**4. COBOL PROGRAMMING**

## Introduction to COBOL

* 1. **COBOL Program Outline**
  2. **COBOL Numeric Formats**
  3. **COBOL Numeric-Edited Output**
  4. **COBOL Verbs**
  5. **COBOL Tables**
  6. **COBOL COPY Statement**
  7. **COBOL REDEFINES**
  8. **COBOL Intrinsic Functions**
  9. **COBOL Control Break Processing**
  10. **Example COBOL Data Validation Program**
  11. **Introduction to COBOL**

Shortly after Grace Hopper, the “Grandmother of Programming,” designed her own English-like language, FLOW-MATIC for the computer on which she and her team were working, the Committee on Data Systems Languages (CODASYL) was formed in 1959 to study and develop a standard programming language that could be used across platforms at that time. Their efforts led to the development of COBOL

COBOL is an acronym for COmmon Business-Oriented Language. Like mainframes in general, the COBOL programming language has been mistakenly thought of as being outdated – NOT TRUE! In the 1990s alone, billions of dollars were spent on COBOL code preparing it for the turn of the century between 1999 and 2000, or “Y2K”. As stated in Murach’s *Introduction to COBOL Programming*, many more billions of dollars will be spent on the enhancement and maintenance of the same programs. In fact, in 2002, an object-oriented version of COBOL was introduced and can even be programmed for the .NET platform.

Although there are many aspects of COBOL that we could study, our focus will be on what could be called the basics of the language. One aspect of COBOL is often used to retrieve data from and update DB2 or other large database structures using SQL statements while running under the Customer Information Control System, or CICS, thus allowing fast and extremely dependable access to stored data in real time via internet-based or other types of GIU-based applications. It is easier to learn the basics of COBOL, though, by writing what are commonly referred to as batch programs that read data from files and formatting the data into output reports. It is precisely this type of programming to which you will be introduced in this chapter.

After learning languages like C++, Java or even Assembly, learning COBOL is relatively easy. Of course, there are some quirks in the language that may take some time to get used to. As stated above, the language was the first developed after Assembly. It was initially supposed to be a programming language that could be learned and used to develop data processing programs by the average office secretary of the day, hence the English-like sentences and the use of verbs and periods found in COBOL. But it was soon obvious that it required more knowledge about programming than an office secretary could ever be expected to have.

COBOL used to be a language that required all source code to be typed in capital letters but now allows a combination of upper and lower case letters. Because of this, it is considered case "insensitive", or it is not case sensitive. Although this is the case, all COBOL in this text will be presented in all capital letters as it is, in many ways, easier to scan with our eyes and read quickly.

# COBOL Program Outline

This is just an overview of how a COBOL program is structured.

### The Four Divisions of a COBOL Program

* IDENTIFICATION DIVISION.

Must begin in column 8. This provides identifying information about the program. It must include:

PROGRAM-ID.

and may also include some other information (all optional) that all begin in column 8:

AUTHOR. INSTALLATION. DATE-WRITTEN. DATE-COMPILED. SECURITY.

* ENVIRONMENT DIVISION.

Must begin in column 8. What is included in this division depends on the specific computer system being used. Some of the details of the format will vary accordingly. For instance, if using VSAM, the SELECT ASSIGN statements become more complex.

The INPUT-OUTPUT SECTION must begin in column 8 and provides information about the files in use in the program and is needed if the program uses one or more files, whether reading from or writing to.

It contains:

FILE-CONTROL.

SELECT ASSIGN statements Example:

SELECT INPUT-FILE ASSIGN TO INFILE.

The SELECT ASSIGN statements begin in column 12 or after. It links the name of the file, INPUT- FILE, as manipulated by statements in the COBOL program with the DD name of the file in the JCL, INFILE.

* DATA DIVISION.

Must being in column 8. This describes the data items like variables, column and page header definitions, etc., in a program. It contains several sections that must all begin in column 8. Each of the sections is technically optional. They are:

FILE SECTION.

The FILE SECTION describes the files in use, along with the definition of what the data record looks like for those files. It is needed if the program reads from and/or writes to files of any type.

WORKING-STORAGE SECTION.

The WORKING-STORAGE SECTION defines and, in many cases, initializes the variables. It is necessary if there are variables necessary to be declared.

LINKAGE SECTION.

The LINKAGE SECTION describes parameters used when the program is called by another program (and may contain other items as well). It is also necessary if the program receives a PARM on the EXEC card at time of execution.

LOCAL-STORAGE SECTION.

The LOCAL-STORAGE SECTION is used in recursion and is not needed otherwise.

* PROCEDURE DIVISION.

Must begin in column 8. This contains all of the executable code, normally organized in a main routine and assorted internal subroutines or "paragraphs" as they are called in COBOL.

### Example

IDENTIFICATION DIVISION.

PROGRAM-ID. *Program name goes here*

AUTHOR. *Programmer's name goes here*

DATE-WRITTEN. *The due date or date finished goes here*

DATE-COMPILED. *(Leave blank as it is supplied by the system.)*

ENVIRONMENT DIVISION. INPUT-OUTPUT SECTION. FILE-CONTROL.

SELECT *file-name* ASSIGN TO *ddname*.

DATA DIVISION.

FILE SECTION.

FD *file-name*

RECORDING MODE IS F.

01 *record-name*.

*Definition of record-name goes here*

WORKING-STORAGE SECTION.

*Definitions of various items go here*

PROCEDURE DIVISION. 0000-MAIN.

*COBOL code goes here*

GOBACK.

0000-EXIT. EXIT.

0100-SUBROUTINE.

*More COBOL code goes here*

0100-EXIT. EXIT.

In the PROCEDURE DIVISION above, execution will begin with the first line of code, and it ends when the

GOBACK command is executed. *There should only be a single GOBACK in any single program.*

This example has no documentation other than parenthetical remarks. As with any program written, documentation is very important, especially in long and complicated programs.

### COBOL Code Layout

COBOL code is written in 80-column lines. Leave columns 1-6 and 73-80 blank, though.

In COBOL, columns 8-11 are referred to as the A margin and columns 12-72 as the B margin.

Column 7 is used in two ways. If an asterisk (\*) is placed in column 7, the remainder of the line is considered documentation and ignored by the compiler. Of course, do not go past column 72. If a hyphen (-) is placed in column 7, it indicates the continuation of a character literal from the line immediately above.

Once again, the names of the four divisions, the names of sections, the names of subroutines, 01-level items in the DATA DIVISION, etc., must all begin in column 8.

# COBOL Numeric Formats

For application programmers, there are basically four ways to declare storage for numeric data in COBOL. The USAGE IS clause used to be necessary to denote how numbers are being stored in a single elementary item but USAGE IS can now be omitted in the declaration of storage. Indication of the format is still required unless the default of DISPLAY, or zoned decimal format, is desired.

The term DISPLAY here is a bit misleading, though. Remember that zoned decimal numbers can be signed. If the zone digit of the rightmost byte of the field, i.e., the next to last hexadecimal digit, is F, A, C or E, the number is positive. If it is B or D, the number is negative. For the number to be purely DISPLAY, it would have to be a positive number with the rightmost byte’s zone digit as F so that it is actually EBCDIC.

