

SAS AS A PEDAGOGICAL TOOL IN CORPORATE MANAGEMENT EDUCATION

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Introduction

Management education is but one of several activities aiming at improving the effectiveness of purposeful organizations.

It aims at developing a broad range of abilities, based on appropriate knowledge, attitudes and skills, to enable participants to cope with a variety of tasks, often ill defined, in many different organizational settings.

The objective of training on the other hand is to develop highly specific and immediately useful skills. It is intended to prepare people to carry out well-known tasks in well-depicted job settings.

Desired results can be achieved only if correct decisions are made. The key activity of good managers should be competent decision making. This should be based on sound judgement. We are assuming here that decision making in an organizational setting follows a rational and logical process. If this is the case, some of what is rational and logical can ultimately be translated into mathematical terms. These can be incorporated into quantitative models and processed with the help of computers.

Great value has been placed upon the development of analytical skills by the manager: the abilities to quantify, to build models, to simulate alternatives, to assign probabilities, to evaluate, to choose rationally among various alternatives. The plethora of MBA programs is testimony to the belief that such skills can be developed through formal educational processes. This paper presents the results of what we believe to be a successful attempt to meet the needs of management education and develop managerial decision making skills.

Approach

A course in Quantitative Methods for financial personnel was to be introduced into the Financial Management Education Program (FINMEP) at International Paper Company.

The objective was to develop an understanding of the general theoretical construct of topics such as probability distributions, descriptive statistics, sampling and test of hypothesis,

economic forecasting, project planning and mathematical programming. Such an understanding will provide a conceptual framework against which the decision maker can develop solutions to diverse managerial problems. The constraints upon achievement of the objective were time limitation, needs for immediate application, and modularity.

Course offerings had to be available in two formats: 2-hour sessions once weekly for a period of eight weeks or an intensive 2½ day seminar. This approach provides participants both flexibility in scheduling and the opportunity to reduce transportation and lodging costs. The value of the educational program can be enhanced if there are identifiable by-products of participation in the program. That is, there are immediate applications of the problem solving techniques addressing the firm's needs.

In order to achieve the objectives under the given constraints we felt that the computer could be used more creatively than is currently the case. There seems to be a dichotomy between classroom discussion and illustrations and computer utilization. As a matter of fact, it is quite common to find separate seminars of computer utilization-application in various fields. Time constraints placed on a typical course preclude illustrations of realistic size problems and the concomitant sensitivity analysis critical to such problems. Thus, instructors are limited to the selection of examples "appropriate" to the imposed constraints, in other words, oversimplified and often times trivial examples.

Frequently courses in statistics fall into one of two categories. Either the course is taught from the theoretical-theorem proving point of view with only lip service paid to data analysis. Or it is taught as a cookbook- follow the recipe procedure with emphasis on the mechanical calculations with no understanding of assumptions and limitations.

The basic approach in designing the course was to bridge the gap between identified immediate needs and conceptual knowledge.

Implementation

Five cases were developed from current corporate data representing diverse situations in the firm. All data from the five cases were presented in the first class session when the notion of random phenomena was discussed. Two cases were drawn from the financial data base; one case dealt with the evaluation of the characteristics of timberlands; another case dealt with output characteristics of a paper machine; and the last case dealt with energy consumption and related measures in a paper mill.

As each topic was developed the theoretical construct introduced was applied to these five cases. Additional homework problems relating to these cases were also given. It is important to note that by applying each new methodology to the same data (set of cases) a participant begins to develop a total understanding of the phenomena being investigated. The class participant recognized that each analysis provides one piece of the puzzle. When all the pieces are put together we have a full picture of the phenomena. In this paper the data base used is published information from another industry, since much of data used for the course is proprietary.

