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IFPS: A LOT MORE THAN A SPREADSHEET

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The Interactive Financial Planning system (IFPS) is a powerful modeling language which can effectively be used by managers (with no computing background) and by computer professionals. Although a quick introduction to the system may leave the impression that IFPS is basically a spreadsheet system, it has capabilities far beyond the typical spreadsheet system. These capabilities include Monte Carlo simulation and optimization.

1. WHAT IS IFPS?

The Interactive Financial Planning System (IFPS) is described by its developer, EXECUCOM Systems Corporation, as "a computerized simulation system which enables planning as a natural extension of normal management thought processes." It could also be described as an "overgrown spreadsheet, or a mainframe *calc." (Fill in the * with whatever prefix you like.) It might be called a decision support system; it might be called a simulation language; it might be called a report writer; it might be called a general-purpose constrained optimizer. Any of these descriptions might be appropriate for a particular application. In the author's opinion, IFPS is primarily a modeling language with an environment built around it to do many things with models. One can build a model, then interrogate the model. This interrogation can include WHAT IF analysis, GOAL SEEKING analysis, SENSITIVITY analysis, MONTE CARLO analysis, and OPTIMIZATION. The results of the analysis can be REPORTed with the report writer, or stored as datafiles for use by other models. Models can be imbedded into a comprehensive decision support system, with a user interface designed so that virtually no user knowledge of IFPS is required. Almost all of these activities are conducted in a language that is very readable, even to people with no other computer experience.

2. WHO CAN USE IFPS?

The capabilities in the previous section are clearly no surprise to the computer professional. "Everybody" knows those things can be done. A very powerful aspect of IFPS is that a non-technical manager can do a great deal with IFPS within a few weeks of an introduction. The author has used IFPS with practicing managers enrolled in an Executive MBA program. The student backgrounds range from long-forgotten high school algebra and no computer experience (and often a lot of anxiety) to computer professionals with advanced technical degrees. The neophyte is pleased (often enthralled) when something thought unattainable - using a computer - has become easy. The person with substantial computing experience is excited about the way in which IFPS makes many things so easy. The computer professional may view IFPS modeling - which a manager can do - as a way of capturing all-important managerial input into a decision support system.

After teaching computer languages for more than seventeen years, the author is just about ready to believe that IFPS is to the manager as movable type was to the masses during the Renaissance: something very powerful is now accessible to many.

3. AN EXAMPLE OF AN IFPS MODEL

A very simple IFPS model and its solution are shown in Figure 1. From this model, there are two very important concepts to notice: (1) the model is easily read by someone familiar with the situation, regarless of that person's computer knowledge, and (2) the model is non-procedural. The model builder has stated relationships that describe the situation, rather than stating a procedure to calculate the end result.

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Figure 1: An IFPS Model and its Solution

```
110 PROFIT = REVENUE - EXPENSES
120 REVENUE = QUANTITY SOLD * PRICE
130 EXPENSES = FIXED COSTS + VARIABLE COSTS
140 FIXED COSTS = RENT + SALARIES + LEASES + '
150               UTILITIES + SUPPLIES
160 VARIABLE COSTS = QUANTITY MADE * UNIT VARIABLE COST
170 UNIT VARIABLE COST = UNIT MATERIAL COST + '
180                      UNIT LABOR COST
190 RENT = 1000
200 SALARIES = 20000
210 LEASES = 4000
220 UTILITIES = 5000
230 SUPPLIES = 500
240 UNIT MATERIAL COST = 8
250 UNIT LABOR COST = 5
260 QUANTITY MADE = 2000
270 QUANTITY SOLD = 2000
280 PRICE = 50
END OF MODEL
? SOLVE

ENTER SOLVE OPTIONS
? ALL

                                1

PROFIT                      43500
REVENUE                    100000
EXPENSES                    56500
FIXED COSTS                 30500
VARIABLE COSTS              26000
UNIT VARIABLE COST             13
RENT                         1000
SALARIES                    20000
LEASES                       4000
UTILITIES                    5000
SUPPLIES                      500
UNIT MATERIAL COST              8
UNIT LABOR COST                 5
QUANTITY MADE                2000
QUANTITY SOLD                2000
PRICE                          50
```

With only two commands - SOLVE the model and display ALL of the solution - the user is able to see the results of the computation.

