SQL Processing with SAS® Tip Sheet

This tip sheet is associated with the SAS® Certified Professional Prep Guide Advanced Programming Using SAS® 9.4. For more information, visit www.sas.com/certify

Basic Queries

PROC SQL <*options*>;
  SELECT *column-1* <, ...*column-n*>
    FROM *input-table*
    <**WHERE** *expression*>
    <**GROUP BY** *col-name*>
    <**HAVING** *expression*>
    <**ORDER BY** *col-name*> <**DESC**> <,...*col-name*>;

SQL Query Order of Execution:

Clause	Description
SELECT	Retrieve data from a table
FROM	Choose and join tables
WHERE	Filter the data
GROUP BY	Aggregate the data
HAVING	Filter the aggregate data
ORDER BY	Sort the final data

Managing Tables

CREATE TABLE	**CREATE TABLE** *table-name* (*column-specification-1*<, ...*column-specification-n*>);
DESCRIBE TABLE	**DESCRIBE TABLE** *table-name-1* <,...*table-name-n*>;
DROP TABLE	**DROP TABLE** *table-name-1* <,...*table-name-n*>;

Managing Views

CREATE VIEW	**CREATE VIEW** *table-name* **AS** *query*;
DESCRIBE VIEW	**DESCRIBE VIEW** *view-name-1* <,...*view-name-n*>;
DROP VIEW	**DROP VIEW** *view-name-1* <,...*view-name-n*>;

Modifying Columns

LABEL=	**SELECT** *col-name* **LABEL=***'column label'*
FORMAT=	**SELECT** *col-name* **FORMAT=***format.*
Creating a new column	**SELECT** *col-name* **AS** *new-col-name*
Filtering new columns	**WHERE CALCULATED** *new-col-name*

Modifying Rows

Inserting rows into tables	**INSERT INTO** *table* **SET** *column-name=value* <, ...*column-name=value*>; **INSERT INTO** *table* <(*column-list*)> **VALUES** (*value*<,...*value*>); **INSERT INTO** *table* <(*column-list*)> **SELECT** *column-1*<,...*column-n*> **FROM** *input-table*;
Eliminating duplicate rows	**SELECT DISTINCT** *col-name*<,...*col-name*>
Filtering rows	**WHERE** *col-name* **IN** (*value1*, *value2*, ...) **WHERE** *col-name* **LIKE** *"_string%"* **WHERE** *col-name* **BETWEEN** *value* **AND** *value* **WHERE** *col-name* **IS NULL** **WHERE** *date-value* *"<01JAN2019>"***d** **WHERE** *time-value* *"<14:45:35>"***t** **WHERE** *datetime-value* *"<01JAN201914:45:35>"***dt**

Remerging Summary Statistics

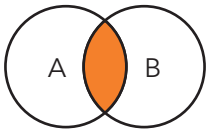
SELECT *col-name*, *summary function*(*argument*)
  FROM *input table*;

SQL Processing with SAS® Tip Sheet

This tip sheet is associated with the SAS® Certified Professional Prep Guide Advanced Programming Using SAS® 9.4. For more information, visit www.sas.com/certify

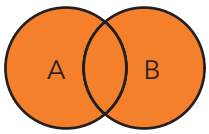
Joins Summary

Inner Join



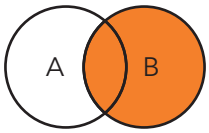
SELECT *<list>*
FROM *table-A* **INNER JOIN** *table-B*
ON A.*Key*=B.*Key*;

Full Join



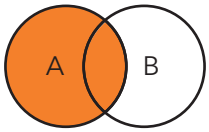
SELECT *<list>*
FROM *table-A* **FULL JOIN** *table-B*
ON A.*Key*=B.*Key*;

Right Join



SELECT *<list>*
FROM *table-A* **RIGHT JOIN** *table-B*
ON A.*Key*=B.*Key*;

Left Join



SELECT *<list>*
FROM *table-A* **LEFT JOIN** *table-B*
ON A.*Key*=B.*Key*;

Creating Macro Variables

Storing a value in a macro variable using SQL:

SELECT *col-name-1 <,...col-name-n>*
INTO:*macrvar_1<,...macvar-n>*
FROM *input-table*;

Storing a list of values in a macro variable using SQL:

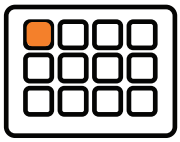
SELECT *col-name-1 <,...col-name-n>*
INTO:*macrvar_1* **SEPARATED BY** *'delimiter'*
FROM *input-table*;

Viewing the value of the macro variable in the SAS Log:

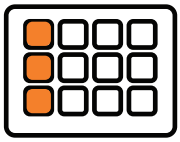
%PUT &=*macvar*;

Subqueries

SELECT *col-name*,
(**SELECT** *function*(*argument*)
FROM *input-table*)
FROM *input-table*;

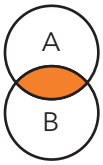


SELECT *col-name*, *<,...col-name>*
FROM *input-table*
WHERE *col-name*
(**SELECT** *function*(*argument*)
FROM *input-table*)



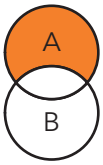
Set Operators

The INTERSECT operator selects unique rows that are common to both tables.