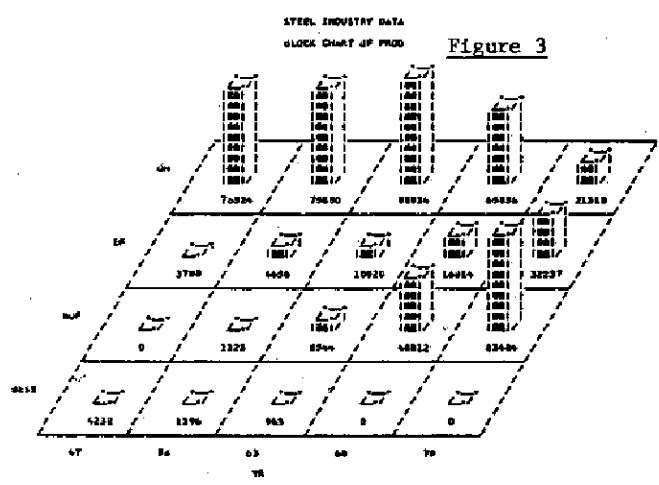
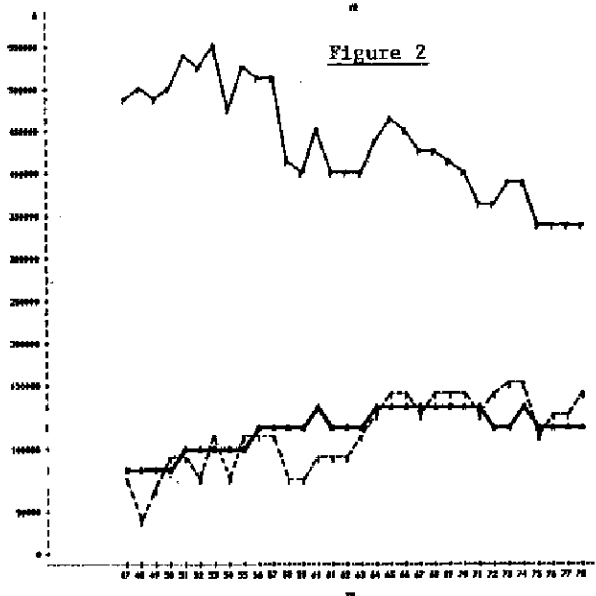
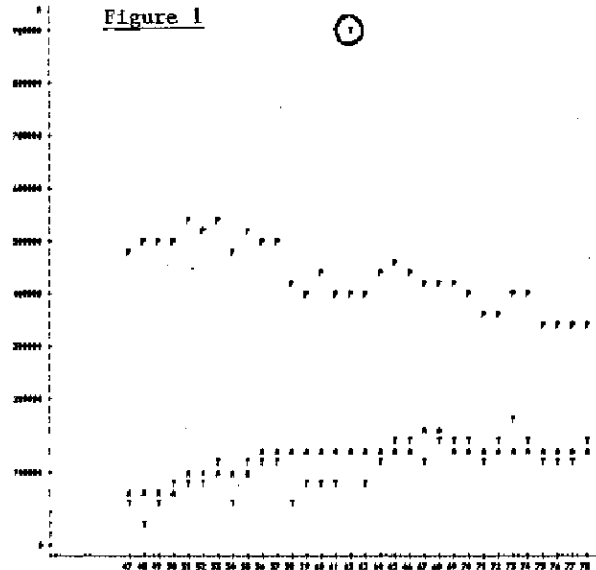
The industry selected, steel, is also large and vital and has long been established.

