIX

EXAMPLE OF COMPUTER PRINT-OUT

MONABUS

INDUSTRY NUMBER 0 FIRM NUMBER 0 PERIOD 0

INDUSTRY SALES		1376915
POTENTIAL FIRM SALES		458971
ACTUAL FIRM SALES		458971
ENDING INVENTORY		121028
INVENTORY UNIT VALUE	\$	2.87
CAPACITY NEXT QUARTER		450000
PRICE	\$	6.25
QUALITY	\$	3.00
MARKETING	\$	230000.
STYLING AND DESIGN	\$	165000.
PRODUCTION VOLUME		430000
INVESTMENT IN PLANT	\$	225000.
DEBT PAYMENT	\$	0.

PROFIT AND LOSS

SALES			\$	2868574.
EXPENSES				
MANUFACTURING COSTS	\$	1182661.		
ADM. AND SELLING		604742.		
MARKETING		230000.		
STYLING AND DESIGN		165000.		
DEPRECIATION		225000.		
REDUCTION IN INV. VALUE		83299.		
INV. CARRYING CHARGE		20878.		
INTEREST ON DEBT		0.		
TOTAL			\$	2511582.
PROFIT BEFORE TAXES			\$	356991.
NET PROFIT			\$	178495.

BALANCE SHEET

CASH	\$	2761795.
INVENTORY	\$	347978.
NET PLANT	\$	9000000.
DEBT	\$	0.
OWNERS EQUITY	\$	12109773.

EXAMPLE OF DECISION FORM

MONABUS DECISION FORM^a

IBM 1620

<u>1</u> Industry	<u>2</u> Firm	<u>3</u> <u>4</u> Quarter	
<u>8</u> <u>9</u> <u>10</u> <u>11</u>			Price
<u>15</u> <u>16</u> <u>17</u> <u>18</u>			Quality
<u>22</u> <u>23</u> <u>24</u> <u>25</u> <u>26</u> <u>27</u> <u>28</u> <u>29</u> <u>30</u>			Marketing
<u>34</u> <u>35</u> <u>36</u> <u>37</u> <u>38</u> <u>39</u> <u>40</u> <u>41</u> <u>42</u>			Styling and Design
<u>46</u> <u>47</u> <u>48</u> <u>49</u> <u>50</u> <u>51</u> <u>52</u> <u>53</u> <u>54</u>			Production Volume
<u>58</u> <u>59</u> <u>60</u> <u>61</u> <u>62</u> <u>63</u> <u>64</u> <u>65</u> <u>66</u>			Investment in Plant
<u>70</u> <u>71</u> <u>72</u> <u>73</u> <u>74</u> <u>75</u> <u>76</u> <u>77</u> <u>78</u>			Debt Payment

^aEnter decisions "right justified" without decimal points.

SUGGESTED FORM FOR CASH FLOW STATEMENT

Receipts		
Sales Revenue		XXXXXX
Disbursements		
Cash Expense*	XXXXXX	
Income Taxes Paid	XXXXXX	
Investment in Plant	XXXXXX	
Debt Payment	XXXXXX	XXXXXX
Addition to Cash Assets		XXXXXX

*To arrive at Cash Expenses subtract reduction in inventory value and depreciation from total expenses.

SUGGESTED FORM FOR ANNUAL REPORT*

Total Yearly Sales	XXXXXX
Total Expenses	-XXXXXX
Net Profit	XXXXXX
Cash	XXXXXX
Inventory	XXXXXX
Net Plant	XXXXXX
Debt	-XXXXXX
Owners Equity	XXXXXX

*Or the annual report could take the form of the quarterly print-out with all profit and loss and Balance Sheet items totaled, including a total of the units sold during the year.

M O N A B U S -

A Business Simulation Exercise

by

W. L. Brown Jr.

Administrator's Manual

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INTRODUCTION

MONABUS has been designed to provide participants with a decision making experience in a dynamically changing business situation that calls for the integration of the various facets of business operation. Rather than being a vehicle for teaching specific management concepts, MONABUS is directed towards developing problem solving ability and an appreciation for balanced decision-making and short and long-range planning. Theory learned in course work can be related to practice by attempting to balance the controllable factors so that the student learns to make the most of available resources and potentialities.

SUMMARY OF MONABUS FEATURES

MONABUS simulates an industry made up of three firms selling the same product in a single market.

The total Market Potential is determined by the general level of economic activity (the economic index) and the constellation of the firms' collective Price/Quality, Marketing, and Styling & Design policies.

