

Introduction to SAS/CALC[®] Software

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ABSTRACT

SAS/CALC software provides all-purpose spreadsheet capabilities for information management. Spreadsheets provide robust data modelling behavior. Although financial applications are typical examples, mathematical and statistical applications such as Monte Carlo simulations can also exploit the spreadsheet's capabilities. This paper highlights the major features including importing and exporting files, two-dimensional and three-dimensional spreadsheets, linking, consolidation, formulas, program entries, integrated graphics, and goal seeking.

Structure

SAS/CALC applications are based on spreadsheets which are tables of rows and columns. Although financial or ledger sheet applications typically come to mind, any information that can be represented as a table of rows and columns can be placed into a spreadsheet.

```

+CALC: P1 SPV3.CALC (E)-----
| File Edit View Execute Charts Locals Globals Help
|-----
| Income and Cash Flow Statement
|-----
|          1991      1992      1993      1994
|-----
| Revenue          40,200,899      0  1,878,333  4,320,167
| Variable cost    21,331,089      0  596,667  2,292,333
| Fixed cost       8,676,233      0  1,500,000  1,500,000
| Book depreciation  457,272      0  40,000  70,769
| TBIT             9,736,304      0  ( 658,333)  457,064
| Taxes            3,894,522      0  ( 263,333)  182,826
| Net income       5,841,783      0  ( 395,000)  274,238
| Capital expense  735,126      0  200,000  200,000
| Working capital  618,664      0  187,833  251,408
| Cash flow        4,945,264      0  ( 742,833)  ( 166,400)
| Cumulative cash flow  0  ( 742,833)  ( 845,233)
| Discounted cash flow  0  ( 687,809)  ( 91,221)
| Cum. discounted cash flow  0  ( 687,809)  ( 775,029)
|-----

```

Display 1 SAS/CALC Spreadsheet

The following data could be represented in a spreadsheet or in a SAS data set for the structure of a spreadsheet is similar to a SAS data set. There are fundamental relationships between the structure of a SAS data set and the structure of a spreadsheet.

Category	SAS data set		Spreadsheet		
	Quarter1	Quarter2	Category	Quarter1	Quarter2
Swimming	4000	3000	Swimming	4000	3000
Tennis	5000	2000	Tennis	5000	2000
Running	6000	4000	Running	6000	4000

An observation in a SAS data set relates to a row in a spreadsheet, a variable in a SAS data set relates to a column in a spreadsheet, and a data value in a SAS data set relates to a cell value in a spreadsheet.

You may prefer to think of a spreadsheet as offering more functionality than a SAS data set. In a SAS data set, all the data values for a given variable must be either character or numeric. This constraint does not exist in a spreadsheet. Some cell values may be character and others may be numeric in a given spreadsheet column. The attributes of a cell is determined by the data placed in that cell.

For example the REVENUE column contains both numeric and character data.

```

+CALC: Y1990 TRACK.CALC (E)-----
| File Edit View Execute Charts Locals Globals Help
|-----
|          EVENT      REVENUE      EXPENSES      PROFIT      VARIANCE
|-----
| ROW1  RUNNING      $544,000.00  $9,876.34  $534,123.66  98%
| ROW2  FIELD        $8,956.45   $8,178.23  $778.22     9%
| ROW3
| ROW4  TOTAL          $552056.45  $18,454.57  $534901.88  97%
|-----

```

Display 2 SAS/CALC Spreadsheet

The ROW4.REVENUE cell is defined as data type CHARACTER.

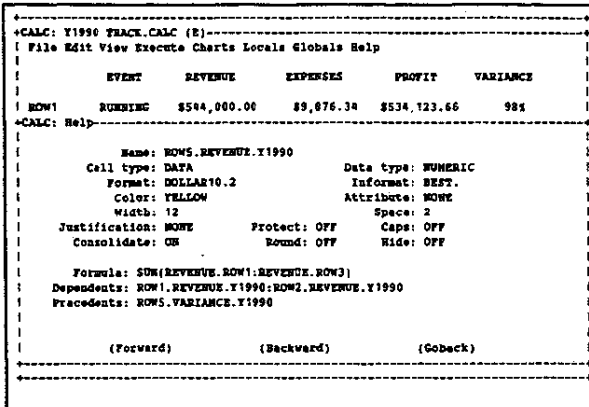
```

+CALC: Y1990 TRACK.CALC (E)-----
| File Edit View Execute Charts Locals Globals Help
|-----
|          EVENT      REVENUE      EXPENSES      PROFIT      VARIANCE
|-----
| ROW1  RUNNING      $544,000.00  $9,876.34  $534,123.66  98%
|-----
| +CALC: Help
|-----
| Name: ROW4.REVENUE.Y1990
| Cell type: LABEL          Data type: CHARACTER
| Format: $CHAR.           Informat: $CHAR.
| Color: YELLOW           Attribute: NONE
| Width: 12                Space: 2
| Justification: LEFT      Protect: OFF       Caps: OFF
| Consolidate: ON          Round: OFF         Hide: OFF
|-----
| (Forward)      (Backward)      (Goback)
|-----

```

Display 3 Cell Attributes

The ROW5.REVENUE cell is defined as data type NUMERIC.



