A PROJECT MANAGEMENT SYSTEM WRITTEN IN SAS SOFTWARE

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Abstract
An easy to use project management system was written in SAS software to track the analysis of clinical trials in a pharmaceutical company environment. This system uses SAS/FSP as an interactive tool to build and review a SAS database and uses SAS programs to produce monthly activity reports, Gantt charts, and calendars indicating start and finish dates for ongoing projects. The system was written and is operated in an environment without SAS/OR.

Introduction
This system was developed to track the analysis of clinical trials in the Biostatistics and Clinical Information Processing Department at Syntex Research. At Syntex, typical clinical trial passes through four stages of research data management: data acquisition, data entry, data compliance (quality assurance), and data analysis. It is essential to ensure that studies progress through these stages in a timely fashion. This system was designed to allow simple online monitoring of the progress of the clinical trials by the managers of each of the departments involved.

The other main design considerations were ease of maintenance and operation by relatively unsophisticated computer users.

Structure
The system has three parts:

1. A SAS dataset containing for each study: a description of the study, a description of the individuals to be involved at each phase, dates of completion, and current status for each task. This dataset was created using a batch SAS job which used a DATA step to create an empty dataset with a specified LENGTH, FORMAT, INFORMAT, and LABEL for each variable in the database. Observations are added to this dataset using PROC FSEDIT. As described below, five generations of the dataset exist at any time to allow error recovery.

   The program used to create this dataset is Appendix A.

2. A TSO CLiST to allow managers to browse and edit the database using FSEDIT/FSBROWSE. Each manager has a customized screen dataset allowing the updating of only those parameters under his/her control. Each manager can then browse and update the masterfile using PROC FSEDIT at his/her leisure. This CLiST is also used by support staff to rapidly enter the large quantity of data required when a new clinical program is initiated or when a large number of values need to be updated.

   The CLiST allocates the necessary OS datasets, executes SAS, and constructs a transaction dataset and specialized data screens in SAS to enter/edit data. The data is 'aged' in a five generation series of datasets using PROC DATASETS each time the database is modified. This allows the system to keep multiple backup datasets as "insurance" in the advent of an error.

   This activities are transparent to the user, who merely enters "%SCHEDULE" and is immediately executing PROC FSEDIT. The CLiST has been written to allow a user who wishes to only examine the dataset and not
edit it, can enter "%SCHEDULE ACCESS(BROWSE)". This stops PROC DATASETS from creating another generation of back-up datasets and reduces overhead costs.

This CLIST and the data entry screens are presented in Appendix B.

3. A set of Batch SAS jobs which are run against the database to produce summary reports for distribution to managers and clients. These reports include breakdowns by project and by individuals involved in projects as well as various sorts of tabular, calendar, and graphical displays of the status of a project. These reports are issued on a periodic basis and are used in scheduling and planning personnel activities.

A sample of one of these reports and program to construct it is presented in Appendix C.

DISCUSSION AND PROBLEMS

The method presented above allowed rapid development and implementation of the management system. Approximately one man-month of programmer time was used in the design and implementation of the system, far less than had the system been written in PL/I and integrated into the interactive environment to the same degree. Maintenance of the system is easy and again requires far less then the same software would have had it been written in PL/I. The most important consideration is that the system works, and does not require a great deal of expertise to use.

Drawbacks to using SAS/FSP to update and browse the file are that it limits the system to one user at a time. It provides no real security to the screen definition file or the raw data to prevent altering or changing inappropriate data, and that it requires the execution/compilation of the program each time it is run. Further, no easy method exists for doing 'SAVES' of the updated data short of jumping out of FSEDIT and reentering it. This could cause the loss of data if the system were to crash in the middle of an updating session.

At the time of this writing, Version 5 of SAS had not yet available. Our understanding is that in Version 5, SAS/FSP will be able to save changes without leaving PROC FSEDIT and that better protection against modification of the screen datasets will be provided.