Each firm's Potential Share of the Market is determined by the relationship of its decisions to those of its competitors.

Actual Firm Sales will be the lesser of either available stock (production plus inventory) or potential sales per firm. When potential sales exceed available stock, the actual sales made will equal the available stock on hand. If there should be more goods available for sale than orders received, the potential sales figure will equal actual sales.

The Economic Index must be determined by the instructor and entered with the other input data each time the game is run. The economic index is really a means of controlling the effectiveness of the teams and can be varied from period to period by using an up or down trend. To give the players an idea of the state of the general economic conditions represented by the economic index, the administrator can tell them that employment is rising or that the Dow-Jones average is down. An index of 1.75 would allow all firms to make a small profit if each made the decisions for period "0" shown on the example of computer out-put (based on suggested history starting values)¹ while an index of 3.0 should result in all firms running away with the game. An index of 2.25 can be used as a starting point. Of course all firms could lose money with a high index if the players made unwise decisions.

The Difference between Price and Quality is the most

¹See appendix for example of computer out-put.

crucial element in determining both industry and firm sales. The effect of extreme decision variation from one period to the next has been controlled to a degree by designing the model so that the larger of: a) the current difference, or b) the average of the current difference and last period's P/Q index is used in computation. The acceptable lower limit on quality is \$3.00 per unit and the maximum price is \$9.99. The computer will automatically reset any decisions outside of the allowable range for price and quality and will also not allow a P/Q index to be less than \$.05; therefore, setting price below quality gives a firm no advantage. (It is possible for a team to do so, and, in fact, the product could be given away.) It is up to the participants to discover at what point a lower price fails to generate additional sales. Of course, if the spread is too narrow, not enough sales income will be generated to cover even the expenses incurred and no profit will be made.

Marketing generates Sales but it has less effect than the Price/Quality ratio in generating product appeal. Sevenths of the current expenditure and three-tenths of the last period's index is used to arrive at the current marketing index. Because of this, marketing decisions have a carry-over effect from period to period.

Styling and Design is reversed in order of importance for current and past expenditures. Three-tenths of the

current budget and seven-tenths of last period's index is used to determine the current S & D index and a large increase in S & D will not affect the market until several periods later. Styling and Design investments also reduce the manufacturing cost per unit.

Marketing and S & D budgets will have the same effect in determining the firm's sales potential if an identical sum of money is invested over an extended period of time; but marketing is more important (for the same expenditure) in the total market calculations. A large expenditure in Styling & Design and none in marketing (or vice versa) will not substitute for a balanced budget between S & D and marketing.

The Upper Limits on the expenditures for Marketing and S & D (considering both current and past investments) is \$399,000 and, while more can be budgeted, no advantage results. Again it is up to the players to determine the point at which increased budgets are not worthwhile.

Debt serves a dual purpose (as explained in the Instructions for Participants, page 10). It can be used as a loan feature when cash falls below zero or when a firm wants to budget more money than is available in its cash account. The administrator should determine the amount that can be borrowed by a team in a given period to add realism and to prevent indiscriminate borrowing. An

administrative check must be used to prevent firms from paying off a loan in the same period that it is incurred. While the players are told in the Participants Manual that they must not do this, there is no check in the program to prevent it from happening. If the firm was successful in earning enough money to offset the debt, no interest would be paid, with the result that they would have free use of borrowed capital. When the Debt decision is used as an investment feature, otherwise idle money can be put to work (as explained in the Instructions for Participants, page 10).

SUGGESTIONS FOR USING MONABUS

The Instructions for Participants Manual may be handed out a few days before the briefing, so that the players will have an opportunity to become familiar with the game. Actual briefing can follow assigning members to a firm, and, while the number can vary, if more than three or four are on one team, some of the team members may have little chance to participate. Teams should be fairly well balanced in terms of representation from the various disciplines, unless an experiment is conducted to compare the results of, say, accountants versus marketing men. The administrator can either appoint players to executive positions or allow the players to choose their own president, vice-president, and so forth. Sometimes the executive committee approach is

adopted by the team--an approach which seems to work out quite well. Most administrators find it a good idea to go over the participant's manual with the group to clear up any misconceptions that might hinder play later on. This discussion should cover the way the players are to record their decision; while it is a small matter, much time and patience can be lost trying to straighten out an incorrectly entered decision at process time.

