A SPREADSHEET APPLICATION USING MULTIPLE INPUT WINDOWS IN THE SAS® SYSTEM FOR PERSONAL COMPUTERS

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One of the most popular features of today's microcomputer software is the interactive spreadsheet. Many computer applications for the home and for business deal with calculations that can be simplified using spreadsheets, leading to the great popularity of software such as Lotus 1-2-3®.

The SAS/FSP® product on larger machines includes PROC FSCALC, a mainframe version of a spreadsheet program, but this procedure has not yet been released for microcomputers. However, using the unique features of the SAS System for Personal Computers, most notably the WINDOW statement, a simulated spreadsheet application can be built.

The primary example described in this paper, designed to assist in the estimating of highway construction costs, makes use of multiple windows to allow modification of detailed cost data for labor, equipment and material components while simultaneously displaying summary cost information. This prototype system was developed for the Pennsylvania Department of Transportation, but the general concepts and programming techniques are useful for many industries and applications.

The Application

As part of a research project for the Pennsylvania Department of Transportation, Info Tech was required to produce a prototype system which could be used to estimate the cost of highway construction work by considering such components as labor costs, equipment rental costs, and raw material purchases. To accomplish this, the concept of an electronic spreadsheet, in which the estimator could enter individual cost components and adjust them as needed without being forced to perform the tedious calculations usually required, was an appealing approach.

It was felt that, in addition to the ability to enter and modify individual data elements, the capability to view how each detailed change affects the "bottom line" was also extremely desirable. Therefore, it was necessary to design a system which could simultaneously display summary cost information while the details were being adjusted.

Due to the speed with which we have produced prototype systems and analyses using the SAS System on larger machines, we pursued this task through the SAS System for Personal Computers. After a bit of experimentation with the WINDOW and DISPLAY statements unique to the SAS environment on the PC, a suitable prototype was completed which used multiple windows to simulate a spreadsheet application.

The Prototype

The resulting system consisted of four input windows: a summary window containing calculated totals and subtotals, and three detail windows, one each for the labor, equipment, and materials components. The summary information is always displayed at the top of the screen, while the components are modified in the bottom half. The command line is used to request switches between windows and to request that information be saved when the final estimates are achieved.

The construction operations which are the subject of cost estimation have been previously defined with a set of default detail components that can be initialized before the first screen appears. Thus, the summary window first appears with a precalculated set of totals which can be used when no further modification is required. The summary window also contains two general parameters (daily productivity and overhead/profit percentage) which can also be adjusted.

In most cases, some changes to the detailed components will be desired. To bring up the window containing the data to be changed, the appropriate code is entered on the COMMAND line: M for the raw materials screen, LA for the labor screen, and EQ for the equipment screen. To return to the summary screen in order to alter the general parameters (daily productivity and overhead/profit percentage), the PROD command is used.

The detail screens can be filled in by specifying only the code of the element chosen, for example, DRV for truck driver on the Labor screen. The description is automatically generated through a "table look-up" using PROC FORMAT specifications previously stored and a PUT statement, relieving the burden of typing in a long character string for each element. In addition, if the hourly rate or unit price is not entered, a default value, also "stored"
via PROC FORMAT, is inserted.

The subtotals for each component group are recalculated whenever the estimator finishes entering data into a window. This can be signaled by moving the cursor to the COMMAND line and, without entering a command, simply hitting the RETURN key. After the summary figures are updated, the current detail screen is redisplayed for further modification.

When the cost estimate is complete, the estimator again moves the cursor to the COMMAND line and enters the STO command to store the final figure. The overall total in the summary window begins to blink and, when the ENTER key is pressed, the entire set of data, including summary totals plus all detail elements, is saved, and the estimator can proceed to the next operation to be estimated.

**Hardcopy Summary**

After all calculations are completed, the final result may need to be documented on paper. A short routine was developed to format the detailed cost component information on a single sheet to allow for further review outside the microcomputer environment. If additional changes become necessary, the spreadsheet system can be re-entered and the modifications applied to the data previously recorded.