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Appendix A

This short program is used to create the SAS dataset containing the schedule dataset.

DATA S.FY85;
LENGTH PROJECT $16 STATUS $16 DSNAME DCANAME BANAME BSNAME $16 CLIENT $16 DESC $80 COMMENTS $147;
FORMAT DPDATE DCDATE BADATE REPTDATE MMDDYY8;
INFORMAT DPDATE DCDATE BADATE REPTDATE MMDDYY8;
LABEL PROJECT='..Project'
STATUS =',Project. Status'
CLIENT =',Client'
DESC =',Description'
DSNAME=', Data,Specialist'
DCANAME=', Data,Compliance, Analyst'
BANAME=', Bioanalyst'
BSNAME=', Biostatistician'
DPDATE=', Date,Entered, DP'
DCDATE=', Date,Entered, DC'
DADATE=', Date,Entered, DA'
REPTDATE=', Date,Report, Due'
COMMENTS=', Comments';

Appendix B

This is the CLIST used to invoke the scheduling system from TSO. Note that invoking it as "%SCHEDULE" causes it to be invoked with the "Normal" access of that user. Invoking it as "%SCHEDULE ACCESS(BROWSE)" forces the system to be invoked in FSBROWSE only. This is also the case if a user who is unknown to the system invokes it. Lastly, if the system is invoked as "%SCHEDULE ACCESS(SYSTEM)" full access is given to the system.
PROC Q ACCESS(NORMAL)
/*========================================================*/

PROJECT MANAGEMENT SYSTEM

VERSION 2.1

THIS CLIST WILL PROVIDE A MEANS FOR ENTERING AND
BROWERING DATA INTO THE PMS DATABASE. THE ACCESS
PARAMETER IN THE EXEC STATEMENT WILL ALLOW DEBUGGING
AND OVERRIDING THE CLIST SECURITY SYSTEM.

PROGRAMMER: AJL CARY 10/12/84

WRITE ACCESS ACCESS SPECIFIED.
IF &ACCESS = NORMAL THEN DO
    /* ACCESS ACCOUNTS FOR BIOSTATISTICS MANAGERS */
    IF &SYSUID = xxxxx OR &SYSUID = xxxxx THEN SET ACCESS = BSSCREEN

    /* ACCESS ACCOUNTS FOR DATA PROCESSING MANAGERS */
    IF &SYSUID = xxxxx THEN SET ACCESS = DSSCREEN

    /* ACCESS ACCOUNTS FOR DATA COMPLIANCE MANAGER */
    IF &SYSUID = xxxxx THEN SET ACCESS = DCSCREEN

    /* ACCESS ACCOUNTS FOR DATA ANALYSIS MANAGERS */
    IF &SYSUID = xxxxx OR &SYSUID = xxxxx THEN SET ACCESS = BASCREEN
END

IF &ACCESS = BSSCREEN OR &ACCESS = BASCREEN OR &ACCESS = DSSCREEN OR
 - ACCESS = DCSCREEN OR ACCESS = SPECIAL
 - THEN DO /* for identified restricted users */
    ALLOCATE F(IN) DAT 'MEN.R7151.PUB.PMS.SCHEDULE.SASLIB'
    OLD DATA
    %SAS OPTIONS ('CLIST')
    DATA FY85; SET IN.FY85;
    PROC DATASETS DDNAM£=IN NOlIST: AGE FY85 PREV1-PREV5;
    PROC FSEDIT DATA=FY85 SCREEN=IN &ACCESS OPTION=I;
    FORMAT STATUS $STATFMT11;
    DATA IN.FY85; SET FY85;
ENDSAS: ENDDATA FREE FILE(IN)
END

