

Natural System Functions for Use in Processing Loops

This chapter describes those Natural system functions which can be used in a program loop context.

It covers the following topics:

- Using System Functions in Processing Loops
 - AVER(r)(field)
 - COUNT(r)(field)
 - MAX(r)(field)
 - MIN(r)(field)
 - NAVER(r)(field)
 - NCOUNT(r)(field)
 - NMIN(r)(field)
 - OLD(r)(field)
 - SUM(r)(field)
 - TOTAL(r)(field)
 - Examples
-

Using System Functions in Processing Loops

The following topics are covered:

- Specification/Evaluation
- Use in SORT GIVE Statement
- Arithmetic Overflows in AVER, NAVER, SUM or TOTAL
- Statement Referencing (r)

Specification/Evaluation

Natural system functions may be specified in

- assignment and arithmetic statements:

- MOVE
- ASSIGN
- COMPUTE
- ADD
- SUBTRACT
- MULTIPLY
- DIVIDE
- input/output statements:
 - DISPLAY
 - PRINT
 - WRITE

that are used within any of the following statement blocks:

- AT BREAK
- AT END OF DATA
- AT END OF PAGE

that is, for all FIND, READ, HISTOGRAM, SORT or READ WORK FILE processing loops.

If a system function is used within an AT END OF PAGE statement, the corresponding DISPLAY statement must include the GIVE SYSTEM FUNCTIONS clause.

Records rejected by a WHERE clause are not evaluated by a system function.

If system functions are evaluated from database fields which originated from different levels of processing loops initiated with a FIND, READ, HISTOGRAM or SORT statement, the values are always processed according to their position in the loop hierarchy. For example, values for an outer loop will only be processed when new data values have been obtained for that loop.

If system functions are evaluated from user-defined variables, the processing is dependent on the position in the loop hierarchy where the user-defined variable was introduced in reporting mode. If the user-defined variable is defined before any processing loop is initiated, it will be evaluated for system functions in the loop where the AT BREAK, AT END OF DATA or AT END OF PAGE statement is defined. If a user-defined variable is introduced within a processing loop it will be processed the same as a database field from that processing.

For selective referencing of system function evaluation for user-defined variables it is recommended to specify a loop reference with the user-defined variable to indicate in which loop the value is to be processed. The loop reference may be specified as a statement label or source code line number.

Use in SORT GIVE Statement

System functions may also be referenced when they have been evaluated in a GIVE clause of a SORT statement.

For a reference to a system function evaluated with a SORT GIVE statement, the name of the system function must be prefixed with an asterisk (*).

Arithmetic Overflows in AVER, NAVER, SUM or TOTAL

Fields to which the system functions AVER, NAVER, SUM and TOTAL are to be applied must be long enough (either by default or user-specified) to hold any overflow digits. If any arithmetic overflow occurs, an error message will be issued.

Normally, the length is the same as that of the field to which the system function is applied; if this is not long enough, use the NL option of the SORT GIVE statement to increase the output length as follows:

```
SUM(field) (NL=nn)
```

This will not only increase the output length but also causes the field to be made longer internally.

Statement Referencing (*r*)

Statement referencing is also available for system functions (see also *Referencing of Database Fields Using (r) Notation* in the section *User-Defined Variables* of the *Programming Guide*).

By using a statement label or the source-code line number (*r*) you can determine in which processing loop the system function is to be evaluated for the specified field.

AVER(*r*)(*field*)

Format/length: Same as field.

Exception: for a field of format N, AVER(*field*) will be of format P (with the same length as the field).

This system function contains the average of all values encountered for the field specified with AVER. AVER is updated when the condition under which AVER was requested is true.

COUNT(*r*)(*field*)

Format/length:

P7

COUNT is incremented by 1 on each pass through the processing loop in which it is located. COUNT is incremented regardless of the value of the field specified with COUNT.

MAX(r)(field)

Format/length: Same as field.

This system function contains the maximum value encountered for the field specified with MAX. MAX is updated (if appropriate) each time the processing loop in which it is contained is executed.

MIN(r)(field)

Format/length: Same as field.

This system function contains the minimum value encountered for the field specified with MIN. MIN is updated (if appropriate) each time the processing loop in which it is located is executed.

NAVER(r)(field)

Format/length: Same as field.

Exception: for a field of format N, NAVER(*field*) will be of format P (with the same length as the field).