Example: A steel case

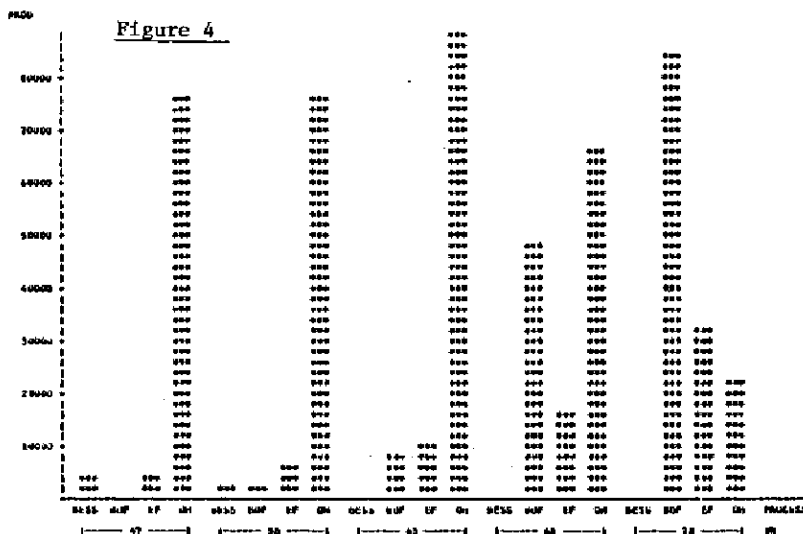
The first lecture dealing with random phenomena presents the opportunity to understand the data by processing it in various ways. SAS provides a very powerful tool for illustrating the many ways in which the data can be represented. The various representations can lead to the formulation of meaningful questions. For example, in Figure 1 in which three variables were plotted against time a question was raised as to why a point (circled T) was significantly larger in one year. The plot provides a measure of validation for the data. It is questionable whether such an error could be identified so readily without this graph. Subsequent statistical analysis of this erroneous data (with only one data item incorrectly punched) provided surprisingly misleading results.

Figure 2 with the corrected data item presents the first organized picture of the steel case. From this the participant can start trying to infer relationships among these three variables. Subsequent lectures will provide them with the tools to test the inferences. Figures 3, 4, and 5 present additional ways of viewing the data. In Figure 3 sources of output can be compared over time. The participant can see apparent increases in some sources and decreases in others. Figure 4 gives a different perspective on the comparisons. Figure 5 provides still another option in showing relative importance of sources of output over time.

STEEL INDUSTRY DATA
 PLOT OF APPE SYMBOL USED TO 1
 PLOT OF PAPE SYMBOL USED TO 2
 PLOT OF TONNAGE-TS SYMBOL USED TO 3



STEEL INDUSTRY DATA
TECHNOLOGY IN PRODUCTION OVER TIME
BAR CHART OF PAGES



STEEL INDUSTRY DATA
BAR CHART OF PAGES

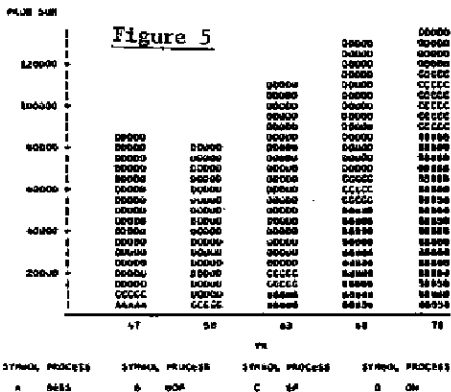


Figure 6

SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS	SYMBOL	PROCESS
TRENCH	32	112761.52	22613.88	20666.88	130799.08	4174.78	2689445.08	8771782.1	28.95								
TURBY	32	112761.52	11262.78	1621.58	16881.08	2811.88	421968.08	254329552.9	121.27								
JANON	31	28985.97	13217.52	5029.88	48226.88	2145.42	842725.08	24233283.2	44.47								
SHYVED	32	12668.25	488.47	841.82	81.68	43982.21	223225.8	223225.8	24.29								
SHYVED	31	861.28	2689.22	3789.48	12889.18	61.88	293273.08	719191.8	33.14								
SHYVED	32	2288.27	438.26	2179.79	3748.88	72.28	87743.27	178226.4	24.29								
SHYVED	32	881.77	212.88	227.97	1815.41	41.71	28882.31	54872.1	24.29								
TRCH	32	22.12	25.87	8.88	62.14	4.45	707.85	325.1	115.21								
A	32	112621.88	12594.88	68211.88	138985.88	2225.24	341162.88	12881722.6	11.18								
B	32	438484.22	62811.88	37728.88	544222.88	11138.88	1288411.88	28888888.8	14.44								
E	32	7.88	5.2	8.88	115.88	8.21	58.88	372.5	268.82								
SHAN	32	1232.44	1748.25	8.88	4881.88	382.28	48124.88	2884279.7	111.27								
G	32	1288.22	841.28	3785.88	22227.88	2487.42	444488.88	7881224.4	48.42								
CH	32	48282.2	2725.48	2541.88	12228.88	4822.22	212824.88	77945221.7	48.24								
BCP	32	2888.28	2414.98	8.88	6249.88	5985.88	828811.88	111458888.4	112.21								

