Using the SYSTEM 2000® DBMS Query Language

Sue Trueblood Rakes, SAS Institute Inc.

Abstract

The basic SYSTEM 2000 software product provides solutions for the spectrum of Information Center needs. It features an integrated data dictionary, on-line query/update, report generator, relational data base access, and programming language interfaces.

Integrated Data Dictionary

The IDD (Integrated Data Dictionary) handles data base information and processes that are integral to data base management functions. The dictionary is at the core of SYSTEM 2000 DBMS and handles definition, communication, and control functions for SYSTEM 2000 data bases.

All access to data bases through user views is authorized by dictionary security information. The dictionary can also store queries defined by the programmer or data base administrator for subsequent recall.

English-like Language (QUEST)

The SYSTEM 2000 query/update (QUEST) language is especially useful for those who need ad hoc access to the data base and for applications developers who need data base testing and prototyping tools. In addition, a SAS® procedure allows users to execute SYSTEM 2000 commands from within the SAS Display Manager.

SYSTEM 2000 Query Language

QUEST, SYSTEM 2000 DBMS's query language facility, provides an English-like syntax for creating, updating, and retrieving a data base. QUEST provides nine basic commands for relational, ad hoc access to a SYSTEM 2000 data base. The commands include three basic retrieval formats and six update commands. The simplest of the retrieval commands is the PRINT command, which displays one item value per line of output. The output of a LIST or PRINT request can have up to 25 ascending and/or descending sort items. (See FIGURE 1.)

A second retrieval command, LIST, produces columnar output that satisfies the majority of ad hoc reporting requirements. LIST automatically generates column headings and adjusts column spacing. The LIST command provides a number of parameters that allow the user greater control of display format to customize output. With the ORDER BY directive, the output of a LIST or PRINT request can have up to 25 ascending and/or descending sort items. (See FIGURE 2.)

The TALLY command provides a histogram display of data item values and occurrence frequency. (See FIGURE 3.)

The user has a choice of four item modification commands in order to accomplish data changes: ADD, ASSIGN, CHANGE, and REMOVE. In addition, for records, INSERT and REMOVE operations can be performed to make value modifications to the data base. (See FIGURE 4.)

All retrieval and update commands can specify selection criteria by means of a WHERE-clause. Easy-to-use syntax accomplishes relational-like access to data items and records for retrieval or update. Note the following operators:

- Boolean, Relational, and Unary Operators:
  - AND, OR, NOT
  - EQUAL, NOT EQUAL, GREATER THAN, LESS THAN, LESS THAN OR EQUAL TO
  - EXISTS, FAILS, SPANS, CONTAINS, HAS

The user can search character or text data for specific character strings. (See FIGURE 5.)

User-defined procedures can be stored in macro fashion as a user convenience. The user enters the procedure name or number, which invokes the stored procedure. These user procedures can be composed of:

- partial commands
- whole commands
- multiple commands
- arithmetic commands

or any combination of the above. In addition, QUEST provides six of the most frequently used arithmetic procedures: to sum (SUM); to count (COUNT); to determine the minimum (MIN); to determine the maximum (MAX); to determine the average (AVG); to determine the standard deviation (SIGMA), as well as four function arithmetic symbols: addition (+); subtraction (-); multiplication (*); division (/). (See FIGURE 6.)

The SYSTEM 2000 DBMS Report Writer feature allows end users and programmers alike to describe multiple, complex reports with a free-form language and to generate reports from all or selected portions of a data base. Up to 99 report formats can be processed with a single pass of the relevant portions of the data base. In addition, Report Writer supports access to non-SYSTEM 2000 files.
Report Writer provides controls for specifying:

- data editing including page headings, column headings, body or detail lines, subtotals, footings, (grand) totals
- temporary variable for keeping calculations
- sorted output ascending/descending sorts
- control breaks. (See FIGURE 7.)

The Report Writer facility provides on-line and batch report specification and generation for complex reporting requirements. Report Writer is easy to use for programmers and end users and represents a powerful adjunct to SYSTEM 2000 DBMS's QUEST facilities.

SYSTEM 2000 DBMS offers the QueX™ (Query/Update by Example) software product for the end-user environment. The QueX software product extends the power of SYSTEM 2000 DBMS beyond QUEST and Report Writer. It offers function-driven, screen-oriented query/update to the non-DP user. It supports full networking and multiple data base access. It also prompts the end user step by step through his authorized logical view of data.

QueX software is based on a sequence of screen displays and starts a session with a request for the end user's password. It extracts the logical record the user is authorized to update or retrieve and asks the user to select the record type to be accessed. (See FIGURE 8.) After displaying the record format, the user can simply supply partial data and direct the system to locate the record and complete the missing data. Once positioned on the initial record, the user has full flexibility in retrieving single or multiple records related to this or any other record in any data base.