The administrator may find it helpful to require that each team submit a written statement of their objectives and policies to overcome one of the problems in business gaming--the "winner" concept (where net profits each quarter or some other single measurement of success is adopted by all teams as the criterion of success). This written statement can later be used in evaluating the players' final reports, and in counseling during the periodic critiques conducted by the administrator. It is often helpful in the preparation of the students' final reports (and period-to-period planning) if charts and graphs of quarterly results are maintained by the teams.

In order to alleviate the problem of teams playing for the "end effect" (that is, putting aside their original objectives in the last quarters of play in order to make a good final showing in the profit column), the administrator may choose not to disclose the number of periods that will

be played, or he may remind the teams that their performance will be judged by how well they attain their stated objectives. To overcome a team's tendency to change its decision policy abruptly when another firm seems to make a better showing in a particular quarter, the administrator may introduce a reporting delay of one decision period into the gaming cycle. For example, the firms would base decisions for period nine on the results generated by the decisions of period seven. The teams would thus base current decisions on information one period old, and, in that way, would be forced to follow established policies to a greater degree.

ADDITIONAL SUGGESTIONS²

Annual reports can be made up by each firm every fourth quarter and exchanged with the other teams.

For use in planning, cash flow statements can be drawn up each quarter by the firms.

To add to the aura of competition, each team may announce its sales revenue and price when the print-outs are returned, but this should be done in such a way that the "winner" concept is not introduced. Everyone should have some knowledge of how his competition is doing--as

²See appendix for suggested forms.

businessmen usually do--but collusion should not be allowed.

The results (print-out) for period "0" may be used as a starting point, or new history cards can be punched if the administrator chooses to start the firms in different positions or at a different asset level. The cash assets and the various indexes can be changed during play by substituting new history card values.

INFORMATION FOR COMPUTER CENTER PERSONNEL

The compiled MONABUS source deck requires approximately 32,000 storage locations on an IBM 1620 - 40K card oriented computer. To run a simulated three-month decision period, the following procedure should be followed:

1. Clear memory
2. Load object deck
3. Load sub-routines
4. Turn switch #1 on (if more than one industry is to be processed)
5. Push "Start" on console
6. Enter data for one industry
 - a. History cards firm 1 - 2 - 3
 - b. Economic index
 - c. Decision cards 1 - 2 - 3
7. For additional industries:
 - a. Push "Start" on console

b. Enter data

8. History cards for next period are the last three in the output deck--these should be removed and saved for use next period. The industry number will be found in column 75, firm number in column 77, and quarter number in columns 79 and 80. The quarter number is automatically updated by the computer.

9. The output can then be listed on an IBM 407 Accounting machine. To print one firm's results on a single page it is necessary to add two wires to a standard board.

a. One wire going from second reading, column 80, to the first row (entry hub) of the digit selector and

b. one wire going from exit hub 11 to a carriage skip.

The approximate time for running MONABUS is as follows:

Load object deck and sub-routines	5 minutes
Load data and process one industry	3
Print results on 407	1
	<hr/>
	9 minutes

In other words, one industry can be completely processed in about 10 minutes, and there is no limit to the number of industries that can be run with one loading of the program. Blank cards can be sorted on columns 3 and 40 on an IBM 026 Sorter.

APPENDIX

EXAMPLE OF COMPUTER PRINT-OUT

MONABUS

INDUSTRY NUMBER 0 FIRM NUMBER 0 PERIOD 0

INDUSTRY SALES		1376915
POTENTIAL FIRM SALES		458971
ACTUAL FIRM SALES		458971
ENDING INVENTORY		121028
INVENTORY UNIT VALUE	\$	2.87
CAPACITY NEXT QUARTER		450000
PRICE	\$	6.25
QUALITY	\$	3.00
MARKETING	\$	230000.
STYLING AND DESIGN	\$	165000.
PRODUCTION VOLUME		430000
INVESTMENT IN PLANT	\$	225000.
DEBT PAYMENT	\$	0.

PROFIT AND LOSS

SALES			\$ 2868574.
EXPENSES			
MANUFACTURING COSTS	\$	1182661.	
ADM. AND SELLING		604742.	
MARKETING		230000.	
STYLING AND DESIGN		165000.	
DEPRECIATION		225000.	
REDUCTION IN INV. VALUE		83299.	
INV. CARRYING CHARGE		20878.	
INTEREST ON DEBT		0.	
TOTAL			\$ 2511582.
PROFIT BEFORE TAXES			\$ 356991.
NET PROFIT			\$ 178495.