When the concept of a probability distribution is introduced and the measures by which these distributions can be characterized are presented we can talk about the meaning of the measures in identifying the distributions. Figure 6 shows the participant that the calculations can be done efficiently without getting into the details of each individual doing it. This leaves sufficient time for discussion of the statistical measures vis-a-vis the frequency charts previously developed (Figures 3, 4, and 5). Similarly, when confidence intervals and test of hypothesis about the mean are discussed a SAS printout provides all the necessary information for these analyses. Figure 7 is introduced when economic forecasting and forecasting error are discussed. For example, figure 7 provides a meaningful vehicle for explaining the sensitivity of exponential forecasting models to the choice of weighting factor.

Figure 8, a correlation matrix, is introduced when the topic of regression is discussed. A large example can be used to test the validity of underlying assumptions of a regression model for understanding interrelationships. Figure 9 represents a detailed regression analysis. It is impressed upon the participant that a tool such as SAS can efficiently and cheaply produce statistical reports. The participant's value to the firm lies in his/her ability to recognize the managerial implication of the analysis. Figure 10 illustrates what could happen if the incorrect data item referred to previously were allowed to remain. This emphasizes the need for total analysis. This combines all the analyses to fully depict the underlying mechanism of the phenomena being studied.

PLOT OF ACTUAL DATA SYMBOL USED IS A
 PLOT OF THEORETICAL VALUES SYMBOL USED IS C
 PLOT OF FITTED DATA SYMBOL USED IS F

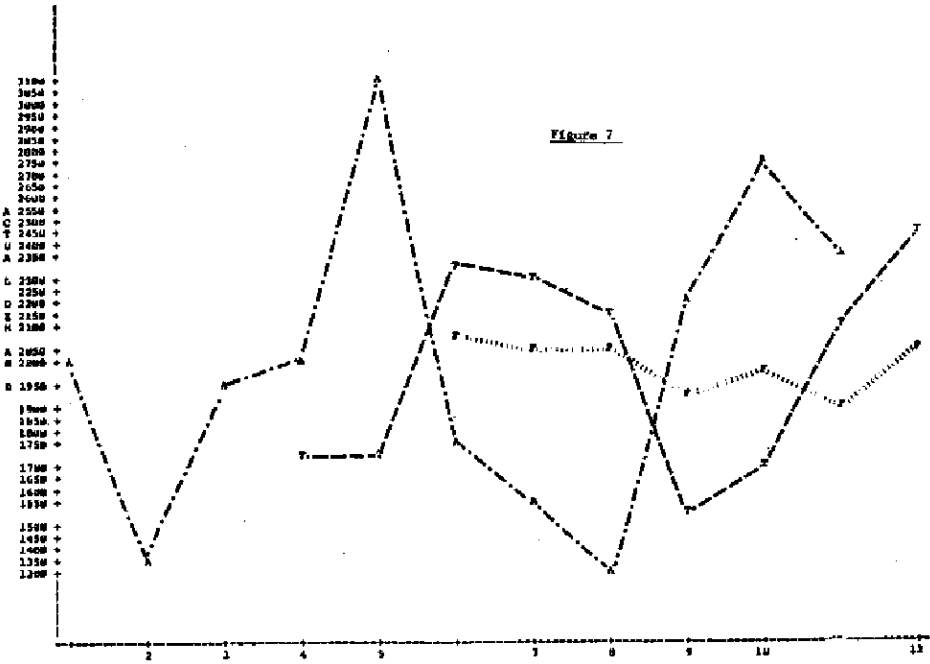


Figure 7

COEFFICIENTS / P > 100 > 100

TERM	COEFF	STD	T	P	TERM	COEFF	STD	T	P
INTERCEPT	1.0000	0.0000	0.0000	0.0000	1	0.0000	0.0000	0.0000	0.0000
MONTH	0.0000	0.0000	0.0000	0.0000	2	0.0000	0.0000	0.0000	0.0000
MONTH ²	0.0000	0.0000	0.0000	0.0000	3	0.0000	0.0000	0.0000	0.0000