### Example

Here are four different ways in which the number 23156 can be stored in zoned decimal format, two hexadecimal digits per byte:

F2F3F1F5F6 F2F3F1F5A6 F2F3F1F5C6 F2F3F1F5E6

The only one of the four that is truly DISPLAY format is the first. If you displayed, for example, the third of these representations above, you would see the following:

2315F because hex C6 is EBCDIC for the capital letter F.

### The Four COBOL Numeric Formats

DISPLAY a zoned decimal number 1 character/byte

default format

PACKED-DECIMAL or a packed decimal number

COMP-3 2 digits/byte

last byte contains the sign digit

BINARY or a binary number

COMP or S9 to S9(4) - stored as 2 bytes

COMP-4 S9(5) to S9(9) - stored as 4 bytes

S9(10) to S9(18) - stored as 8 bytes NOT aligned on a specific

boundary

BINARY SYNC or a binary number on a specific boundary

COMP SYNC or S9 to S9(4) - stored as 2 bytes on a halfword boundary

COMP-4 SYNC S9(5) to S9(9) - stored as 4 bytes on a fullword boundary

S9(10) to S9(18) - stored as 8 bytes on a doubleword boundary Note that COMP is an abbreviation for COMPUTATIONAL.

For the sake of being up-to-date, please use PACKED-DECIMAL, BINARY and BINARY SYNC in your COBOL programs.

The USAGE IS part of the phrase is optional and ***should be left out***. It is better to simply do the following:

01 FIELD-B PIC S9(5) COMP-3.

or

01 FIELD-B PIC S9(5) PACKED-DECIMAL.

Of course, the items could also have VALUE clauses:

01 FIELD-B PIC S9(5) COMP-3 VALUE 327.

or

01 FIELD-B PIC S9(5) PACKED-DECIMAL VALUE 8433.

As a review, these are stored in different ways. Remember from above that the default is DISPLAY format, which is zoned decimal numbers, one per byte (or column).

Although zoned decimal number can actually be EBCDIC for digits 0 through 9 (F0 through F9), as stated above, do NOT assume they are. For example, either of the following five-byte fields holds the zoned decimal representation of -354:

F0F0F3F5B4 or F0F0F3F5D4

Although there is no character match for EBCDIC B4, there is for EBCDIC D4; it is the capital letter M.

COMP-3, or PACKED-DECIMAL, means that the value will be stored as a packed decimal number, i.e., one byte for each two digits, including a sign digit at the end.

COMP, COMP-4, or BINARY, means that the value will be stored in binary form of one of three lengths:

S9 to S9(4) is stored as 2 bytes, a half word S9(5) to S9(9) is stored as 4 bytes, a full word S9(10) to S9(18) is stored as 8 bytes, a double word

Hint: Just remember "1, 5 and 10" and "2, 4 and 8" and it is easy to remember how long the field actually is in bytes.

These refer to 2, 4 or 8 bytes in binary format, not necessarily to anything declared as a half word, full word or double full word; i.e., not necessarily aligned on a boundary.

COMP SYNC, COMP-4 SYNC, or BINARY SYNC, means the same as COMP but the storage is aligned on a half word boundary (for S9 to S9(4)) or on a full word boundary (otherwise).

Because of the SYNC alignment, there might be slack bytes embedded in WORKING-STORAGE. This can affect calculating the size of a table entry, and being aware of it is important when doing group moves, computing the size of a record, or passing parameters to Assembler programs.

Once again, note that anything declared at a 01-level in the COBOL Data Division is stored on a doubleword boundary.

One of the very best characteristics of COBOL is that it performs the conversions between numeric formats in elementary moves and arithmetic operations. It is important to remember that it will NOT perform the conversions between numeric formats if moved with MOVE CORRESPONDING, though! More on this later.

### More Examples of the Four Formats

Display Examples

01 FLD-A PIC S9(5).

or

01 FLD-A PIC S9(5) DISPLAY.

Packed Decimal Examples

01 FLD-B PIC S9(5) PACKED-DECIMAL.  Preferred notation.

or

01 FLD-B PIC S9(5) COMP-3.

or

01 FLD-B PIC S9(5) COMPUTATIONAL-3.

Binary Examples

01 FLD-C PIC S9(5) BINARY.  Preferred notation.

or

01 FLD-C PIC S9(5) COMP.

or

01 FLD-C PIC S9(5) COMPUTATIONAL.

or

01 FLD-C PIC S9(5) COMP-4.

or

01 FLD-C PIC S9(5) COMPUTATIONAL-4.

Binary On Boundary Examples

 Preferred notation.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 01 | FLD-D | PIC | S9(5) | BINARY SYNC. |
| or |  |  |  |  |  |
|  | 01 | FLD-D | PIC | S9(5) | COMP SYNC. |
| or |  |  |  |  |  |
|  | 01 | FLD-D | PIC | S9(5) | COMP-4 SYNC. |

### Usage Guidelines

DISPLAY Numerical items that will not be used for arithmetic and will be printed.

01 FLD-A PIC S9(5) DISPLAY VALUE 23.

or

01 FLD-A PIC S9(5) VALUE 23.

stored as 5 bytes: F0 F0 F0 F2 F3

Note: As stated above, the sign does NOT take an additional byte of storage but rather is noted by the zone hex digit in the final, or rightmost, byte of the representation. F, A, C, or E are positive representatios and B and D are negative.

PACKED-DECIMAL/COMP-3 Numerical items that will be used in arithmetic and will eventually be

printed.

01 FLD-B PIC S9(5) PACKED-DECIMAL VALUE 23.

or

01 FLD-B PIC S9(5) COMP-3 VALUE 23.

stored as 3 bytes: 00 02 3F

BINARY/COMP/COMP-4 Numerical items that will be used ONLY for arithmetic and will NOT be

printed.

01 FLD-C PIC S9(5) BINARY.

or

01 FLD-C PIC S9(5) COMP VALUE 23.

or

01 FLD-C PIC S9(5) COMP-4 VALUE 23.

stored as 4 bytes: 00 00 00 17

### Suggested Usage Rules

Use DISPLAY for numeric items that will not be used in arithmetic and will be printed. (No conversion will be needed to print them.)

Use PACKED-DECIMAL or COMP-3, for numeric items that will be used in arithmetic and will eventually be printed. (One conversion will be needed to print them.)

Use BINARY or COMP, for numeric items that will be used in arithmetic and will not be printed. (Two conversions will be needed to print them.)

### Example of How the Formats are Stored: Positive Integers

Suppose we have the items FIELD-A, FIELD-B, and FIELD-C as defined above, but each with the value 23:

|  |  |  |  |
| --- | --- | --- | --- |
| 01 FIELD-A  01 FIELD-B | PIC S9(5) PIC S9(5) | PACKED-DECIMAL | VALUE 23.  VALUE 23. |
| 01 FIELD-C | PIC S9(5) | BINARY | VALUE 23. |
| Then: |  |  |  |

FIELD-A might be stored as 5 bytes: F0 F0 F0 F2 C3

or F0 F0 F0 F2 F3 or F0 F0 F0 F2 A3 or F0 F0 F0 F2 E3

|  |  |  |  |
| --- | --- | --- | --- |
| FIELD-B is stored as 3 bytes: | 00 | 02 | 3C |
| or | 00 | 02 | 3F |
| or | 00 | 02 | 3A |
| or | 00 | 02 | 3E |
| FIELD-C is stored as 4 bytes: | 00 | 00 | 00 17 |

For FIELD-C, remember that the leftmost bit of the 32 is the sign bit. A 0 indicates a positive binary representation and a 1 indicates a negative.