BALANCE SHEET

CASH	\$	2761795.
INVENTORY	\$	347978.
NET PLANT	\$	9000000.
DEBT	\$	0.
OWNERS EQUITY	\$	12109773.

EXAMPLE OF DECISION FORM

MONABUS DECISION FORM^a

IBM 1620

<u>1</u> Industry	<u>2</u> Firm	<u>3</u> <u>4</u> Quarter	
<u>8</u> <u>6</u> <u>2</u> <u>5</u>			Price
<u>9</u> <u>10</u> <u>11</u>			
<u>15</u> <u>3</u> <u>0</u> <u>0</u>			Quality
<u>16</u> <u>17</u> <u>18</u>			
<u>22</u> <u>23</u> <u>24</u> <u>2</u> <u>3</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u>			Marketing
<u>25</u> <u>26</u> <u>27</u> <u>28</u> <u>29</u> <u>30</u>			
<u>34</u> <u>35</u> <u>36</u> <u>1</u> <u>6</u> <u>5</u> <u>0</u> <u>0</u> <u>0</u>			Styling and Design
<u>37</u> <u>38</u> <u>39</u> <u>40</u> <u>41</u> <u>42</u>			
<u>46</u> <u>47</u> <u>48</u> <u>4</u> <u>3</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u>			Production Volume
<u>49</u> <u>50</u> <u>51</u> <u>52</u> <u>53</u> <u>54</u>			
<u>58</u> <u>59</u> <u>60</u> <u>2</u> <u>2</u> <u>5</u> <u>0</u> <u>0</u> <u>0</u>			Investment in Plant
<u>61</u> <u>62</u> <u>63</u> <u>64</u> <u>65</u> <u>66</u>			
<u>70</u> <u>71</u> <u>72</u> <u>73</u> <u>74</u> <u>75</u> <u>76</u> <u>77</u> <u>0</u>			Debt Payment
<u>78</u>			

^aEnter decisions "right justified" without decimal points.

SUGGESTED FORM FOR CASH FLOW STATEMENT

Receipts		
Sales Revenue		XXXXXX
Disbursements		
Cash Expense*	XXXXXX	
Income Taxes Paid	XXXXXX	
Investment in Plant	XXXXXX	
Debt Payment	XXXXXX	XXXXXX
Addition to Cash Assets		XXXXXX

*To arrive at Cash Expenses subtract reduction in inventory value and depreciation from total expenses.

SUGGESTED FORM FOR ANNUAL REPORT*

Total Yearly Sales	XXXXXX
Total Expenses	-XXXXXX
Net Profit	XXXXXX
Cash	XXXXXX
Inventory	XXXXXX
Net Plant	XXXXXX
Debt	-XXXXXX
Owners Equity	XXXXXX

*Or the annual report could take the form of the quarterly print-out with all profit and loss and Balance Sheet items totaled, including a total of the units sold during the year.

MONABUS HISTORY CARD FORM
(with suggested starting values)

$\frac{\text{—}}{1} \frac{\text{—}}{2} \frac{\text{—}}{3} \frac{\text{3}}{4} \frac{\text{2}}{5} \frac{\text{5}}{6}$	HPRICE/QUALITY
$\frac{\text{—}}{7} \frac{\text{—}}{8} \frac{\text{—}}{9} \frac{\text{—}}{10} \frac{\text{2}}{11} \frac{\text{3}}{12} \frac{\text{0}}{13} \frac{\text{0}}{14} \frac{\text{0}}{15} \frac{\text{0}}{16}$	HMARKETING
$\frac{\text{—}}{17} \frac{\text{—}}{18} \frac{\text{—}}{19} \frac{\text{—}}{20} \frac{\text{1}}{21} \frac{\text{6}}{22} \frac{\text{5}}{23} \frac{\text{0}}{24} \frac{\text{0}}{25} \frac{\text{0}}{26}$	HSTYLING & DESIGN
$\frac{\text{—}}{27} \frac{\text{—}}{28} \frac{\text{—}}{29} \frac{\text{—}}{30} \frac{\text{1}}{31} \frac{\text{5}}{32} \frac{\text{0}}{33} \frac{\text{0}}{34} \frac{\text{0}}{35} \frac{\text{0}}{36}$	HINVENTORY
$\frac{\text{—}}{37} \frac{\text{—}}{38} \frac{\text{—}}{39} \frac{\text{—}}{40} \frac{\text{4}}{41} \frac{\text{5}}{42} \frac{\text{0}}{43} \frac{\text{0}}{44} \frac{\text{0}}{45} \frac{\text{0}}{46}$	HCAPACITY
$\frac{\text{—}}{47} \frac{\text{—}}{48} \frac{\text{—}}{49} \frac{\text{2}}{50} \frac{\text{5}}{51} \frac{\text{0}}{52} \frac{\text{0}}{53} \frac{\text{0}}{54} \frac{\text{0}}{55} \frac{\text{0}}{56}$	HCASH
$\frac{\text{—}}{57} \frac{\text{—}}{58} \frac{\text{—}}{59} \frac{\text{—}}{60} \frac{\text{—}}{61} \frac{\text{—}}{62} \frac{\text{—}}{63} \frac{\text{—}}{64} \frac{\text{—}}{65} \frac{\text{0}}{66}$	HDEBT
$\frac{\text{—}}{67} \frac{\text{—}}{68} \frac{\text{—}}{69} \frac{\text{3}}{70} \frac{\text{0}}{71} \frac{\text{0}}{72}$	HINVENTORY UNIT VALUE