This system function contains the average of all values - excluding null values - encountered for the field specified with NAVER. NAVER is updated when the condition under which NAVER was requested is true.

NCOUNT(r)(field)

Format/length: P7

NCOUNT is incremented by 1 on each pass through the processing loop in which it is located unless the value of the field specified with NCOUNT is a null value.

Whether the result of NCOUNT is an array or a scalar value depends on its argument (field). The number of the resulting occurrences is the same as of field.

NMIN(r)(field)

Format/length: Same as field.

This system function contains the minimum value encountered - excluding null values - for the field specified with NMIN. NMIN is updated (if appropriate) each time the processing loop in which it is located is executed.

OLD(r)(field)

Format/length: Same as field.

This system function contains the value which the field specified with OLD contained prior to a control break as specified in an AT BREAK condition, or prior to the end-of-page or end-of-data condition.

SUM(r)(field)

Format/length: Same as field.

Exception: for a field of format N, SUM(*field*) will be of format P (with the same length as the field).

This system function contains the sum of all values encountered for the field specified with SUM. SUM is updated each time the loop in which it is located is executed. When SUM is used following an AT BREAK condition, it is reset after each value break. Only values that occur between breaks are added.

TOTAL(r)(field)

Format/length: Same as field.

Exception: for a field of format N, TOTAL(*field*) will be of format P (with the same length as the field).

This system function contains the sum of all values encountered for the field specified with TOTAL in all open processing loops in which TOTAL is located.

Examples

The following examples are provided below:

- Example 1 - AT BREAK Statement with Natural System Functions OLD, MIN, AVER, MAX, SUM, COUNT
- Example 2 - AT BREAK Statement with Natural System Function AVER
- Example 3 - AT END OF DATA Statement with System Functions MAX, MIN, AVER
- Example 4 - AT END OF PAGE Statement with System Function AVER

Example 1 - AT BREAK Statement with Natural System Functions OLD, MIN, AVER, MAX, SUM, COUNT

```
** Example 'ATBEX3': AT BREAK (with Natural system functions)
*****
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
2 NAME
```

```

2 CITY
2 SALARY (1)
2 CURR-CODE (1)
END-DEFINE
*
LIMIT 3
READ EMPLOY-VIEW LOGICAL BY CITY = 'SALT LAKE CITY'
  DISPLAY NOTITLE CITY NAME 'SALARY' SALARY(1) 'CURRENCY' CURR-CODE(1)
  /*
AT BREAK OF CITY
  WRITE / OLD(CITY) (EM=X^X^X^X^X^X^X^X^X^X^X^X^X^X^X^X^X)
    31T ' MINIMUM:' MIN(SALARY(1)) CURR-CODE(1) /
    31T ' AVERAGE:' AVER(SALARY(1)) CURR-CODE(1) /
    31T ' MAXIMUM:' MAX(SALARY(1)) CURR-CODE(1) /
    31T ' SUM:' SUM(SALARY(1)) CURR-CODE(1) /
    35T COUNT(SALARY(1)) 'RECORDS FOUND' /
END-BREAK
  /*
AT END OF DATA
  WRITE 22T 'TOTAL (ALL RECORDS):'
    T*SALARY TOTAL(SALARY(1)) CURR-CODE(1)
END-ENDDATA
END-READ
*
END

```

Output of program ATBEX3:

CITY	NAME	SALARY	CURRENCY
SALT LAKE CITY	ANDERSON	50000	USD
SALT LAKE CITY	SAMUELSON	24000	USD
S A L T L A K E C I T Y	MINIMUM:	24000	USD
	AVERAGE:	37000	USD
	MAXIMUM:	50000	USD
	SUM:	74000	USD
		2 RECORDS FOUND	
SAN DIEGO	GEE	60000	USD
S A N D I E G O	MINIMUM:	60000	USD
	AVERAGE:	60000	USD
	MAXIMUM:	60000	USD
	SUM:	60000	USD
		1 RECORDS FOUND	
	TOTAL (ALL RECORDS):	134000	USD

Example 2 - AT BREAK Statement with Natural System Function AVER

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** Example 'ATBEX4': AT BREAK (with Natural system functions)
*****
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 NAME
  2 CITY
  2 SALARY (2)
*
1 #INC-SALARY (P11)
END-DEFINE

```