### Negative Integers

Suppose we move the value -23 to each of the same three fields defined above.

Then:

FIELD-A is stored as 5 bytes: F0 F0 F0 F2 D3

or F0 F0 F0 F2 B3

FIELD-B is stored as 3 bytes: 00 02 3D

or 00 02 3B

FIELD-C is stored as 4 bytes: FF FF FF E9 FIELD-C as a 4-byte 32-bit representation of -23:

11111111 11111111 11111111 11101001

**^**

### the sign bit

For FIELD-C, remember that the negative bit representation of an integer, as shown above, is the two's complement of the bit representation of the integer's absolute value.

Note that, if the S denoting signed storage is omitted from a numeric picture clause definition, the storage will not be able to store anything but the absolute value of any negative number.

Also remember that the sign of any number stored in signed storage will NOT take any storage itself but is inherent in how the number is stored itself.

# COBOL Numeric-Edited Output  under construction!

COBOL facilitates the creation of formatted numeric-edited output.

### The Floating Dollar Sign

Placiong a floating dollar sign just to the left of the first non-zero digit when reading the number from left to right and with commas appropriately spaced is simple in COBOL.

For example, an accumulator field defined as:

05 ACCT-TOTAL PIC S9(12)V99 PACKED-DECIMAL VALUE 0.

can be easily moved to a field in which it will be formatted with a floating dollar sign and commas. If the output field is defined as:

05 OUT-ACCT-TOTAL PIC $$$$,$$$,$$$,$$9.99.

If a dollar amount has been accumulated in ACCT-TOTAL, the statement:

MOVE ACCT-TOTAL TO OUT-ACCT-TOTAL.

will result in the value being fully formatted with a floating dollar sign placed just to the left of the first non-zero digit (from left to right) and with commas appropriately spaced.

For example, if the field ACCT-TOTAL holds the value 46533.87, the displayed value would be:

bbbbbbbbb$46,533.87

where the lower-case letter b is used to denote a space.

If the possibility exists that a negative dollar value will be moved to the numeric-edited output field, either of the following definitions should be used:

05 OUT-ACCT-TOTAL PIC $$$$,$$$,$$$,$$9.99DB.

or

05 OUT-ACCT-TOTAL PIC $$$$,$$$,$$$,$$9.99CR.

If a negative value is moved to either of these two example fields, the DB (debit) or CR (credit) will be displayed, respectively. If the value is positive, the DB or CR will be replaced by two spaces. This may seem strange because a credit indicates positive to most uf us but, in accountancy, both a debit and a credit are considered negative values. Note that it is best to only use the DB or CR when using the floating dollar point or, more specifically, when displaying dollar amounts.

# COBOL Verbs

Commands in COBOL are known as COBOL verbs. Because COBOL is so like structured English and was first implemented for non-programmers to use for simple programming, the term *verb* is appropriate.

The most commonly used COBOL verbs and some of their variations are:

OPEN

OPEN INPUT OPEN OUTPUT CLOSE

READ

READ INTO READ AT END

READ INTO AT END

WRITE WRITE FROM

WRITE AFTER WRITE FROM AFTER

PERFORM PERFORM UNTIL

PERFORM VARYING UNTIL MOVE

ADD

ADD GIVING

ADD GIVING ROUNDED SUBTRACT

SUBTRACT GIVING SUBTRACT GIVING ROUNDED MULTIPLY

MULTIPLY GIVING MULTIPLY GIVING ROUNDED DIVIDE

DIVIDE GIVING

DIVIDE GIVING ROUNDED

COMPUTE

COMPUTE ROUNDED

SEARCH SEARCH ALL

INSPECT REPLACING EVALUATE

* Unless writing records to a file, never use WRITE without the AFTER for line spacing.
* Never WRITE blank lines.
* Unless you have adequate reason, do NOT use the READ AT END with the NOT AT END structure.
* If possible, do not use the arithmetic verbs above except if adding to a counter of some sort. For example:

ADD 1 TO LINE-CTR. For all others, use COMPUTE and COMPUTE ROUNDED below.

# COBOL Tables

COBOL tables are defined in the DATA DIVISION using the OCCURS n [TIMES] clause. If the table level is to be indexed, both the OCCURS n [TIMES] and the INDEXED BY clauses must be used together in the table’s definition.

If using a subscript to reference a table entry, simply define it in WORKING-STORAGE as an integer large enough to hold the maximum number of entries. Always define a subscript as BINARY SYNC, COMP SYNC or COMP-4 SYNC. For example, if a table has an OCCURS 500, the subscript could be defined as:

01 SUBSCRIPTS.

05 TBL-SUB PIC S9(3) BINARY SYNC.

or

01 TBL-SUB PIC S9(3) BINARY SYNC.

Unlike subscripts, the INDEXED BY clause simply gives a name to an index and the named index requires no further definition. In other words, and index will have **NO** PIC clause anywhere in the program.

If using an index, it cannot be manipulated by the standard arithmetic verbs (ADD, SUBTRACT,...) or the

MOVE verb. Instead, the SET verb must be used:

FORMAT 1: SET var\_name\_1/index\_1 TO var\_name\_2/index\_2/integer FORMAT 2: SET index\_1 index\_2 ... UP/DOWN BY var\_name/integer

Like subscripts, index values can also be altered by PERFORM VARYING, SEARCH, or SEARCH ALL verbs.

Indexes are stored as binary values that represent the displacement from the beginning of the table to the specific entry.

Unlike third, fourth and fifth-generation languages and arrays, the valid range for both subscripts and indexes is 1 to n with n being the maximum number of entries. Of course, because indexes are stored as byte displacements, an index value of 1 corresponds to a byte displacement of 0.

A multi-dimensional table is created by nesting OCCURS clauses.

01 ANNUAL-SALES-DATA.

05 YEARLY-SALES OCCURS 5

INDEXED BY YR-NDX.

10 MONTHLY-SALES OCCURS 12

INDEXED BY M-NDX.

15 SALE-AMOUNT PIC 9(7)V99.

To access an entry in a multi-dimensional table, the order of the indexes will correspond to the nesting order of the OCCURS clauses.

SALE-AMOUNT(1, 4) references year 1 and month 4 (April).

SALE-AMOUNT(4, 1) references year 4 and month 1 (January).

To access an entry in a multi-dimensional table, every field needs as many indexes as there are OCCURS

clauses that are a part of it or above it. In other words: SALE-AMOUNT(4) would be invalid and will not compile. **Example of Multi-Dimensional Table Processing**

The following is defined WORKING-STORAGE:

01 ANNUAL-SALES-DATA.

05 YEARLY-SALES OCCURS 5

INDEXED BY YR-NDX.