Display 4 Cell Attributes

In addition the data in a SAS data set is static. Any changes to the data requires specific edits. In a spreadsheet cell values can be defined as functions of other cell values. As cell values are edited, the other cell values are updated automatically.

Importing and Exporting Data

SAS/CALC provides direct read/write access to any data stored in a SAS data set or any proprietary data storage format support by a SAS data engine. Columns and rows can be transposed during the read/write process.

Data step views can be used to process various legacy files.

SAS/ACCESS views can be used to process data in other proprietary file structures.

SAS/ACCESS Interface Engines

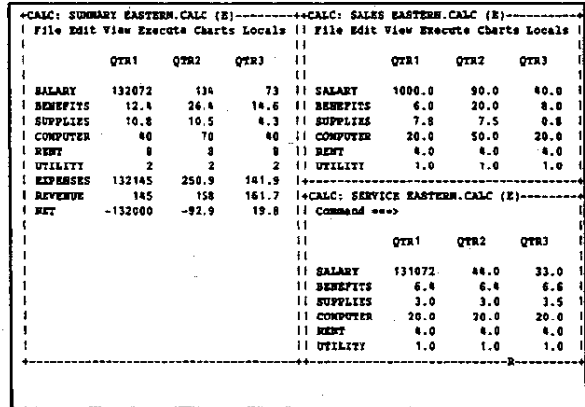
Operating System	Database
MVS	DB2 SYSTEM 2000
	CA-DATACOM/DB ADABAS
	IMS-DL/I ORACLE
CMS	ORACLE SYSTEM 2000
	SQL/DS
VMS	ORACLE Rdb/VMS
	INGRES
OS/2	AS400 PCFF
	Sybase Database Manager
	SQL Server
Windows	PCFF ODBC
	Sybase SQL Server
UNIX	ORACLE Sybase
	Ingres INFORMIX
	SQL Server

Three-Dimensional Spreadsheets

3-D spreadsheets handle data in a single spreadsheet using rows, columns, and pages. Each page has the same row and column dimensions. 3-D spreadsheets are best suited for applications where you would otherwise have several identical spreadsheets. The page dimension adds another level of information. Sometimes the page dimension can be thought of as equivalent to a BY variable in a SAS data set.

Data in 3-D spreadsheet can be viewed four different ways:

- row by column
- column by page
- row by page
- each page in a separate window in either a tile or cascade format.

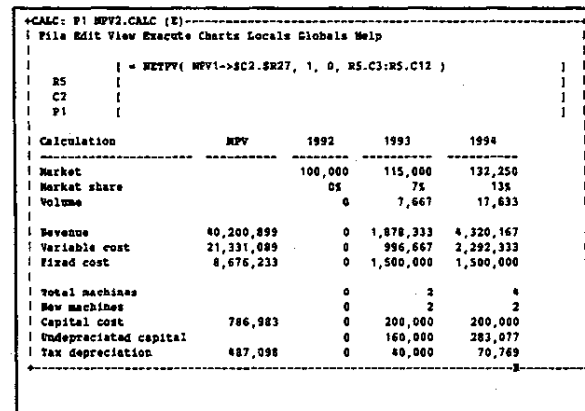


Display 5 Multiple Page Spreadsheet Tile Format

Calculations

Calculations in a spreadsheet are done by programs which represent sets of calculations together or are done by formulas which are computations assigned to specific cells.

Formulas can be placed in individual cells.



Display 6 Cell Formula

Formulas can be placed in SAS/CALC programs which are stored in PGM catalog entries. The program executes when a RUN, EXEC, or RECALC command is issued or when one or more cells are modified. The programs are written using screen control language.

```

+CALC: NPVP1.PGM (E)-----
| Command --->
|
| 00017 /* Initialize first year and first market first discount factor.*/
| 00018
| 00019 R19.C3 = NPV1->C2.R12; /* first year */
| 00020 R1.C3 = NPV1->C2.R8; /* first market */
| 00021 R16.C3 = 1.0; /* first discount factor */
| 00022
| 00023 /* Initialize the rest of years, markets, and discount factors. */
| 00024
| 00025 do i = 2 to 10;
| 00026 years[ i ] = years[ i - 1 ] + 1;
| 00027 mkt[ i ] = mkt[ i - 1 ] * ( 1 + NPV1->C2.R9 );
| 00028 disfact[ i ] = disfact[ i - 1 ] / ( 1 + NPV1->C2.R27 );
| 00029 and;
| 00030
| 00031 /* Establish the market share and set up volume per year. */
| 00032
| 00033 mktshr = NPV1->C2.R10 * MAX( 0, MIN( 1, ( years - NPV1->C2.R12 ) /
| 00034 NPV1->C2.R14 ) ) * MAX( 0, MIN( 1, 1 - ( years -
| 00035 NPV1->C2.R12 - NPV1->C2.R15 ) / NPV1->C2.R16 );
| 00036 vol = mkt * mktshr;
  
```

Display 7 Program

In addition the SCL program can invoke SAS/FSP and SAS/AF applications.