The QueX software product automatically controls concurrency and helps the user through each retrieval operation. The current data base and current record are displayed continually.

Full Boolean selection logic is supported. In addition, the user can perform data entry, deletion, and modification.

The QueX software product is available on 3270 or compatible terminals under IBM CICS and TSO and Sperry environments. It is truly query by example plus update. It is the solution to immediate end-user productivity.

The QUEST free-form language provides simple commands for users; assists nontechnical users; provides both update and retrieval capabilities; and relieves dependency on DP.

The commands PRINT, LIST and TALLY allow easy browsing and provide flexibility in generating output.

The where-clause with TEXT search and Boolean logic provides a powerful search facility; presents a relational view of data; and supports indexed and nonindexed searches.

Functions summarize data and provide "what if" views.

Report Writer provides further freedom from programming (even with complex reporting) and produces high-volume, formal reports.

User-defined procedures are easy to use, aid productivity, and minimize educational needs.

The QueX software product offers multiple data base access; requires minimal training; provides menu orientation using function keys; tailors SYSTEM 2000 DBMS to user needs through a self-contained language; supports prompting; and supports consistency of use in repetitive request situations.

Connections between SYSTEM 2000 DBMS and the SAS System

PROC QUEST is a member of a growing family of interfaces between SYSTEM 2000 DBMS and the SAS System. The boundaries between SYSTEM 2000 DBMS and the SAS System will become steadily less significant as the products become completely integrated. The following software components have been conceived, designed, developed, tested, documented, and packaged:

1. PROC S2K

A facility to subset and download SYSTEM 2000 data into a SAS file. PROC S2K reads the IDD (Integrated Data Dictionary) of a designated data base and displays a menu of component/record names and pictures. Users can check off the items they want and enter an optional subsetting command (essentially a SYSTEM 2000 where-clause). PROC S2K then downloads the data into a SAS data set.

2. PROC S2KLOAD

A FLEX program that uploads a flat file into a SYSTEM 2000 data base. Any SAS data set can be easily dumped into a flat file format that can be handled by PROC S2KLOAD.

3. PROC QUEST

PROC QUEST allows the SAS user to either log on to a Multi-User™ copy of SYSTEM 2000 DBMS, or load his own single-user copy of SYSTEM 2000 DBMS, and issue SYSTEM 2000 SCF commands.
FIGURE 1
Sample PRINT Commands

PRINT EMPLOYEE NUMBER, LAST NAME, FORENAME, VACATION ACCRUED:

EMPLOYEE NUMBER: 1043
LAST NAME: GIBSON
FORENAME: MOLLY I.
ACCRUED VACATION: 40.00

EMPLOYEE NUMBER: 1120
LAST NAME: REID
FORENAME: DAVID G.
ACCRUED VACATION: 72.00

PRINT HIRE DATE, POSITION TITLE WHERE LAST NAME EQ GIBSON AND FORENAME EQ MOLLY:
HIRE DATE: 10/01/78
POSITION TITLE: CONTRACTS ADMINISTRATOR

FIGURE 2
Sample LIST Commands

LIST LAST NAME, FORENAME, PAY RATE, ORDERED BY PAY RATE WHERE DEPARTMENT EQ ENGINEERING AND PAY RATE LT $2,400:

LAST NAME  FORENAME  PAY RATE
RICHARDSON  TRAVIS   $2,180.00
FREEMAN      GEORGE   $2,200.00
BROWN        ROBERT   $2,200.00
ALLAN        MICHELLE $2,225.00

FIGURE 3
TALLY Command

TALLY SECURITY CLEARANCE:
****************************
ITEM SECURITY CLEARANCE
****************************

57 CONFIDENTIAL
12 SECRET
5 TOP SECRET
412 UNCLASSIFIED

4 DISTINCT VALUES

486 TOTAL OCCURRENCES

FIGURE 4
QUEST Update Commands

REMOVE SALARY WITHIN POSITION WHERE EMPLOYEE NUMBER EQ 1109 AND START DATE EQ 01/31/80:
-1 SELECTED RECORD(S)

ASSIGN SECURITY CLEARANCE EQ SECRET WHERE DEPARTMENT EQ NUCLEAR RESEARCH OR POSITION TITLE EQ PHYSICIST:
-178 SELECTED RECORD(S)

CHANGE PAY RATE=(PAY RATE+12) WHERE POSITION TITLE EQ SENIOR FINANCE OFFICER AND HIRE DATE LE 12/31/78:
-14 SELECTED RECORD(S)

ADD EMPLOYEE STATUS EQ EXEMPT WHERE PAY SCHEDULE SPANS G-1-G-4:
-285 SELECTED RECORD(S)