10 MONTHLY-SALES OCCURS 12

INDEXED BY M-NDX.

15 SALE-AMOUNT PIC 9(7)V99.

The following are statements in the PROCEDURE-DIVISION: 0000-MAIN.

.

. *other statements can precede the following*

.

PERFORM VARYING YR-NDX FROM 1 BY 1 UNTIL YR-NDX > 5 PERFORM VARYING M-NDX FROM 1 BY 1 UNTIL M-NDX > 12

ADD SALE-AMOUNT(YR-NDX, M-NDX) TO TOTAL-AMOUNT END-PERFORM

END-PERFORM.

.

. GOBACK.

0000-EXIT. EXIT.

or

0000-MAIN.

.

. *other statements can precede the following*

.

PERFORM 1000-ADD VARYING YR-NDX FROM 1 BY 1 UNTIL YR-NDX > 5 AFTER M-NDX FROM 1 BY 1 UNTIL M-NDX > 12.

.

. GOBACK.

0000-EXIT. EXIT.

1000-ADD.

ADD SALE-AMOUNT(YR-NDX, M-NDX) TO TOTAL-AMOUNT.

1000-EXIT. EXIT.

Both of the above examples would accomplish the same thing.

### COBOL Subscripts vs. Indexes

Differences Between Subscripts and Indexes:

|  |  |
| --- | --- |
| ***Subscripts*** | ***Indexes*** |
| 1. Needs to be declared with PIC clause. | 1. Does NOT need to be declared with a PIC clause |
| 2. Holds a binary value of 1 to n. | 2. Holds a binary value representing a displacement in bytes from the beginning of the table. |
| 3. Can be displayed using DISPLAY. | 3. Cannot be displayed using DISPLAY. |
| 4. Can be altered using the arithmetic verbs. | 4. Can only be altered using the SET verb. |
| 5. Can be altered using the MOVE verb. | 5. Cannot be altered using the MOVE verb. |
| 6. Can refer to any entry at any level of any tree. | 6. Can only refer to an entry at a specific level of a  specific tree. |
| 7. Cannot be used with the SEARCH or SEARCH ALL  verbs. | 7. Required to be used with the SEARCH or SEARCH ALL verbs. |

Similarities Between Subscripts and Indexes:

* Both reference a single entry at a single level of a COBOL table.
* Can be altered, or used, with the PERFORM VARYING with no special considerations.

Note: Subscripts should always be defined as BINARY SYNC or COMP SYNC and, for good form, a subscript name should end with the suffix –SUB and an index with the suffix –NDX.

### Examples of COBOL Table Storage

One- or Single-Dimensional Table:

01 TABLE-1.

05 DATA-1 OCCURS 3 PIC X(6).

--------------------------------------

| TABLE-1 |

--------------------------------------

| DATA-1 | DATA-1 | DATA-1 |

--------------------------------------

Another One- or Single-Dimensional Table:

01 TABLE-2.

05 DATA-2 OCCURS 3.

10 FLD-A PIC X(4).

10 FLD-B PIC X(4).

-----------------------------------------------

| TABLE-2 |

-----------------------------------------------

| DATA-2 | DATA-2 | DATA-2 |

-----------------------------------------------

| FLD-A | FLD-B | FLD-A | FLD-B | FLD-A | FLD-B |

-----------------------------------------------

Two-Dimensional Table:

01 TABLE-3.

05 FLD-A OCCURS 3.

10 FLD-B OCCURS 2 PIC X(4).

-----------------------------------------------

| TABLE-3 |

-----------------------------------------------

| FLD-A | FLD-A | FLD-A |

-----------------------------------------------

| FLD-B | FLD-B | FLD-B | FLD-B | FLD-B | FLD-B |

-----------------------------------------------

Two One- or Single-Dimensional Tables Under the Same 01-Level:

01 TABLE-4.

05 FLD-A OCCURS 3 PIC X(3).

05 FLD-B OCCURS 2 PIC X(4).

-----------------------------------------------

| TABLE-4 |

-----------------------------------------------

| FLD-A | FLD-A | FLD-A | FLD-B | FLD-B |

-----------------------------------------------

Two-Dimensional Table:

01 TABLE-5.

05 FLD-A OCCURS 2.

10 FLD-B PIC X(4).

10 FLD-C OCCURS 2 PIC X(4).

-----------------------------------------------

| TABLE-5 |

-----------------------------------------------

| FLD-A | FLD-A |

-----------------------------------------------

| FLD-B | FLD-C | FLD-C | FLD-B | FLD-C | FLD-C |

-----------------------------------------------

Note that any of the above-defined table examples can be indexed along with the OCCURS clause.

Also note that indexed table entries can be manipulated using a subscript as long as the subscript is large enough to hold the maximum number of entries for that table level. Indexes cannot be used to manipulate other levels of other tables.

# COBOL SEARCH and SEARCH ALL Verbs

COBOL provides a means by which a table level can be searched for a matching value in a field without necessarily implementing a PERFORM VARYING. SEARCH is used to implement a sequential search through a table or a portion of a table and SEARCH ALL is used to implement a binary search.

### Requirements of SEARCH

* Table levels on which a SEARCH will be implemented must be indexed.
* SEARCH can be implemented to look for a match in any field on the indexed level as long as the field is not itself part of a lower level table.
* The index value must be set before the SEARCH is implemented.
* The table level need not be in any sort order based on the field being searched.

### Requirements of SEARCH ALL

* As with SEARCH, table levels on which a SEARCH ALL will be implemented must be indexed.
* The table level being searched with SEARCH ALL must be declared using the ASCENDING KEY or DESCENDING KEY field.
* For it to work, the table level must actually be in order based on the ASCENDING or DESCENDING KEY field.
* Unlike with SEARCH, the index value need not be set before the SEARCH ALL is implemented. In fact, if it is set, SEARCH ALL immediately alters in to begin the search in a binary fashion.

### Examples

Given the following table definition:

01 FUND-TBL.

05 FUND-TBL-ENTRY OCCURS 300

ASCENDING KEY FUND-NBR INDEXED BY FUND-NDX.

10 FUND-NBR PIC 9(2).

10 FUND-SHR-PRC PIC S9(3)V99 DECIMAL.

# COBOL COPY Statement

The COBOL COPY statement facilitates the copying of previously written COBOL source code into a program. Although it is often referred to as the “COPY verb,” the COPY statement is NOT a verb like MOVE, ADD, COMPUTE, READ, etc. The copying of the source code actually happens prior to COBOL compilation and is therefore NOT executable.

Although it is possible to copy in an entire COBOL program using the COPY statement, it is often used to copy in what is commonly referred to as a “copybook.” This is a section of storage like that found in the DATA DIVISION with levels and PIC clauses. But, as stated above, the code copied in can also be COBOL statements, COBOL paragraphs, or anything that can be typed into a COBOL program.