$\frac{\text{—}}{75}$ INDUSTRY NO. $\frac{\text{—}}{77}$ FIRM NO. $\frac{\text{—}}{79} \frac{\text{—}}{80}$ QUARTER NO.

Enter history data in the same manner that decisions are recorded.

MONABUS ECONOMIC INDEX CARD FORM^a

$\frac{2}{17} \frac{\cdot}{18} \frac{2}{19} \frac{5}{20}^b$

Economic Index

^aPunch on separate IBM card each period of play and enter with input data.

^bSee page 2 for discussion of the Economic Index.

MONABUS Program and Definition of
Program Variables

DEFINITION OF PROGRAM VARIABLES

HAPQ(I)	Price-Quality Index, History
HAMK(I)	Marketing Index, History
HASD(I)	Styling & Design Index, History
HINV(I)	Inventory (in units), History
HCAP(I)	Plant Capacity (in units), History
HCASH(I)	Cash, History
HDEBT(I)	Debt, History
HIUV(I)	Inventory Unit Value, History
IND	Industry Number
IFIRM	Firm Number
IQTR	Quarter Number
XPR(I)	Price, Decision
XQT(I)	Quality, Decision
XMK(I)	Marketing, Decision
XSD(I)	Styling & Design, Decision
XPV(I)	Production Volume, Decision
XIP(I)	Investment in Plant, Decision
XDP(I)	Debt Payment, Decision
APQ(I)	Price-Quality Index, Firm
DUMA	Dummy Variable
DUMB	Dummy Variable
AMK(I)	Marketing Index, Firm
ASD(I)	Styling & Design Index, Firm
ZMS(I)	Market Share Weighting Factor, Firm

PSF(I)	Potential Sales, Firm
AST(I)	Available Stock, Firm
AS(I)	Actual Sales, Firm
AINV(I)	Ending Inventory, Firm
CAP(I)	Capacity, Firm
SREV(I)	Sales Revenue, Firm
FCPU(I)	Manufacturing Cost per Unit, Firm
TMNC(I)	Total Manufacturing Cost, Firm
AIUV(I)	Inventory Unit Value, Firm
CIV(I)	Reduction in Inventory Value, Firm
EIV(I)	Ending Inventory Value, Firm
BICC(I)	Inventory Carrying Charge, Firm
DEXP(I)	Depreciation Expense, Firm
ADEXP(I)	Administration & Selling Expense, Firm
DBEXP(I)	Debt Expense, Firm
TEXP(I)	Total Expense, Firm
PBIT(I)	Profit before Income Tax, Firm
TNP(I)	Net Profit, Firm
CEXP(I)	Cash Expense, Firm
TDIS(I)	Total Disbursements, Firm
ACASH(I)	Addition to Cash Assets, Firm
CASH(I)	Cash, Firm
PNET(I)	Plant Net Book Value, Firm
TXDA	Dummy Variable
TXDB	Dummy Variable
DEBT(I)	Debt, Firm

OEQT(I)	Owners Equity, Firm
I	Firm
EX	Economic Index
SUMA	Dummy Variable
BPQ	Industry Price-Quality Index
SUMB	Dummy Variable
BMK	Industry Marketing Index
SUMC	Dummy Variable
BSD	Industry Styling & Design Index
ASP	Average Sales Potential per Firm
SUMD	Dummy Variable
ZTM	Total Market Determination Factor
TIS	Total Industry Sales (Units)