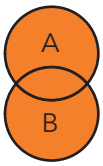
SELECT *<list>*
FROM *table-A* **INTERSECT**
SELECT *<list>*
FROM *table-B*;

The EXCEPT operator selects unique rows from table A that are not found in table B.



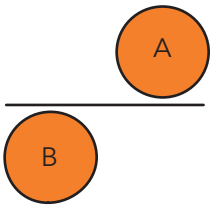
SELECT *<list>*
FROM *table-A* **EXCEPT**
SELECT *<list>*
FROM *table-B*;

The UNION operator selects unique rows from both tables.



SELECT *<list>*
FROM *table-A* **UNION**
SELECT *<list>*
FROM *table-B*;

The OUTER UNION operator selects all rows from both tables.



SELECT *<list>*
FROM *table-A* **OUTER UNION**
SELECT *<list>*
FROM *table-B*;

Accessing DBMS Data

The SQL pass-through facility enables you to code in the native DBMS SQL syntax and pass the query to the database.

PROC SQL;
CONNECT TO *DBMS-name* <**AS** *alias*>
(*DBMS-connection-options*);
SELECT *col-name*
FROM CONNECTION TO *DBMS-name|alias* (*dbms-query*);
DISCONNECT FROM *DBMS-name|alias*;
QUIT;

SAS® Macro Language Processing

This tip sheet is associated with the SAS® Certified Professional Prep Guide Advanced Programming Using SAS® 9.4. For more information, visit www.sas.com/certify

SAS Macro Facility

Creating Macro Variables

Syntax	Description
%GLOBAL *macro-variable-1 ...macro-variable-n*;	Creates a macro variable that is available during the execution of the entire SAS session.
%LET *variable=value*;	Creates a macro variable and assigns it a value.
%LOCAL *macro-variable-1 ...macro-variable-n*;	Creates a macro variable that is available only during the execution of the macro where it is defined.

Defining a Macro

%MACRO *macro-name* <(*parameter-list*)>;
macro-text
%MEND <*macro-name*>;

The *parameter-list* can be:
<*positional-parameter-1*, ...*positional-parameter-n*> or
<*keyword-1=value-1*, ...*keyword-n=value-n*>

Calling a Macro

%macro-name
%macro-name(positional-parameter-1, ...positional-parameter-n)
%macro-name(keyword-1=value-1, ...keyword-n=value-n)

Referencing a Macro Variable

Use the name of the macro variable with an ampersand.
&macro-variable;

Macro Character Functions

Syntax	Description
%INDEX (*source*, *string*)	Determines the position of the first character of a string within another string.
%SCAN (*argument*, *n*, <*charlist* < ,*modifiers*>>)	Searches the argument and returns the *n*th word.
%SUBSTR(*argument*, *position*, <,*length*>)	Produces a substring of character string (*argument*) by extracting the specified number of characters (*length*) beginning at the specified starting position.
%UPCASE(*character-string*| *text-expression*)	Converts lowercase characters in the argument to uppercase.

SAS Functions with Macro Variables

Syntax	Description
%EVAL(*arithmetic or logical expression*)	Evaluates arithmetic and logical expressions using integer arithmetic.
%SYSEVALF(*expression* <,*conversion-type*>)	Evaluates arithmetic and logical expressions using floating-point arithmetic.
%SYSFUNC(*function* (*argument-1* <...*argument-n*>) <,*format*>)	Executes SAS functions or user-written functions in the macro facility.

Troubleshooting Macro Variable References

Enables you to write your own messages to the SAS log.
%PUT *text*;

Deletes the specified variables from the macro global symbol table.
%SYMDEL *macro-variable-1* <...*macro-variable-n*></*option*>;

SAS® Macro Language Processing

This tip sheet is associated with the SAS® Certified Professional Prep Guide Advanced Programming Using SAS® 9.4. For more information, visit www.sas.com/certify

Masking Special Characters

Syntax	Description
%STR(*argument*)	Hides the usual meaning of a semicolon(;) so it appears as constant text.
%**NRSTR** (*character-string*)	Hides the usual meaning of an ampersand (&) or a percent sign (%) so they appear as constant text.
%**SUPERQ** (*argument*)	Masks all special characters and mnemonic operators at macro execution but prevents further resolution of the value.
%**BQUOTE**(*character-string | text-expression*)	Masks special characters and mnemonic operators in a resolved value at macro execution.
%**QUPCASE**(*character-string | text-expression*)	Converts values to uppercase and returns a result that masks special characters and mnemonic operators.
%**QSUBSTR**(*argument, position <,length>*)	Produces a substring of a character string.
%**QSCAN**(*argument, n <,charlist<, modifiers>>*)	Searches for a word and masks special characters and mnemonic operators.
%**QSYSFUNC**(*function(arguments) <,format>*)	Executes functions and masks special characters and mnemonic operators.