Spreadsheet Linking and Consolidation

Two or more spreadsheets can be linked together. Cells, columns, rows, pages, and ranges of a linked spreadsheet are referred to in the formula for a cell or in the program entry.

Links are first defined for the spreadsheets. In this example the CORPRATE spreadsheet is linked to the EASTERN spreadsheet and the WESTERN spreadsheet.

```

+CALC: PAGE1 CORPRATE.CALC (E)-----
| File Edit View Execute Charts Locals Globals Help
|
|+CALC: DRILLDOWN CORPRATE.CALC (E)-----
| File View Locals Globals Help
|
|
|
|
|
|
|
|
|
|          ELINK    IN.DEMO.EASTERN.CALC
|
| IN.DEMO.CORPRATE.CALC
|
|          WLINK    IN.DEMO.WESTERN.CALC
|
|
|
|
|
|
  
```

Display 8 Multiple Page Spreadsheet

The link names can be used in formula references.

```

+CALC: PAGE1 CORPRATE.CALC (E)-----
| File Edit View Execute Charts Locals Globals Help
|
|
| -ELINK-> SUMMARY.SALARY.QTR1 + WLINK->SUMMARY.SALARY.QTR1
|
| TOTAL    |
| QTR1     |
| PAGE1    |
|
|          QTR1    QTR2    QTR3    QTR4    ACTUAL    BUDGET
|
| TOTAL    | 132145  | 211.0  | 150.0  | 151.5  | 522.0  | 132658
| TOTAL    | 30.4    | 30.4   | 31.6   | 28.3   | 114.8  | 120.7
| TOTAL    | 14.3    | 14.0   | 8.6    | 9.0    | 26.6   | 45.9
| TOTAL    | 80.0    | 110.0  | 80.0   | 90.0   | 344.0  | 360.0
| TOTAL    | 16.0    | 16.0   | 16.0   | 19.2   | 67.2   | 67.2
| TOTAL    | 4.0     | 4.0    | 4.0    | 4.0    | 16.0   | 16.0
| TOTAL    | 132290  | 385.4  | 290.2  | 302.0  | 1090.6 | 133267
| TOTAL    | 290.0   | 316.0  | 323.4  | 294.0  | 1281.4 | 1223.4
| TOTAL    | -132000 | -69.4  | 33.2   | -8.0   | 190.8  | -132044
  
```

Display 9 Cell Formula

A composite link can point to multiple spreadsheets. Appropriate information is pulled from each spreadsheet. When a spreadsheet is modified, all spreadsheets that are dependent on the modified cell are also updated.

Spreadsheets can also be consolidated. When consolidated, only like-named cell values are imported. The cell values can be added, subtracted, or replaced.

Drill-Down Manager

Drill-down represents a graphical (or text based) representation of linked spreadsheets showing dependencies. You can activate and deactivate spreadsheet links, traverse tree structures, and open spreadsheets using a point-and-click graphical interface.

```

+CALC: PAGE1 CORPRATE.CALC (E)-----
|+CALC: Drilldown Actions--rts Locals Globals Help
|
| Select Action:  | QTR3    QTR4    ACTUAL    BUDGET
|
| Open           | 150.0   151.5   522.0   132658
| Activate       | 31.6    28.3    114.8   120.7
| Deactivate     | 8.6     9.0     26.6    45.9
| (Goback)       | 80.0    90.0    344.0   360.0
|                | 16.0    19.2    67.2    67.2
|
|+CALC (E)-----
| File View Locals Globals Help
|
|
|
|
|
|
|
|
|          ELINK    IN.DEMO.EASTERN.CALC
|
| IN.DEMO.CORPRATE.CALC
|
|          WLINK    IN.DEMO.WESTERN.CALC
|
|
|
|
|
|
  