FIGURE 5
Powerful Where-clause Syntax

PRINT COUNT EMPLOYEE WHERE POSITION TITLE CONTAINS THE WORD ADMINISTRATOR AND PAY RATE LE $1,800:
COUNT EMPLOYEE:

LIST LAST NAME, FORENAME, DEPARTMENT WHERE LAST NAME WHERE ETHNIC ORIGIN EQ ANGLO-AMERICAN AND HIRE DATE LE 01/01/80:

LAST NAME  FORENAME  DEPARTMENT
ALVAREZ     JIM       RECEIVING
BARTLETT    THOMAS    SALES
MANSFIELD   ALFRED    FINANCE
ORLANDO     MARIA     MANUFACTURING
THOMAS      ROBERT    ENGINEERING

FIGURE 6
User Procedures

DEFINE: 1100/WAGE REPORT(STRING$LIST LAST NAME, FORENAME, PAY RATE, ORDERED BY LAST NAME WHERE POSITION TITLE EQ "ENGINEERING")
MAP: *WAGE REPORT(ENGINEER)

INVOKE A USER PROCEDURE

<table>
<thead>
<tr>
<th>LAST NAME</th>
<th>FORENAME</th>
<th>PAY RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKINS</td>
<td>WALTER</td>
<td>$2,100.00</td>
</tr>
<tr>
<td>BATES</td>
<td>JOHN</td>
<td>$1,800.00</td>
</tr>
<tr>
<td>DAVIS</td>
<td>MICHELLE</td>
<td>$2,425.00</td>
</tr>
<tr>
<td>LEWIS</td>
<td>JAMES</td>
<td>$2,136.00</td>
</tr>
</tbody>
</table>

383
FIGURE 7
Report Specification Example

REPORT:
FOR REPORT SAMPLE1:
ORDER BY DEPARTMENT, LAST NAME, FORENAME:
SKIP 20 LINES,
PRINT(20)/CURRENT EMPLOYEES BY DEPARTMENT/:
PRINT(28)/XYZ CORPORATION/:
FOR DEPARTMENT, SKIP 5 LINES:
PRINT(5)/LAST NAME/,(20)/FIRST NAME/, (35)/EMP NUMBER/, (50)/HIRE DATE/:
PRINT(5)/---/, (20)/---/, (35)/---/, (50)/---/:
AT END, SKIP 2 LINES:
PRINT(5)/EMPLOYEES OF DEPARTMENT -/, L(30,X(16))DEPARTMENT:
FOR RECORD,
PRINT L(5,X(12))LAST NAME, L(20,X(10)), FORENAME,
R(35,29999)EMPLOYEE NUMBER, R(50)HIRE DATE:
END REPORT:
GENERATE SAMPLE1 WHERE DEPARTMENT EQ ADMINISTRATION:

FIGURE 8
QueX Session

REPORT:
FOR REPORT SAMPLE1:
ORDER BY DEPARTMENT, LAST NAME, FORENAME:
SKIP 20 LINES,
PRINT(20)/CURRENT EMPLOYEES BY DEPARTMENT/:
PRINT(28)/XYZ CORPORATION/:
FOR DEPARTMENT, SKIP 5 LINES:
PRINT(5)/LAST NAME/, (20)/FIRST NAME/, (35)/EMP NUMBER/, (50)/HIRE DATE/:
PRINT(5)/---/, (20)/---/, (35)/---/, (50)/---/:
AT END, SKIP 2 LINES:
PRINT(5)/EMPLOYEES OF DEPARTMENT -/, L(30,X(16))DEPARTMENT:
FOR RECORD,
PRINT L(5,X(12))LAST NAME, L(20,X(10)), FORENAME,
R(35,29999)EMPLOYEE NUMBER, R(50)HIRE DATE:
END REPORT:
GENERATE SAMPLE1 WHERE DEPARTMENT EQ ADMINISTRATION:

PART NAME BEARING
PART NUMBER A7903
PART SIZE PX-49
MINIMUM ORDER 3000
PRIME VENDOR ACME METALS
CURRENT COST 11.26
SELECT RECORD PART
HELP MODIFY COUNT

1. DURING A TYPICAL SESSION, QUEX SUPPLIES A RECORD DESCRIPTION.
2. THEN THE USER FILLS IN WHAT HE KNOWS.
3. QUEX FILLS IN THE BLANKS.
4. A USER CAN MODIFY DATA.
5. A USER CAN REQUEST ANY RELATED RECORD.
6. QUEX SUPPLIES ANY RECORD FROM ANY DATA BASE.

SAS and SYSTEM 2000 are registered trademarks of SAS Institute Inc., Cary, NC, USA. Multi-User and QueX are trademarks of SAS Institute Inc. A footnote should accompany the first use of each registered trademark or trademark and should state that the referenced trademark is used to identify products or services of SAS Institute Inc.