Conditional Processing

%IF *expression* **%THEN** *text*;
<%ELSE *text***>;**

%IF *expression* **%THEN %DO;**
text and/or macro language statements;
%END;
%ELSE %DO;
text and/or macro language statements;
%END;

%DO *index-variable=start* **%TO** *stop* <%BY *increment*>;
text
%END;

Options

OPTIONS MCOMPILENOTE= NONE | NOAUTOCALL | ALL;
OPTIONS MPRINT | **NOMPRINT**;
OPTIONS MLOGIC | **NOMLOGIC**;
OPTIONS MAUTOSOURCE | **NOAUTOSOURCE**;

Creating Macros in SQL

PROC SQL NOPRINT;
SELECT *column1<,column2,...>*
INTO :*macro-variable-1<,:macro-variable-2,...>*
<TRIMMED>
FROM *table-1 | view-1*
<WHERE *expression*>
<*other clauses*>;
QUIT;

DATA Step Interface

CALL SYMPUTX(*macro-variable-name*, *value* <,*symbol-table*>);

PUT(*source*,*format.*);

Advanced Macro Techniques

%INCLUDE *file-specification* </SOURCE2>;

DOSUBL(*text-string*)**;**

Default Autocall Library

%LOWCASE(*argument*)
%QLOWCASE(*argument*)
%LEFT(*argument*)
%TRIM(*argument*)
%CMPRES(*argument*)
%DATATYP(*argument*)

Advanced SAS® Programming Techniques

This tip sheet is associated with the SAS® Certified Professional Prep Guide Advanced Programming Using SAS® 9.4. For more information, visit www.sas.com/certify

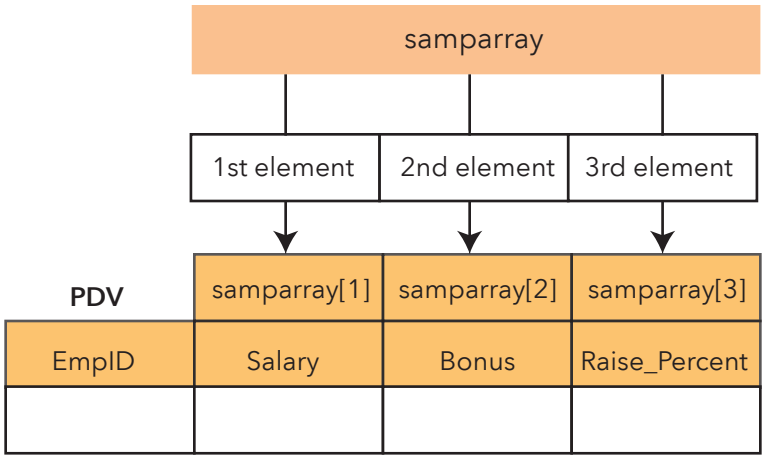
Arrays

Defining an array

ARRAY *array-name*<[*number-of-array-elements*]>
<$> <*length*> <*array-elements*>
<_TEMPORARY_> <(*initial-values*)>;

Referencing an array

array-name[*element-number*];



The number of elements must be enclosed in either parentheses ( ), braces { }, or brackets [ ].

Unknown Number of Elements

Use an asterisk (*) within your brackets when defining an array.

Use the DIM function to return the number of elements in an array.

DIM(*array-name*);