```

Display 10 Drill Down

You can examine any of the spreadsheets as well as deactivate the spreadsheets' contribution to the summary spreadsheet.

```

+CALC: PAGE1 CORPRATE.CALC (R)-----
| File Edit View Execute Charts Locals Globals Help
+-----+-----+-----+-----+-----+-----+
| QTR1   QTR2   QTR3   QTR4   ACTUAL   BUDGET
+-----+-----+-----+-----+-----+-----+
| TOTAL  132145  211.0   150.0   151.5   522.0   132658
| TOTREN  30.4    30.4    31.6    28.3    114.8   120.7
| TOTSUPP 14.3    14.8     8.6     9.0    26.6    45.9
| TOTCOMP 80.0    110.0   80.0    90.0   344.0   360.0
| TOTRENT 16.0    16.0    16.0    19.2    67.2    67.2
| TOTUTIL 4.0     4.0     4.0     4.0    16.0    16.0
+-----+-----+-----+-----+-----+-----+
+CALC: SALES EASTERN.CALC (R)-----
| File Edit View Execute Charts Locals Globals Help
+-----+-----+-----+-----+-----+-----+
| QTR1   QTR2   QTR3   QTR4   BUDGET   ACTUAL   CHANGE
+-----+-----+-----+-----+-----+-----+
| SALARY 1000.0  98.0    40.0    44.0    112.0   1174.0  -1062.0
| BENEFITS 6.0    20.0    8.0     8.8    28.8    42.8    -14.0
| SUPPLIES 7.8    7.5     0.8     0.8    2.3    16.9    -14.6
| COMPUTER 20.0    50.0   20.0    25.0    86.0   115.0   -29.0
| RENT 4.0     4.0     4.0     4.8    16.8    16.8    0.0
| UTILITY 1.0     1.0     1.0     1.0     4.0     4.0     0.0
+-----+-----+-----+-----+-----+-----+

```

Display 11 Drill Down

Integrated Interactive Graphics

Integrated interactive graphics provide you the ability to examine the data in one or more spreadsheets using a variety of graphics:

- bar charts
- line charts
- pie charts
- sequence plots
- view multiple charts simultaneously.

The charts and the spreadsheets are hot-linked together which means changes made to the spreadsheet are automatically updated on the graph.

SAS/GRAPH software is not required to display the graph. However, to save the graph or replay it to a different device driver, SAS/GRAPH software is required.

Goal Seeking

SAS/CALC conducts goal seek, minimization, maximization, and what-if analysis.

- goal seek attempts to find the value for the cells specified in the parameter section that allow the target to have the goal value
- minimization attempts to find the values for the cells specified in the parameter section that allow the target to have the minimum value
- maximization attempts to find the values for the cells specified in the parameter section that

allow the target to have the maximum value

what-if calculates the value of the target cell for the current value or test value of the parameter cells.

You specify the desired value for the target cell and what parameter cell values are to be modified to reach the desired outcome.

```

+CALC: Y1990 WATER.CALC (R)-----
| File Edit View Execute Charts Locals Globals Help
+-----+-----+-----+-----+-----+-----+
+CALC: Solve Window
+-----+-----+-----+-----+-----+-----+
| Target section:
| Cell: REVENUE.BOW5                      Current value: 20383.11
+-----+-----+-----+-----+-----+-----+
| Method:
| * Goal seek   Goal value: 25000          Search control:
| o Minimize   Tolerance: 0.0100
| o Maximize   Maximum iterations: 400
| o What-if    Maximum executions: 1200
+-----+-----+-----+-----+-----+-----+
| Parameter section: (Maximum of 64, scroll for more parameters)
| Cell: REVENUE.BOW1                      Current value: 16620.92
| Test value: _____                  Lower: _____
| Parameter: 1                             Upper: _____
| (Run) (Undo) (Cancel) (Help)
+-----+-----+-----+-----+-----+-----+

```

Display 12 Goal Seek

A non-linear surface search method is used to find solutions. The required values for the parameter cells are reported.

```

+CALC: Y1990 WATER.CALC (R)-----
| File Edit View Execute Charts Locals Globals Help
+-----+-----+-----+-----+-----+-----+
+CALC: Solve Window
+-----+-----+-----+-----+-----+-----+
| NOTE: Analysis complete with 45 executions and 8 iterations.
| Target section:
| Cell: REVENUE.BOW5                      Current value: 24998.11
+-----+-----+-----+-----+-----+-----+
| Method:
| * Goal seek   Goal value: 25000          Search control:
| o Minimize   Tolerance: 0.0100
| o Maximize   Maximum iterations: 400
| o What-if    Maximum executions: 1200
+-----+-----+-----+-----+-----+-----+
| Parameter section: (Maximum of 64, scroll for more parameters)
| Cell: REVENUE.BOW1                      Current value: 21235.92
| Test value: _____                  Lower: _____
| Parameter: 1                             Upper: _____
| (Run) (Undo) (Cancel) (Help)
+-----+-----+-----+-----+-----+-----+

```

Display 13 Goal Seek

SUMMARY

SAS/CALC is a comprehensive application development toolkit for representing data in a table of rows and columns and defining simple and complex functions that define the relationships and modeling behavior of the data.