COBOL copybooks are useful in a number of ways but several of their primary uses are 1) to save the programmer time in typing in lots of large, multi-leveled and/or complex DATA DIVISION statements and

2) to facilitate the use of conventional or standard names for fields between programs in the same application or between applications. For example, a mutual fund transaction processing system’s conventional – or standardized – name for the field that stores the shareholder’s legal name might be SHR- HOLDER-NME and have size of PIC X(30). If copybooks are created – and used – for every DATA DIVISION structure in every COBOL program in the system or application that uses the shareholder’s legal name, the same elementary item name and size will be used. This can potentially save a lot in maintenance and any future enhancements. Using copybooks, imagine how much easier it would be to scan an application’s COBOL program source code for the standardized name and, if necessary, expand the field to PIC X(35).

When using the COPY statement, the source of the line or lines of code that are copied into a program is a single member of what is usually referred to as a COPYLIB, or copy library, PDS or PDSE. Copy libraries meant to be used in COBOL programs have 80-byte-long records that are inserted in whole in the program immediately following the COPY statement itself.

Format:

COPY member-name

[SUPPRESS]

[REPLACING string1 BY string2

string3 BY string4].

member-name PDS or PDSE member name of the code to copy into the program.

SUPPRESS the copied text will not be printed in the source code listing.

REPLACING replaces every occurrence of string1 by string2.

Note that the text that is copied in will have a 'C' in column 1 of the source listing unless suppressed. Example:

In the COBOL Compiler step, add a DD card named SYSLIB referencing the PDS or PDSE where the copybooks are stored as members.

Example:

//SYSLIB DD DSN=KC0nnnn.CSCI465.COPYLIB,DISP=SHR

Note that copy library PDSs or PDSEs can be concatenated on the SYSLIB card if necessary.

In the DATA DIVISION, or anywhere else in your program you want to copy the code from the PDS or PDSE member, use the COPY statement such as:

COPY SALESREC.

Each 80-byte line from the copy library member named SALESREC will be inserted in the source code following the COPY statement itself. Once again, this happens prior to compilation.

In Assembler, the COPY statement works almost exactly the same way as in COBOL although the SUPPRESS and REPLACING options cannot be used and there is no need for the LIB parameter on the EXEC card for the Assembler. The COPY library is included in SYSLIB as before because this is very similar to using a macro. Note that macro libraries are also in SYSLIB.

In COBOL or in Assembler, the code to be copied may contain other COPY statements, but no circular COPY references are allowed, and this practice is strongly discouraged in any case.

# COBOL REDEFINES

As the name suggests, the COBOL REDEFINES allows for the redefinition of any storage defined in the

DATA DIVISION. One might consider it a new way to look at the same bytes.

As an example of the use of the REDEFINES, the following COBOL data structure involves redefining sections of an input record that can come in several different formats. This is a typical situation and a good example as a single transaction input record can represent one of several types of transactions.

The COBOL program reads a record from the input file and then, based on the transaction code, determines the type of transaction to process and thus which data items to use based on that transaction type. Note that the PIC X(18) field originally defined as IN-DATA is being redefined in three different ways. It is the same 18 bytes of storage but the REDEFINES allows the programmer to consider those bytes in several different formats based on the IN-TRAN-CODE.

01 IN-TRAN-RECORD.

05 IN-TRAN-CODE PIC X.

88 ADD-TRANSACTION VALUE 'A'.

88 UPDATE-TRANSACTION VALUE 'U'.

88 DELETE-TRANSACTION VALUE 'D'. 05 IN-TRAN-FIELD PIC 9(6).

05 IN-DATA. PIC X(18).

05 IN-ADD-TRAN REDEFINES IN-DATA.

10 IN-ADD-FIELD1 PIC X.

10 IN-ADD-FIELD2 PIC 9.

10 IN-ADD-FIELD3 PIC X(10).

10 IN-ADD-FIELD4 PIC 9(6). 05 IN-ALTER-TRAN REDEFINES IN-DATA.

10 IN-ALTER-CODE PIC 9.

10 IN-ALTER-DATA PIC X(17).

10 IN-ALTER-1 REDEFINES IN-ALTER-DATA.

15 IN-ALTER-FIELD1 PIC 9(3).

15 FILLER PIC X(14).

10 IN-ALTER-2 REDEFINES IN-ALTER-DATA.

15 IN-ALTER-FIELD2 PIC 9(8).

15 FILLER PIC X(9).

10 IN-ALTER-3 REDEFINES IN-ALTER-DATA.

15 IN-ALTER-FIELD3 PIC X(10).

15 FILLER PIC X(7). 05 DELETE-TRAN REDEFINES IN-DATA.

10 FILLER PIC X(18).

**Rules for the REDEFINES**

A data item can only redefine a preceding item at the same level.

The number of bytes in the redefined area must match the number of bytes of the area being redefined.

### Example

The next example involves defining a table already loaded with information. For good measure, it is redefined twice, once with subscripts and once with indexes.

|  |  |  |
| --- | --- | --- |
| 01 | SEASON-NAME-DATA. |  |
|  | 05 FILLER | PIC X(6) VALUE 'SPRING'. |
|  | 05 FILLER | PIC X(6) VALUE 'SUMMER'. |
|  | 05 FILLER | PIC X(6) VALUE 'FALL'. |
|  | 05 FILLER | PIC X(6) VALUE 'WINTER'. |
| 01 | SEASON-NAME-TBL | REDEFINES SEASON-NAME-DATA. |
|  | 05 SEASON-NAME | OCCURS 4 |
|  |  | PIC X(6). |
| 01 | SEASON-NAME-TBL-NDXD | REDEFINES SEASON-NAME-DATA. |
|  | 05 SEASON-NAME-NDXD | OCCURS 4 |
|  |  | INDEXED BY S-N-NDX |
|  |  | PIC X(6). |

VALUE clauses can only be placed on the original data item definitions.

# COBOL Intrinsic Functions

An intrinsic function performs a mathematical, character, or logical operation and allows the programmer to reference a data item that is derived from other data items during execution of the program.

Functions are elementary data items. They are classified as one of three types -- alphanumeric, numeric, or integer -- depending on the type of value they return. Functions may not be receiving operands.

A function is referenced by specifying its name, along with any required arguments, in a PROCEDURE DIVISION statement.

A few of the intrinsic functions are briefly described below. Date functions are described in the next section.

### FUNCTION CURRENT-DATE

Probably the most useful intrinsic function is CURRENT-DATE which is a replacement for ACCEPT DATE and ACCEPT TIME. CURRENT-DATE is Y2K-compliant, having a 4-digit year. This function returns data to fill a user-defined 20-character alphanumeric field which is laid out as follows:

01 CURRENT-DATE-FIELDS.

|  |  |  |  |
| --- | --- | --- | --- |
| 05 | CURRENT-DATE. |  | |
|  | 10 CURRENT-YEAR | PIC | 9(4). |
|  | 10 CURRENT-MONTH | PIC | 9(2). |
|  | 10 CURRENT-DAY | PIC | 9(2). |
| 05 | CURRENT-TIME. |  |  |
|  | 10 CURRENT-HOUR | PIC | 9(2). |
|  | 10 CURRENT-MINUTE | PIC | 9(2). |
|  | 10 CURRENT-SECOND | PIC | 9(2). |
|  | 10 CURRENT-MS | PIC | 9(2). |
| 05 | DIFF-FROM-GMT | PIC | S9(4). |

Type or copy the above into your WORKING-STORAGE SECTION. You may change the names of the fields to suit your needs but the data types and field lengths must remain as described above. Also, it is useful to put this at the very end of your WORKING-STORAGE SECTION as you probably will not refer to the fields very often.