**Other Applications**

This example concentrates on highway construction operations, but there are other possible uses of this type of spreadsheet procedure. For instance, firms which estimate the cost of developing computer systems or software packages could use the component approach to divide costs into categories such as labor (programming, analysis, composition of documentation), equipment (hardware and software requirements for development and/or installation), and "materials" (miscellaneous costs such as printing of documentation and general expenses, e.g., photocopying, telephone, travel, etc.).

Another component configuration could be the division of costs into hourly, daily and miscellaneous other costs. This setup could be used to estimate the cost of having an employee attend a SUGI conference. Hourly costs may include long-distance telephone expenses and income lost to the employer resulting from the attendee's absence from the office as might be the case with a consulting firm. Daily costs cover expenses such as lodging and meals, while additional costs to consider are registration fees and transportation costs which do not vary based on the length of the trip and can be looked at as "fixed" expenses.

**FIGURES AND EXAMPLES**

Examples of the spreadsheet screens are shown in Figures 1 through 5. Figure 1 is the initial summary window that is displayed which reflects all default values for all components of the task as that data is permanently stored. Figures 2, 3 and 4 illustrate the three different detail windows with default values also shown. Figure 5 is the screen configuration as the final values are saved.

Figure 6 is a sample of a look-up table definition for descriptions and default unit costs using PROC FORMAT. Figure 7 is the hardcopy cost analysis summary report.

**TO CONTACT AUTHOR**

For more information concerning this simulated spreadsheet application concept, contact Warren Repole at Info Tech, P. O. Box 14545, Gainesville, Florida, 32604, telephone (904) 375-7624.

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ITEM 0305-0011 QUANTITY 10,000.00
PRODUCTION RATE PER DAY 1500
% O & P 10
MATERIALS LABOR EQUIPMENT PRICE
$11.62 $0.95 $0.97 $13.53

Enter Approximate Production Rate per Day and Overhead & Profit Percentage.

Figure 1

ITEM 0305-0011 QUANTITY 10,000.00
PRODUCTION RATE PER DAY 1500
% O & P 10
MATERIALS LABOR EQUIPMENT PRICE
$11.62 $0.95 $0.97 $13.53

Figure 2

ITEM 0305-0011 QUANTITY 10,000.00
PRODUCTION RATE PER DAY 1500
% O & P 10
MATERIALS LABOR EQUIPMENT PRICE
$11.62 $0.95 $0.97 $13.53

Figure 3
**Figure 4**

**Figure 5**
PROC FORMAT LIBRARY=LIBRARY;
  VALUE $LABORD /* Labor Classifications */
  'FORE'='FOREMAN'
  'OPER'='EQUIPMENT OPERATOR'
  'DRIV'='TRUCK DRIVER'
  'LBG1'='LABORER GROUP 1'
  'LBG2'='LABORER GROUP 2'
  'FLAG'='FLAGMAN'
  'TECH'='TECHNICIAN'
  'MECH'='MECHANIC'
  'TEAM'='TEAMSTER'
  'PNTR'='PAINTER'
  'BLST'='SAND BLASTER'
  OTHER='** UNKNOWN LABOR **'

VALUE $LABORP /* Default Hourly Labor Rates */
  'FORE'='25.00'
  'OPER'='20.00'
  'DRIV'='15.00'
  'LBG1'='13.50'
  'LBG2'='14.25'
  'FLAG'='12.00'
  'MECH'='18.00'
  'TEAM'='15.00'
  'PNTR'='12.50'
  OTHER=' '

RUN;

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COST ANALYSIS FORM

ITEM 0305-0011 QUANTITY 10,000.00 CONTRACT ITI000

PRODUCTION PER DAY: 1,500.00
% OVERHEAD AND PROFIT: 10
TOTAL UNIT COST (INCLUDING O & P): $13.53

MATERIAL UNIT COST: $11.62
LABOR UNIT COST: $0.95
EQUIPMENT UNIT COST: $0.97

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<td>EQUIPMENT OPERATOR</td>
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<td>POWER BROOM</td>
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<tr>
<td>VIBRATORY ROLLER</td>
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Figure 6

Figure 7