*1010

C M O N A B U S , A BUSINESS SIMULATION EXERCISE BY W. L. BROWN JR.
C FOR THE IBM 1620, 40K OR LARGER, CARD ORIENTED SYSTEM DATE 3-66
C

DIMENSION HAPQ(3),HAMK(3),HASD(3),HINV(3),HCAP(3),HCASH(3),HDEBT(3
1),HIUV(3)

DIMENSION IND(3),IFIRM(3),IQTR(3),XPR(3),XQT(3),XMK(3),XSD(3),XPV(1
3),XIP(3),XDP(3)

DIMENSION APQ(3),DUMA(3),DUMB(3),AMK(3),ASD(3),ZMS(3),PSF(3),AST(3
1),AS(3),AINV(3),CAP(3),SREV(3),FCPU(3),TMNC(3),AIUV(3),CIV(3),EIV(2
3),BICC(3),DEXP(3),ADEXP(3),DREXP(3),TEXP(3),PBIT(3),TNP(3),CEXP(3
3),TDIS(3),ACASH(3),CASH(3),PNET(3),TXDA(3),TXDR(3),DEBT(3),OEQT(3)

1000 PAUSE

DO 1 I=1,3

READ 212,HAPQ(I),HAMK(I),HASD(I),HINV(I),HCAP(I),HCASH(I),HDEBT(I)
1,HIUV(I)

212 FORMAT (F6.2,6F10.0,F6.2)

1 CONTINUE

READ 100,EX

DO 2 I=1,3

READ 101,IND(I),IFIRM(I),IQTR(I),XPR(I),XQT(I),XMK(I),XSD(I),XPV(I
1),XIP(I),XDP(I)

2 CONTINUE

100 FORMAT (16X,F4.2)

101 FORMAT (I1,I1,I2,3X,F4.2,3X,F4.2,3X,F9.0,3X,F9.0,3X,F9.0,3X,F9.0,3
1X,F9.0)

C PRICE-QUALITY INDEX = APQ(I)

DO 47 I=1,3

IF(XPR(I)-9.99)49,49,50

50 XPR(I)=9.99

49 CONTINUE

IF(XQT(I)-3.)41,42,42

```

41 XQT(I)=3.
42 DUMA(I)=XPR(I)-XQT(I)
    IF(DUMA(I))43,43,44
43 DUMA(I)=.05
44 DUMB(I)=(DUMA(I)+HAPQ(I))/2.
    IF(DUMA(I)-DUMB(I))45,46,46
45 APQ(I)=DUMB(I)
    GO TO 47
46 APQ(I)=DUMA(I)
47 CONTINUE
C    MARKETING INDEX = AMK(I)
    DO 51 I=1,3
        AMK(I)=(.7*XMK(I))+(.3*HAMK(I))
        IF(399000.-AMK(I))90,91,91
90 AMK(I)=399000.
C    STYLING AND DESIGN INDEX = ASD(I)
91 ASD(I)=(.3*XSD(I))+(.7*HASD(I))
    IF(399000.-ASD(I))92,51,51
92 ASD(I)=399000.
51 CONTINUE
C    INDUSTRY PRICE-QUALITY INDEX = BPQ
    SUMA=0.0
    DO 52 I=1,3
        SUMA=SUMA+APQ(I)
52 CONTINUE
    BPQ=SUMA/3.
C    INDUSTRY MARKETING INDEX = BMK
    SUMB=0.0
    DO 53 I=1,3
        SUMB=SUMB+AMK(I)
53 CONTINUE
    BMK=SUMB/3.

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C      INDUSTRY STYLING AND DESIGN INDEX = BSD
      SUMC=0.0
      DO 54 I=1,3
      SUMC=SUMC+ASD(I)
54 CONTINUE
      BSD=SUMC/3.

C      INDUSTRY AVERAGE POTENTIAL SALES PER FIRM = ASP
      ASP=(22000.*FX*(9.-BPQ)*(7.-BPQ)*(BMK+10000.)*(BSD+50000.))/((BMK+
1100000.)*(BSD+200000.))

C      FIRM MARKET SHARE WEIGHTING FACTOR = ZMS(I)
      DO 55 I=1,3
      ZMS(I)=((30.*EX*(7.-APQ(I))**2)*(AMK(I)+100000.)*(ASD(I)+100000.))
1/(500000.**2)
55 CONTINUE

C      TOTAL MARKET DETERMINATION FACTOR = ZTM
      SUMD=0.0
      DO 56 I=1,3
      SUMD=SUMD+ZMS(I)
56 CONTINUE
      ZTM=(ASP*3.)/SUMD
      DO 59 I=1,3

C      POTENTIAL SALES PER FIRM = PSF(I)
      PSF(I)=ZMS(I)*ZTM

C      AVAILABLE STOCK PER FIRM = AST(I)
      IF(HCAP(I)-XPV(I))94,95,95
94 XPV(I)=HCAP(I)
95 AST(I)=HINV(I)+XPV(I)

C      ACTUAL SALES PER FIRM = AS(I)
      IF(AST(I)-PSF(I))57,58,58
57 AS(I)=AST(I)
      GO TO 59
58 AS(I)=PSF(I)