Notice that the time returned is given down to the millisecond and you are also provided the difference between your time and Greenwich Mean Time in the field named DIFF-FROM-GMT above. A negative value means that you are ahead of GMT and positive means you are behind.

The function is used in a MOVE:

MOVE FUNCTION CURRENT-DATE TO CURRENT-DATE-FIELDS.

You may also use reference modification to only grab the part of the date you want:

* Get the current date in yyyymmdd format

MOVE FUNCTION CURRENT-DATE (1:8) TO WS-TODAY.

* Get the current time in hhmmss format

MOVE FUNCTION CURRENT-DATE (9:6) TO WS-TIME.

Note that, in the above two move statements, the destination fields WS-TODAY and WS-TIME are user- defined fields.

If you can, call the CURRENT-DATE function once at the very beginning of your program. Whenever possible, avoid calling the function from within a loop.

### FUNCTION LENGTH (argument-1)

The length function returns an integer equal to the length of the argument (in bytes). The argument may be a nonnumeric literal or a data item.

*Example:* COMPUTE LENGTH-OF-VARIABLE = FUNCTION LENGTH(VARIABLE-1).

The data item LENGTH-OF-VARIABLE will contain the number of bytes in the data item VARIABLE-1.

### FUNCTION MAX (argument-1 argument-2 ...)

The MAX function returns the content of whichever argument contains the greatest value. The function type depends on the argument type.

Arguments may be numeric, alphanumeric, or alphabetic, but all arguments must be of the same type.

*Example:* COMPUTE HIGH-NUMBER =

FUNCTION MAX (VARIABLE-1 VARIABLE-2 VARIABLE-3).

The data item HIGH-NUMBER will contain the same value as whichever variable has the highest value.

### FUNCTION MIN(argument-1 argument-2 ...)

The MIN function returns the content of whichever argument has the smallest value. The function type depends on the argument type.

Arguments may be numeric, alphanumeric, or alphabetic, but all arguments must be of the same type.

*Example:* COMPUTE LOW-NUMBER =

FUNCTION MIN(VARIABLE-1 VARIABLE-2 VARIABLE-3).

The data item LOW-NUMBER will contain the same value as whichever variable has the lowest value.

### FUNCTION MEAN(argument-1 argument-2 ...)

The MEAN function returns a numeric value that approximates the arithmetic average of the arguments.

The arguments must be numeric.

*Example:* COMPUTE AVERAGE-VALUE =

FUNCTION MEAN(VAR-1 VAR-2 VAR-3 VAR-4).

The data item AVERAGE-VALUE will contain the average of the four variables, calculated by adding up the values in the arguments and dividing by the number of arguments.

The ALL subscript can be used to obtain the average of items contained in a table.

*Example:* COMPUTE AVERAGE-SALARY = FUNCTION MEAN(EMP-SALARY(ALL)).

The values in all of the instances of EMP-SALARY in the table will be added together, and the total will be divided by the number of instances. The result will be placed in AVERAGE-SALARY.

### FUNCTION MEDIAN(argument-1 argument-2 ...)

The MEDIAN function returns the middle value in a list formed by arranging the arguments in sorted order. If the number of occurrences is even, the returned value is the arithmetic mean of the values referenced by the two middle occurrences.

The value returned is a numeric value, and all of the arguments must be numeric.

*Example:* COMPUTE MIDDLE-NUMBER =

FUNCTION MEDIAN(VAR-1 VAR-2 VAR-3 VAR-4 VAR-5).

MIDDLE-NUMBER will contain the median of the five variables used as arguments.

The ALL subscript could be used to obtain the median of a series of numbers stored in a table.

### FUNCTION SUM (argument-1 argument-2 ...)

The SUM function returns an integer or numeric value that is the sum of the arguments.

The function type will be integer if all of the arguments are integers. The function type will be numeric if all of the arguments are numeric or if the arguments are mixed (some integer and some numeric).

*Example:* COMPUTE TOTAL-AMOUNT = FUNCTION SUM(VAR-1 VAR-2 VAR-3).

The data item TOTAL-AMOUNT will contain the sum of the three variables. The subscript ALL may be used to sum up a series of numbers in a table. **FUNCTION RANDOM (argument-1)**

The RANDOM function returns a numeric value that is a pseudo-random number. The same argument value will always produce the same random number. The returned value will range between zero and one.

Argument-1 is optional. If the first reference to this function omits argument-1, a seed value of zero is used. Subsequent references to the function without argument-1 return the next number in the current sequence.

*Example:* COMPUTE RANDOM-NUMBER = FUNCTION RANDOM(20).

The data item RANDOM-NUMBER will contain a number that the function calculated using the number 20 as a seed value.

### FUNCTION REVERSE(argument-1)

The REVERSE function returns a character string of exactly the same length as the argument, and containing the same characters as the argument, but in reverse order.

The function type is alphanumeric.

Argument-1 may be alphabetic or alphanumeric and must be at least one character in length.

*Example:* MOVE FUNCTION REVERSE(CUST-NAME) TO REVERSE-NAME.

If CUST-NAME contains JOHNSONbbb, then REVERSE-NAME will contain bbbNOSNHOJ.

### FUNCTION UPPER-CASE(argument-1)

The UPPER-CASE function returns a character string that is the same length as the argument, with each lower-case letter replaced by the corresponding upper-case letter.

The function type is alphanumeric.

The argument must be either alphabetic or alphanumeric and must be at least one character in length.

*Example:* MOVE FUNCTION UPPER-CASE(VAR-1) TO VAR-2.

If VAR-1 contains the value 'abcde', then VAR-2 will contain 'ABCDE'.

### MORE INTRINSIC DATE FUNCTIONS

Cobol has several intrinsic functions pertaining to dates. These functions involve 4-digit years and are Y2K compliant.

The following material covers the functions INTEGER-OF-DATE, DATE-OF-INTEGER, and CURRENT- DATE. It does not cover the related Julian date functions INTEGER-OF-DAY and DAY-OF-INTEGER.

Cobol's intrinsic date functions number the days following December 31, 1600. Thus, January 1, 1601 has the integer value 1. January 1, 2000 has the integer value 145732.

### FUNCTION INTEGER-OF-DATE(argument-1)

*Argument:* An elementary numeric data item containing a date in the format yyyymmdd

*Returns:* An integer that is at least 6 digits long. A field intended to hold the returned value must be an elementary numeric data item that can hold at least 6 digits.

### FUNCTION DATE-OF-INTEGER(argument-1)

*Argument:* An elementary numeric data item containing an integer representing the number of days since December 31, 1600.

*Returns:* A date in the format yyyymmdd. A field intended to hold the returned value must be an elementary numeric data item that is 8 digits long.