4. INTERROGATING A MODEL

What happens if something is changed? The widespread use of spreadsheet packages has made the concept of "WHAT IF" analysis almost commonplace. IFPS performs WHAT IF analysis quite easily, as shown in Figure 2. In the WHAT IF solution, PRICE is temporarily changed from 50 (Figure 1) to 50 (in the WHAT IF case).

5. A FULL SPREADSHEET

By making only modest changes in the model, projections for a number of years can be made. The various columns must be labeled (a COLUMNS statement); lists must be provided for variables (rows) which have different definitions from year to year. The statements on lines 180 through 280 in Figure 3 illustrate some of the elementary ways that variables may be defined across the matrix. The range of modeling statements is much broader than those illustrated; IF-THEN-ELSE logic, table lookup, interpolation, mathematical functions, and many other statements are a part of the modeling language.

When a model of this low level of complexity is demonstrated to a class of managers, the thought that "I wish I could have done that when..." is almost audible in the classroom. Is the "Data Processing Deparatment" also heard to wonder if their security brought about multi-year backlogs is waning? This simple model only begins to scratch the surface of the things that can be done - with relative ease - with the modeling language.

6. ADDING UNCERTAINTY TO A MODEL

If one wants to describe the uncertainty in profit that results from uncertainty in any of the relationships or data, a variety of statements is available to the model builder. For example, if UNIT MATERIAL COST is believed to be normally distributed with a mean of $8 and standard deviation of $3 in the first year, and increasing by $2 in the following years, the modeling statement

UNIT MATERIAL COST + NORRAND (8,5) , PREVIOUS + 2

Figure 2: An Example of WHAT IF Analysis

```
ENTER SOLVE OPTIONS
? WHAT IF
WHAT IF CASE 1
ENTER STATEMENTS
? PRICE = 40
? SOLVE
ENTER SOLVE OPTIONS
? ALL

***** WHAT IF CASE 1 *****
1 WHAT IF STATEMENT PROCESSED

                                    1

PROFIT                          23500
REVENUE                         80000
EXPENSES                        56500
FIXED COSTS                     30500
VARIABLE COSTS                  26000
UNIT VARIABLE COST                 13
RENT                             1000
SALARIES                        20000
LEASES                           4000
UTILITIES                        5000
SUPPLIES                          500
UNIT MATERIAL COST                  8
UNIT LABOR COST                     5
QUANTITY MADE                    2000
QUANTITY SOLD                    2000
PRICE                              40
```

would accomplish that specification. The MONTE CARLO command would cause multiple solutions of the spreadsheet, and a report would be displayed summarizing the results of those multiple solutions according to the options specified.

7. OPTIMIZING ON A SPREADSHEET

Perhaps the most creative capability of the IFPS package is the optional optimization package, OPTIMUM. One typically thinks of optimization in terms of mathematical notation, or perhaps in terms of a network. OPTIMUM views optimization from the perspective of a spreadsheet. For managers, the idea of the "playing with numbers on a spreadsheet" is familiar turf and is likely to be useful, while stating things with symbols (including those Greek letters, like sigma) is foreign and may produce an uncomfortable feeling. Although managerial comfort isn't everything, it does occasionally have some impact upon the successful implementation of analytical results.

The spreadsheet statement of an optimization model is conceptually nothing more than notations on a spreadsheet solution. Simply circle the one entry that is to be made as big as you can make it (the OBJECTIVE), then box those entires that can be changed to make the objective as big as it can get. These boxed entries are the DECISION variables in the optimization problem. Finally, mark with a triangle those entires on the spreadsheet that "need to be watched to see that nothing gets out of hand" while the decision variables are changed. The limits for the cells marked in triangles are the CONSTRAINTS of the optimization problem. All of these spreadsheet marks are translated into an easily read DIRECTIVE set which defines the problem to the OPTIMUM software.