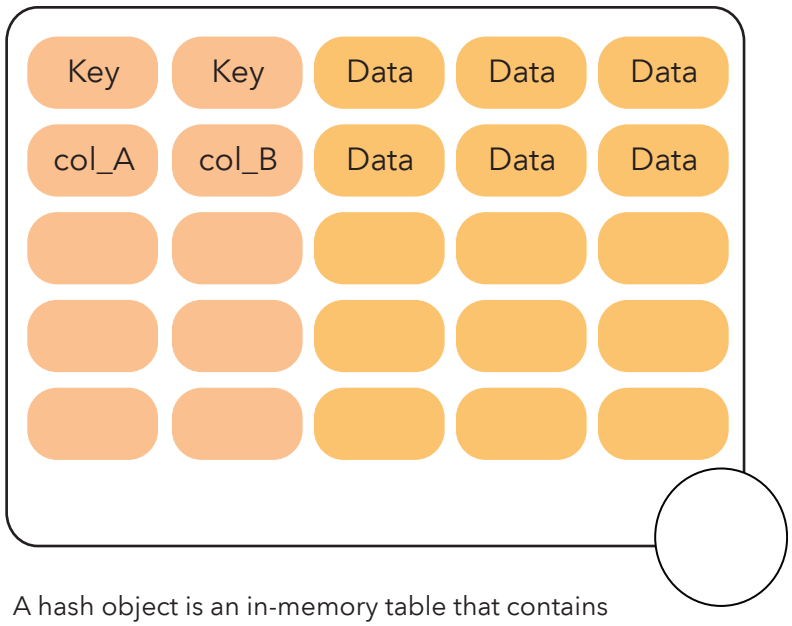
Two-Dimensional Arrays

ARRAY *array-name*
[*number-of-rows*,*number-of-columns*];

array samplearray[3,2];

The example above creates an array named SampleArray which has 3 rows and 2 columns.

Hash Objects



A hash object is an in-memory table that contains key and data components.

Hash Object and Iterator Process

Declaring hash object or hash iterator object:

DECLARE hash *object-name*
(<*argument_tag-1*:*value-1*, ...>);

DECLARE hiter *object-name*
('*hash-object-name*');

Defining a hash object:

object-name.**ADD( )**;
object-name.**DEFINEKEY**('*key-1*' <, ...'*key-n*'>);
object-name.**DEFINEDATA**('*data-1*' <, ...'*data-n*'>);
object-name.**DEFINEDONE**( );
object-name.**OUTPUT**( );

Using a hash object:

object-name.**FIND**( );

Retrieving a hash object with a hash iterator object:

object-name.**FIRST**( );
object-name.**LAST**();
object-name.**NEXT**();
object-name.**PREV**( );

Advanced SAS® Programming Techniques

This tip sheet is associated with the SAS® Certified Professional Prep Guide Advanced Programming Using SAS® 9.4. For more information, visit www.sas.com/certify

Picture Formats

PROC FORMAT;
  PICTURE *format-name* <(*format-options*)>
  <*value-range-set-1*= '*template-value*' (*template-options*)>
  <*value-range-set-n*= '*template-value*' (*template-options*)>;
RUN;

Options

Creating Custom Date, Time, Datetime Formats

DATATYPE=DATE | TIME | DATETIME
enables the use of directives in the picture as a template to format date, time, or datetime values.

DEFAULT=length
specifies the default length of the picture.

Creating Custom Numeric Formats

MULT|MULTIPLIER=*n*
specifies a number to multiply the value by.

PREFIX='*prefix*'
specifies a character prefix to place in front of the formatted value.

ROUND
rounds the value to the nearest integer before formatting.

Creating Functions

PROC FCMP OUTLIB=*libref.table.package*;
  FUNCTION *function-name*(*arguments*) <$> <*length*>;
    . . . *programming statements* . . .
  RETURN(*expression*);
  ENDSUB;
QUIT;

Using Custom Functions

OPTIONS CMPLIB=*libref.table* | (*libref.table-1*...*libref.table-n*)

Advanced Functions

LAG<*n*>(*column*);
COUNT(*string, substring*<,*modifiers*>);
COUNTC(*string, character-list*<,*modifiers*>);
COUNTW(*string,* <,*delimiters*><,*modifiers*>);
FIND(*string, substring*<,*modifiers*><,*start-position*>);
FINDC(*string, character-list*<,*modifiers*> <,*start-position*>);
FINDW(*string, word*<,*delimiters*><,*modifiers*><,*start-position*>);

Perl Regular Expressions

Perl Regular Expressions Metacharacters

Metacharacter	Description
/.../	Starting and ending delimiter
(...)	Enables grouping
|	Denotes the OR situation
\d	Matches a digit (0-9)
\D	Matches a non-digit such as letter
\s	Matches a whitespace character
\w	Matches a group of characters
.	Matches any character
[...]	Matches a character in brackets
[^...]	Matches a character not in brackets
^	Matches the beginning of the string
$	Matches the end of the string
\b	Matches a word boundary
\B	Matches a non-word boundary
*	Matches the preceding character 0 or more times
+	Matches the preceding character 1 or more times
?	Matches the preceding character 0 or 1 times
{n}	Matches exactly n times
\	Overrides the next metacharacter such as a (or ?)

PRXMATCH Function

PRXMATCH function searches for a pattern match and returns the position at which the pattern is found.

PRXMATCH (*Perl-regular-expression*, *source*);

PRXPARSE Function

PRXPARSE function returns a pattern identifier number that is used by other PRX functions and call routines.

pattern-ID-number=**PRXPARSE** (*Perl-regular-expression*);

PRXCHANGE Function

PRXCHANGE function performs a substitution for a pattern match

PRXCHANGE (*Perl-regular-expression*, *times*, *source*)