MONTH ³	0.0000	0.0000	0.0000	0.0000	4	0.0000	0.0000	0.0000	0.0000
MONTH ⁴	0.0000	0.0000	0.0000	0.0000	5	0.0000	0.0000	0.0000	0.0000
MONTH ⁵	0.0000	0.0000	0.0000	0.0000	6	0.0000	0.0000	0.0000	0.0000
MONTH ⁶	0.0000	0.0000	0.0000	0.0000	7	0.0000	0.0000	0.0000	0.0000
MONTH ⁷	0.0000	0.0000	0.0000	0.0000	8	0.0000	0.0000	0.0000	0.0000
MONTH ⁸	0.0000	0.0000	0.0000	0.0000	9	0.0000	0.0000	0.0000	0.0000
MONTH ⁹	0.0000	0.0000	0.0000	0.0000	10	0.0000	0.0000	0.0000	0.0000
MONTH ¹⁰	0.0000	0.0000	0.0000	0.0000	11	0.0000	0.0000	0.0000	0.0000

Bibliography

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2. M. Mohl, N. Finger and N. Fraiman. "Interactive Computing in Management Education: An Example in Aggregate Production Planning" Proceedings of the Fourth NJ Conference on the Use of Computers in Higher Education. 1978.
3. SAS Institute Inc. SAS User's Guide, 1979 edition. Raleigh, North Carolina.
4. Taylor and G. L. Lippitt. Management Development and Training Handbook. McGraw Hill. 1975.

Figure 8

Figure 9

REGRESSION ANALYSIS FOR THE STEEL INDUSTRY IN THE U.S.A.

STEP	VARIABLES REMOVED	R SQUARE	CP	F	MEAN SQUARE
1	INTERCEPT	0.9999	24.0564434	1.0000	0.0000
2	MONTH	0.9999	24.0564434	1.0000	0.0000
3	MONTH ²	0.9999	24.0564434	1.0000	0.0000
4	MONTH ³	0.9999	24.0564434	1.0000	0.0000
5	MONTH ⁴	0.9999	24.0564434	1.0000	0.0000
6	MONTH ⁵	0.9999	24.0564434	1.0000	0.0000
7	MONTH ⁶	0.9999	24.0564434	1.0000	0.0000
8	MONTH ⁷	0.9999	24.0564434	1.0000	0.0000
9	MONTH ⁸	0.9999	24.0564434	1.0000	0.0000
10	MONTH ⁹	0.9999	24.0564434	1.0000	0.0000
11	MONTH ¹⁰	0.9999	24.0564434	1.0000	0.0000

Figure 10

STEEL INDUSTRY DATA

STEP	VARIABLES REMOVED	R SQUARE	CP	F	MEAN SQUARE
1	INTERCEPT	0.9999	1.0000	1.0000	0.0000
2	MONTH	0.9999	1.0000	1.0000	0.0000
3	MONTH ²	0.9999	1.0000	1.0000	0.0000
4	MONTH ³	0.9999	1.0000	1.0000	0.0000
5	MONTH ⁴	0.9999	1.0000	1.0000	0.0000
6	MONTH ⁵	0.9999	1.0000	1.0000	0.0000
7	MONTH ⁶	0.9999	1.0000	1.0000	0.0000
8	MONTH ⁷	0.9999	1.0000	1.0000	0.0000
9	MONTH ⁸	0.9999	1.0000	1.0000	0.0000
10	MONTH ⁹	0.9999	1.0000	1.0000	0.0000
11	MONTH ¹⁰	0.9999	1.0000	1.0000	0.0000