When OPTIMUM is told to SOLVE, with nothing more than the model and the directive set (identifying the objective, the decision variables, and the constraint variables with their constraining values), the OPTIMUM package determines whether the problem is linear, chooses an algorithm, and begins the solution process. As one would expect, there is no way to be sure that a non-linear problem has converged to a global optimum. Not surprisingly, some nonlinear problems may require enormous amounts of computer time. Nonetheless, the solution power placed in the hands of someone totally non-mathematical is impressive.

An extremely important aspect is that managerial talent is focused upon building a model (stating relationships) and describing the nature of the optimization problem (what are the decision variables, the constraints, and the objective). This managerial focus is towards "What do I want" rather than "how do I get it." Classroom experience has indicated that OPTIMUM may be the first product to take optimization away from the mathematician and give it to the manager.

8. WHAT ELSE?

These illustrations only scratch the surface of the capabilities if IFPS. The author's experience with the language has been in the classroom with non-technical managers; in that environment, the author awards it virtually nothing but congratulations. The use of IFPS in more than 130 Universities (according to conversations with Execucom personnel) indicates it is well accepted in much of higher education. But its widespread use in large companies throughout the world indicates that the commercial user finds much more in IFPS. Among these features are the extensive report writing capabilities, the consolidation capability, the command file capability, the ability to re-define text strings at solution time, simultaneous equation detection and solution, and the ease with which menus can be created.

With the many capabilities of IFPS, it is clearly more than a spreadsheet. It is a powerful attitude-changer for the frightened neophyte computer user. It is also a very flexible modeling system with extensive analytical capabilities.

Figure 3: A Model Describing Several Years

```
100 COLUMNS YEAR 1, YEAR 2, YEAR 3, YEAR 4, YEAR 5
110 PROFIT = REVENUE - EXPENSES
120 REVENUE = QUANTITY SOLD X PRICE
130 EXPENSES = FIXED COSTS + VARIABLE COSTS
140 FIXED COSTS = RENT + SALARIES + LEASES + '
150              UTILITIES + SUPPLIES
160 VARIABLE COSTS = QUANTITY MADE X UNIT VARIABLE COST
170 UNIT VARIABLE COST = UNIT MATERIAL COST + '
180                     UNIT LABOR COST
190 RENT = 1000, PREVIOUS RENT + 100
200 SALARIES = 20000, PREVIOUS SALARIES X 1.10
210 LEASES = 4000, MAXIMUM (PREVIOUS LEASES X 1.05, 4700)
220 UTILITIES = 5000, PREVIOUS X 1.20
230 SUPPLIES = 500, PREVIOUS X 1.1
240 UNIT MATERIAL COST = 8, PREVIOUS + 2
250 UNIT LABOR COST = 5, PREVIOUS X 1.04 FOR 2, '
251                  PREVIOUS X 1.18, PREVIOUS X 1.10
260 QUANTITY MADE = 2000, ROUND (PREVIOUS X 1.05)
270 QUANTITY SOLD = 2000, ROUND (PREVIOUS X 1.05)
280 PRICE = 50, ROUNDUP (PREVIOUS X 1.08)

? SOLVE
MODEL PRO2  VERSION OF  08/08/83  09:54 -- 5 COLUMNS 16 VARIABLES
ENTER SOLVE OPTIONS
? ALL
```

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
PROFIT	43500	47130	53570	58570	66987
REVENUE	100000	113400	130095	148160	170170
EXPENSES	56500	66270	76525	89590	103183
FIXED COSTS	30500	34350	38140	42407	47223
VARIABLE COSTS	26000	31920	38385	47183	55961
UNIT VARIABLE COST	13	15.20	17.41	20.38	23.02
RENT	1000	1100	1200	1300	1400
SALARIES	20000	22000	24200	26620	29282
LEASES	4000	4700	4935	5182	5441
UTILITIES	5000	6000	7200	8640	10368
SUPPLIES	500	550	605	665.5	732.1
UNIT MATERIAL COST	8	10	12	14	16
UNIT LABOR COST	5	5.200	5.408	6.381	7.020
QUANTITY MADE	2000	2100	2205	2315	2431
QUANTITY SOLD	2000	2100	2205	2315	2431
PRICE	50	54	59	64	70