```

59 CONTINUE

C TOTAL INDUSTRY SALES = TIS

TIS=0.0

DO 60 I=1,3

TIS=TIS+AS(I)

60 CONTINUE

C ACCOUNTING FOR EACH FIRM

DO 64 I=1,3

C ENDING INVENTORY = AINV(I)

AINV(I)=AST(I)-AS(I)

C CAPACITY NEXT QUARTER = CAP(I)

CAP(I)=(.975*HCAP(I))+(.05*XIP(I))

C SALES REVENUE = SREV(I)

SREV(I)=XPR(I)*AS(I)

C MANUFACTURING COST PER UNIT = FCPU(I)

FCPU(I)=XQT(I)-((ASD(I)+1000.)/(ASD(I)+500000.))

C TOTAL MANUFACTURING COSTS = TMNC(I)

TMNC(I)=FCPU(I)*XPV(I)

C INVENTORY UNIT VALUE = AIUV(I)

AIUV(I)=(HIUV(I)+FCPU(I))/2.

C CHANGE IN INVENTORY VALUE = CIV(I)

CIV(I)=AIUV(I)*(HINV(I)-AINV(I))

C INVENTORY VALUE = EIV(I)

EIV(I)=AIUV(I)*AINV(I)

C INVENTORY CARRYING CHARGE = BICC(I)

BICC(I)=EIV(I)*.06

C DEPRECIATION EXPENSE = DEXP(I)

DEXP(I)=HCAP(I)*.5

C ADMINISTRATION AND SELLING EXPENSE = ADEXP(I)

ADEXP(I)=400000.+(.2*HCAP(I))+(.04*SREV(I))

C DEBT EXPENSE = DBEXP(I)

DBEXP(I)=HDFBT(I)*.06

```

C      TOTAL EXPENSES = TEXP(I)
      TEXP(I)=TMNC(I)+BICC(I)+DEXP(I)+ADEXP(I)+DBEXP(I)+XMK(I)+XSD(I)+C
1V(I)

C      PROFIT BEFORE TAXES = PBIT(I)
      PBIT(I)=SREV(I)-TEXP(I)

C      NET PROFIT = TNP(I)
      TNP(I)=PBIT(I)*.5

C      CASH EXPENSES = CEXP(I)
      CEXP(I)=TEXP(I)-(CIV(I)+DEXP(I))

C      TOTAL DISBURSMENTS = TDIS(I)
      TDIS(I)=CEXP(I)+TNP(I)+XIP(I)+XDP(I)

C      ADDITION TO CASH = ACASH(I)
      ACASH(I)=SREV(I)-TDIS(I)

C      NET CASH = CASH(I)
      CASH(I)=HCASH(I)+ACASH(I)

C      PLANT VALUE = PNET(I)
      PNET(I)=CAP(I)*20.

64 CONTINUE

C      DEBT DETERMINATION
      DO 66 I=1,3
      TXDA(I)=TMNC(I)+XMK(I)+XSD(I)+XIP(I)+XDP(I)-HCASH(I)
      IF(TXDA(I))65,65,66

65 TXDA(I)=0.0

66 CONTINUE
      DO 69 I=1,3
      IF(CASH(I))67,68,68

67 TXDB(I)=(-CASH(I))
      CASH(I)=0.0
      GO TO 69

68 TXDB(I)=0.0

69 CONTINUE
      DO 70 I=1,3

```

DEBT(I)=HDEBT(I)+TXDA(I)+TXDB(I)-XDP(I)

C OWNERS EQUITY = OEQT(I)

OEQT(I)=CASH(I)+EIV(I)+PNET(I)-DEBT(I)