**Examples of Date Arithmetic Using the Functions**

1. Suppose we want to find the number of days between March 15, 1999, and and October 30, 1999. We can use the INTEGER-OF-DATE function to turn each date into an integer, and then subtract the integers.

In WORKING-STORAGE:

|  |  |  |  |
| --- | --- | --- | --- |
| 01 | START-DATE | PIC | 9(8) VALUE 19990315. |
| 01 | END-DATE | PIC | 9(8) VALUE 19991030. |
| 01 | START-INT | PIC | 9(6). |
| 01 | END-INT | PIC | 9(6). |
| 01 | DAYS-BETWEEN | PIC | 9(6). |

In the PROCEDURE DIVISION:

COMPUTE START-INT = FUNCTION INTEGER-OF-DATE (START-DATE). COMPUTE END-INT = FUNCTION INTEGER-OF-DATE (END-DATE).

COMPUTE DAYS-BETWEEN = END-INT – START-INT.

If the following DISPLAYs were included:

DISPLAY 'START-INT= ' START-INT. DISPLAY 'END-INT= ' END-INT.

DISPLAY 'DAYS-BETWEEN= ' DAYS-BETWEEN.

The output from the DISPLAYs would look like this:

START-INT= 145440

END-INT= 145669

DAYS-BETWEEN= 000229

In place of the three statements, a single statement could be used:

COMPUTE DAYS-BETWEEN =

FUNCTION INTEGER-OF-DATE (END-DATE) - FUNCTION INTEGER-OF-DATE (START-DATE).

This is a a single compute statement that subtracts one returned integer from another eliminates the need for the working storage variables START-INT and END-INT.

1. Suppose we want to find the number of days between March 15, 1999 and the current date (whatever that is).

In working storage, change the definition of END-DATE: 01 TODAY.

05 END-DATE PIC 9(8).

Or, alternatively:

01 TODAY PIC X(8).

01 END-DATE REDEFINES TODAY PIC 9(8).

Note that either of the above results in an *alphanumeric* field (TODAY), which is a requirement of the

CURRENT-DATE function.

In working storage, get the end date before subtracting:

MOVE FUNCTION CURRENT-DATE TO TODAY. COMPUTE DAYS-BETWEEN =

FUNCTION INTEGER-OF-DATE (END-DATE) - FUNCTION INTEGER-OF-DATE (START-DATE).

1. Suppose we want to find out what the date was 100 days ago.

MOVE FUNCTION CURRENT-DATE TO TODAY.

COMPUTE END-INT = FUNCTION INTEGER-OF-DATE (END-DATE). COMPUTE START-INT = START-INT – 100.

COMPUTE START-DATE = FUNCTION DATE-OF-INTEGER (START-INT).

# COBOL Control Break Processing

In control break processing, we have an input file which has been sorted on several key fields. We can think of the group as occurring in large groups of records, each group having the same value of the first key. Within each large group, the records occur in smaller groups according to the value of the second key. This pattern continues, depending on the number of keys.

We are interested in statistics (sum, maximum, minimum, etc.) for the file as a whole, for each large group, for each small group within each large group, etc.

### Pseudocode

Main routine:

Zero grand totals Read first record

Perform Process-One-Large-Group until end of file

Print grand totals

Process-One-Large-Group routine: Save large group identifier Zero large group subtotals

Fill in headings with identifier for large group Perform Process-Smaller-Group

until new identifier for large group or end of file

Print subtotals for large group

Add large group subtotals to grand totals

Process-Smaller-Group routine: Save smaller group identifier Zero smaller group subtotals

Fill in headings with identifier for smaller group Perform Process-Smallest-Group

until new identifier for smaller group or new identifier for large group

or end of file

Print subtotals for smaller group

Add smaller group subtotals to large group subtotals

Process-Smallest-Group routine: Save smallest group identifier Zero smallest group subtotals

Fill in headings with identifier for smallest group Perform Process-One-Record

until new identifier for smallest group or new identifier for smaller group or new identifier for large group

or end of file

Print subtotals for smallest group

Add smallest group subtotals to smaller group subtotals

Process-One-Record routine:

Do whatever needs to be done with the record (depends on the purpose of the program)

Read the next record

### Notes

The above pseudocode assumes we are adding up totals. We could easily instead be looking for a maximum value or a minimum value at each point. There may be a lot of variables involved.

If we have more than 3 levels of control, there can be any number of routines between Main and Process- One-Record, but all of them look very similar. If we have only 1 key, control-break processing loses its distinctive meaning.

The priming Read is in Main; the other Read is in Process-One-Record.

All of this is absolutely dependent on the data being sorted in order by the various key fields, which are the identifiers for the large group, smaller group, and smallest group, in that order. If we want other statistics, we need to re-sort the data and write a new program.

There is no assumption here that each large group contains the same number of smaller groups, or that each smaller group contains the same number of smallest groups. If that was the case, we could theoretically put all the data in a multidimensional table--if we could have a table large enough.

### Example

Suppose our records look like this:

Salesperson-Name City Month Sales-Total Sales-Data

The data is sorted on 3 keys: 1st Salesperson-Name, 2nd City, 3rd Month. We want a report like this:

Name: John Jones City: Baltimore Month: June Sales-Data Sales-Amount

.......... $.......

.......... $.......

.......... $.......

.......... $.......

Total = $........

Each time a control field (a key field) changes, we have a control break. We advance to a new page. (We may end up with a lot of pages of output.) For control breaks higher than the first, we will also print totals for the city, for the salesperson, or (last) for the company as a whole.

Here is pseudocode for this example: 000-Main.

Initialize company total. Priming read.

Perform 100-Process-One-Salesperson until End-of-File. Print company total.

100-Process-One-Salesperson.

Save the salesperson name and put it in the heading. Initialize salesperson total.

Perform 200-Process-One-City until End-of-File or we have a new salesperson.

Add salesperson total to company total. Print salesperson total.

200-Process-One-City.

Save the city name and put it in the heading. Initialize city total.

Perform 300-Process-One-Month until End-of-File or we have a new salesperson or

we have a new city.

Add city total to salesperson total. Print city total.

300-Process-One-Month.

Save the month name and put it in the heading. Advance to a new page and print the heading. Initialize month total.

Perform 400-Process-One-Sale until End-of-File or we have a new salesperson or

we have a new city or we have a new month.

Add month total to city total. Print month total.

400-Process-One-Sale.

Print a line about the latest sale. Add sales amount to month total. Read next record.

# Example COBOL Data Validation Program

IDENTIFICATION DIVISION.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - PROGRAM NAME: DATAVAL \*

\* \*

* + - AUTHORS: programmer name \*

\* \*

* + - FUNCTION: This program validates input \*
    - transactions that will be used by \*
    - another program to update a \*
    - a sequential master file of patient \*
    - records. A separate error message is \*
    - produced for each error found on an \*
    - invalid record. \*

\* \*

* + - INPUT: A file, on disk, containing a header \*
    - record with the date the file was \*
    - created, followed by an unspecified \*
    - number of Add, Alter, and Delete \*
    - transactions. \*

\* \*

* + - OUTPUT: (1) A file, on disk, containing the \*
    - valid records, and (2) an error report \*
    - showing each invalid record, along \*
    - with one or more error messages. \*

\* \*

* + - NOTES: NONE \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM-ID. DATAVAL.