```

*
LIMIT 4
EMPL. READ EMPLOY-VIEW BY CITY STARTING FROM 'ALBU'
  COMPUTE #INC-SALARY = SALARY (1) + SALARY (2)
  DISPLAY NAME CITY SALARY (1:2) 'CUMULATIVE' #INC-SALARY
  SKIP 1
/*
AT BREAK CITY
  WRITE NOTITLE
    'AVERAGE:'          T*SALARY (1)  AVER(SALARY(1)) /
    'AVERAGE CUMULATIVE:' T*#INC-SALARY AVER(EMPL.) (#INC-SALARY)
END-BREAK
END-READ
*
END
    
```

Output of program ATBEX4:

NAME	CITY	ANNUAL	CUMULATIVE
			SALARY
HAMMOND	ALBUQUERQUE	22000	42200
		20200	
ROLLING	ALBUQUERQUE	34000	65200
		31200	
FREEMAN	ALBUQUERQUE	34000	65200
		31200	
LINCOLN	ALBUQUERQUE	41000	78700
		37700	
AVERAGE:		32750	
AVERAGE CUMULATIVE:			62825

Example 3 - AT END OF DATA Statement with System Functions MAX, MIN, AVER

```

** Example 'AEDEX1S': AT END OF DATA
*****
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 PERSONNEL-ID
  2 NAME
  2 FIRST-NAME
  2 SALARY (1)
  2 CURR-CODE (1)
END-DEFINE
*
LIMIT 5
EMP. FIND EMPLOY-VIEW WITH CITY = 'STUTTGART'
  IF NO RECORDS FOUND
    ENTER
  END-NOREC
  DISPLAY PERSONNEL-ID NAME FIRST-NAME
    SALARY (1) CURR-CODE (1)
/*
AT END OF DATA
  IF *COUNTER (EMP.) = 0
    
```

```

        WRITE 'NO RECORDS FOUND'
        ESCAPE BOTTOM
    END-IF
    WRITE NOTITLE / 'SALARY STATISTICS:'
                / 7X 'MAXIMUM:' MAX(SALARY(1)) CURR-CODE (1)
                / 7X 'MINIMUM:' MIN(SALARY(1)) CURR-CODE (1)
                / 7X 'AVERAGE:' AVER(SALARY(1)) CURR-CODE (1)

END-ENDDATA
/*
END-FIND
*
END

```

Output of program AEDEX1S:

PERSONNEL ID	NAME	FIRST-NAME	ANNUAL SALARY	CURRENCY CODE
11100328	BERGHAUS	ROSE	70800	DM
11100329	BARTHEL	PETER	42000	DM
11300313	AECKERLE	SUSANNE	55200	DM
11300316	KANTE	GABRIELE	61200	DM
11500304	KLUGE	ELKE	49200	DM

SALARY STATISTICS:

MAXIMUM:	70800	DM
MINIMUM:	42000	DM
AVERAGE:	55680	DM

Example 4 - AT END OF PAGE Statement with System Function AVER

```

** Example 'AEPEX1S': AT END OF PAGE (structured mode)
*****
DEFINE DATA LOCAL
1 EMPLOY-VIEW VIEW OF EMPLOYEES
  2 PERSONNEL-ID
  2 NAME
  2 JOB-TITLE
  2 SALARY (1)
  2 CURR-CODE (1)
END-DEFINE
*
FORMAT PS=10
LIMIT 10
READ EMPLOY-VIEW BY PERSONNEL-ID FROM '20017000'
  DISPLAY NOTITLE GIVE SYSTEM FUNCTIONS
      NAME JOB-TITLE 'SALARY' SALARY(1) CURR-CODE (1)
/*
AT END OF PAGE
  WRITE / 28T 'AVERAGE SALARY: ...' AVER(SALARY(1)) CURR-CODE (1)
END-ENDPAGE
END-READ
*
END

```

Output of program AEPEX1S:

NAME	CURRENT POSITION	SALARY	CURRENCY CODE
CREMER	ANALYST	34000	USD
MARKUSH	TRAINEE	22000	USD
GEE	MANAGER	39500	USD
KUNEY	DBA	40200	USD
NEEDHAM	PROGRAMMER	32500	USD
JACKSON	PROGRAMMER	33000	USD
AVERAGE SALARY: ...		33533	USD