70 CONTINUE

200 FORMAT (17HINDUSTRY NUMBER ,I1,4X,13HFIRM NUMBER ,I1,4X,8HPERIOD
1 ,I2)

201 FORMAT (14HINDUSTRY SALES,16X,I10/20HPOTENTIAL FIRM SALES,10X,I10/
117HACTUAL FIRM SALES,13X,I10/16HFENDING INVENTORY,14X,I10/20HINVENT
2ORY UNIT VALUE,9X,1H\$,4X,F6.2/21HCAPACITY NEXT QUARTER,9X,I10/5HPR
3ICE,24X,1H\$,4X,F6.2/7HQUALITY,22X,1H\$,4X,F6.2/9HMARKETING,20X,1H\$,
41X,F10.0/18HSTYLING AND DESIGN,11X,1H\$,1X,F10.0)

214 FORMAT (17HPRODUCTION VOLUME,13X,I10/19HINVESTMENT IN PLANT,10X,1H
1\$,1X,F10.0/12HDEBT PAYMENT,17X,1H\$,1X,F10.0)

203 FORMAT (5HSALES,64X,1H\$,F10.0)

205 FORMAT (21H MANUFACTURING COSTS,33X,1H\$,F10.0/18H ADM. AND SELL
1NG,37X,F10.0/11H MARKETING,44X,F10.0/20H STYLING AND DESIGN,35X,
2F10.0/14H DEPRECIATION,41X,F10.0/25H REDUCTION IN INV. VALUE,30X
3,F10.0/22H INV. CARRYING CHARGE,33X,F10.0/18H INTEREST ON DEBT,3
47X,F10.0/5HTOTAL,64X,1H\$,F10.0)

206 FORMAT (19HPROFIT BEFORE TAXES,50X,1H\$,F10.0/10HNET PROFIT,59X,1H\$
1,F10.0)

208 FORMAT (4HCASH,45X,1H\$,F10.0/9HINVENTORY,40X,1H\$,F10.0/9HNET PLANT
1,40X,1H\$,F10.0//4HDEBT,45X,1H\$,F10.0//13HOWNERS EQUITY,36X,1H\$,F10
2.0,19X,1H-)

211 FORMAT (F6.2,6F10.0,F6.2,2X,I1,1X,I1,1X,I2)

DO 80 I=1,3

PUNCH 500

500 FORMAT (7HMONABUS)

PUNCH 600

600 FORMAT (1H)

PUNCH 200,IND(I),IFIRM(I),IQTR(I)

PUNCH 410

410 FORMAT (1H)
PUNCH 411

411 FORMAT (1H)
PUNCH 201,TIS,PSF(I),AS(I),AINV(I),AIUV(I),CAP(I),XPR(I),XQT(I),XN
1K(I),XSD(I)
PUNCH 214,XPV(I),XIP(I),XDP(I)
PUNCH 412

412 FORMAT (1H)
PUNCH 413

413 FORMAT (1H)
PUNCH 202

202 FORMAT (30X,15HPROFIT AND LOSS)
PUNCH 414

414 FORMAT (1H)
PUNCH 415

415 FORMAT (1H)
PUNCH 203,SREV(I)
PUNCH 204

204 FORMAT (8HEXPENSES)
PUNCH 205,TMNC(I),ADEXP(I),XMK(I),XSD(I),DEXP(I),CIV(I),BICC(I),DB
1EXP(I),TEXP(I)
PUNCH 416

416 FORMAT (1H)
PUNCH 417

417 FORMAT (1H)
PUNCH 206,PBIT(I),TNP(I)
PUNCH 418

418 FORMAT (1H)
PUNCH 419

419 FORMAT (1H)
PUNCH 207

207 FORMAT (33X,13HBALANCE SHEET)

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        PUNCH 420
420  FORMAT (1H )
        PUNCH 421
421  FORMAT (1H )
        PUNCH 208,CASH(I),EIV(I),PNFT(I),DFBT(I),OEQT(I)
80  CONTINUE
C    HISTORICAL DATA FOR NEXT PERIOD
        DO 82 I=1,3
            IQTR(I)=IQTR(I)+1
82  CONTINUE
        DO 81 I=1,3
            PUNCH 211,APQ(I),AMK(I),ASD(I),AINV(I),CAP(I),CASH(I),DEBT(I),AIUV
1(I),IND(I),IFIRM(I),IQTR(I)
81  CONTINUE
        IF(SENSE SWITCH 1)1000,1001
1001 STOP
        END

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