ELSE IF &ACCESS = NORMAL OR &ACCESS = BROWSE THEN DO

    /* HANDLE THOSE SESSIONS WHICH WILL ONLY USE FSBROWSE */
    ALLOCATE F(IN) DAT 'MEN.R7151.PUB.PMS.SCHEDULE.SASLIB'
    SHR DATA
    %SAS OPTIONS ('CLIST')
    PROC FSBROWSE DATA=IN.FY85 SCREEN=IN.SYSTEM OPTION=I;
    FORMAT STATUS $STATFMT11;
RUN
ENDSAS: ENDDATA FREE FILE(IN)
END
ELSE WRITE INVALID ACCESS SPECIFICATION
WRITE EXITING PROJECT MANAGEMENT SYSTEM &SYSDATE &SYSTIME
END

The following screen is used for data entry.

PROJECT MANAGEMENT SYSTEM

PROJECT: TRIAL 1  STATUS: COMPLETED CLIENT: A

DESCRIPTION: DRUG A VS DRUG B - TWO PERIOD CROSSOVER

DATA SPECIALIST: GLOIN THORINSSON DATE ENTERED DATA PROCESSING: 12/10/84
DC ANALYST : FREDIGAR BOLGER DC ANALYST: 12/24/84
BIOANALYST : RHADAGAST BROWN DATE ENTERED DATA COMPLIANCE: 01/07/85
BIOSPECIALIST: ELENDEL HALFEL PROJECT COMPLETION DATE: 02/04/85

COMMENTS:

****************************************************
STATUS CODES ARE: IN DP AW ANALYSIS CANCELLED IN DC AW DC
AW IN DA HOLD COMPLETED IN DP AW
****************************************************
Appendix C

The attached program is a sample of a customized report written against the database. The report shows the scheduled activities for a given program (program would be a collection of projects related in some fashion. For this report it is the first Drug mentioned in the Description.) and client.

DATA WORK;
SET S.SCHEDULE;
ARRAY DPWEEK I $ DPWEEK01-DPWEEK26;
ARRAY DCWEEK I $ DCWEEK01-DCWEEK26;
ARRAY DAWEEK I $ DAWEEK01-DAWEEK26;
/* if an activity is present in a given week put an asterisk in that week */
DO I=INTCK('WEEK', '31DEC84'D,DPDATE) TO INTCK('WEEK', '31DEC84'D,DPDATE);
IF 1<=I<=27 THEN DPWEEK="*":
END;
DO I=INTCK('WEEK', '31DEC84'D,DCDATE) TO INTCK('WEEK', '31DEC84'D,DCDATE);
IF 1<=I<=27 THEN DCWEEK="*":
END;
DO I=INTCK('WEEK', '31DEC84'O,OADATE) TO INTCK('WEEK', '31DEC84'D,REPTDATE);
IF 1<=I<=27 THEN DAWEEK="*":
END;
PROGRAM=SUBSTR(DESC,1,6):
/* selects program */
PROC SORT; BY CLIENT PROGRAM;
DATA _NULL_;/* print the report out in a data step */
SET WORK END=LASTOBS; BY CLIENT PROGRAM;
FILE PRINT PS=50 LS=110 N=PS HEADER=NEWPAGE;
BAR='!'; COLOR=:
/* if its the last obs in a program or a client or if there are 8 observations on the page put a new page unless it is the very last obs in the dataset */
IF (MODI N,8)=0 OR LAST. PROGRAM OR LAST.CLIENT AND NOT LASTOBS; THEN PUT PAGE;
RETURN;
NEWPAGE: /* heading information for each page */
PUT @5 CLIENT @23 'STATUS' @41 'DATE' @59 'M/D/Y' / @5 'PROJECT' @23 'TASK' @41 'INDIVIDUAL' @59 'NAME' / @5 'DATE' @23 'DATE' @41 'DATE' /;
RETURN;
492
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<th>PROJECT/STATUS</th>
<th>TASK</th>
<th>DATA PROCESSING</th>
<th>DATA COMPLIANCE</th>
<th>RESPONSIBLE INDIVIDUAL</th>
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