ENVIRONMENT DIVISION. INPUT-OUTPUT SECTION. FILE-CONTROL.

SELECT TRAN-FILE ASSIGN TO OLDTRAN. SELECT NEW-FILE ASSIGN TO NEWTRAN. SELECT PRINT-FILE ASSIGN TO PRINTER.

DATA DIVISION.

FILE SECTION.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - The input file contains the transactions to be \*
    - validated. \*
    - The transactions are preceded by one header record. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

FD TRAN-FILE

RECORD CONTAINS 83 CHARACTERS RECORDING MODE IS F.

01 HEADER-RECORD.

05 DATE-BLANKS PIC X(8).

05 DATE-FIELD PIC 9(8).

05 DATE-MORE-BLANKS PIC X(67).

01 TRAN-RECORD.

05 TRAN-PATIENT-NUM PIC 9(5).

05 TRAN-CODE PIC 9.

05 TRAN-INFO PIC X(77).

05 TRAN-ADD-INFO REDEFINES TRAN-INFO.

|  |  |  |  |
| --- | --- | --- | --- |
| 10 | TRAN-ADD-PATIENT | PIC | X(20). |
| 10 | TRAN-ADD-DOCTOR | PIC | X(10). |
| 10 | TRAN-ADD-LAST-VISIT | PIC | 9(8). |
| 10 | TRAN-ADD-DX. |  |  |
|  | 15 TRAN-ADD-DXI | PIC | X. |
|  | 15 TRAN-ADD-DXII | PIC | 99. |
| 10 | TRAN-ADD-NEXT-VISIT | PIC | 9(8). |
| 10 | TRAN-ADD-CHARGE | PIC | 9999V99. |
| 10 | TRAN-ADD-PT-PAID | PIC | 9999V99. |
| 10 | TRAN-ADD-INS-CO | PIC | X(10). |
| 10 | TRAN-ADD-INS-PAID | PIC | 9999V99. |

05 TRAN-ALTER-INFO REDEFINES TRAN-INFO.

10 TRAN-ALTER-CODE PIC 9.

10 TRAN-ALTER-FIELD PIC X(76).

10 TRAN-ALTER-PATIENT REDEFINES TRAN-ALTER-FIELD.

15 TRAN-NEW-NAME PIC X(20).

15 FILLER PIC X(56).

10 TRAN-ALTER-DOCTOR REDEFINES TRAN-ALTER-FIELD.

15 TRAN-NEW-DOCTOR PIC X(10).

15 FILLER PIC X(66).

10 TRAN-ALTER-LAST-VISIT REDEFINES

TRAN-ALTER-FIELD.

15 TRAN-NEW-LAST-VISIT PIC 9(8).

15 FILLER PIC X(68).

10 TRAN-ALTER-DX REDEFINES TRAN-ALTER-FIELD.

15 TRAN-NEW-DXI PIC X.

15 TRAN-NEW-DXII PIC 99.

15 FILLER PIC X(73).

10 TRAN-ALTER-NEXT-VISIT REDEFINES

TRAN-ALTER-FIELD.

15 TRAN-NEW-NEXT-VISIT PIC 9(8).

15 FILLER PIC X(68).

10 TRAN-ALTER-CHARGE REDEFINES TRAN-ALTER-FIELD.

15 TRAN-NEW-CHARGE PIC 9999V99.

15 FILLER PIC X(70).

10 TRAN-ALTER-PAID REDEFINES TRAN-ALTER-FIELD.

15 TRAN-NEW-PT-PAID PIC 9999V99.

15 FILLER PIC X(70).

10 TRAN-ALTER-INS-CO REDEFINES TRAN-ALTER-FIELD.

15 TRAN-NEW-INS-CO PIC X(10).

15 FILLER PIC X(66).

10 TRAN-ALTER-INS-PAID REDEFINES

TRAN-ALTER-FIELD.

15 TRAN-NEW-INS-PAID PIC 9999V99.

15 FILLER PIC X(70). 05 TRAN-DELETE-INFO REDEFINES TRAN-INFO.

10 TRAN-DELETE-BLANKS PIC X(77).

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - This output file contains a generic print line that \*
    - is used to print all of the lines on the report. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

FD PRINT-FILE

LABEL RECORDS ARE OMITTED RECORDING MODE IS F.

01 PRINT-LINE PIC X(132).

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - This output file, on disk, contains all of the valid \*
    - records from the input file. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

FD NEW-FILE

LABEL RECORDS ARE STANDARD BLOCK CONTAINS 30 RECORDS RECORDING MODE IS F.

01 NEW-RECORD PIC X(83).

WORKING-STORAGE SECTION.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - VARIABLE DICTIONARY \*

\* \*

* + - SYS-DATE: Holds date accepted from system. \*
    - SYS-TIME: Holds time accepted from system. \*

\* \*

* + - NEW-FILE-HEADER: Header record for the edited tran \*
    - file. \*

\* \*

* + - TITLE-LINE1: Page headers. \*
    - TITLE-LINE2: \*

\* \*

* + - COLUMN-LINE1: Column headers. \*

|  |  |  |
| --- | --- | --- |
| \* COLUMN-LINE2: |  | \* |
| \* |  | \* |
| \* SUMMARY-TITLE-LINE2: | Page header for the contents of | \* |
| \* | the valid file. | \* |
| \* |  | \* |
| \* DETAIL-LINE: | Prints the contents of the | \* |
| \* | record above the error messages. | \* |
| \* |  | \* |
| \* FIRST-ERROR-LINE: | Prints the first error line. | \* |
| \* |  | \* |
| \* NEXT-ERROR-LINE: | Prints any subsequent error | \* |
| \* | lines for the same transaction. | \* |
| \* |  | \* |
| \* SUMMARY-LINE: | Prints the number of valid and | \* |
| \* | invalid records processed. | \* |
| \* |  | \* |
| \* NEW-RECORD-LINE: | For printing contents of valid | \* |
| \* | file. | \* |
| \* |  | \* |
| \* EOF-FLAG: | Set to 'y' when end of file | \* |
| \* | occurs. | \* |
| \* |  | \* |
| \* HEADER-ERROR-FLAG: | Set to 'y' if header on input | \* |
| \* | file is not valid. | \* |
| \* |  | \* |
| \* ERROR-FLAG: | Set to 'y' when the first error | \* |
| \* | for a transaction is printed. | \* |
| \* |  | \* |
| \* ERROR-SUB: | Subscript for error message | \* |
| \* | table. | \* |
| \* |  | \* |
| \* ERROR-TOTAL | Count of invalid transactions. | \* |
| \* |  | \* |
| \* VALID-TOTAL | Count of valid transactions. | \* |
| \* |  | \* |
| \* COUNT-LINE | Line counter. | \* |
| \* |  | \* |
| \* COUNT-PAGE | Page counter. | \* |
| \* |  | \* |
| \* ERROR-TABLE | Table of error messages. | \* |
| \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* | | |

|  |  |  |  |
| --- | --- | --- | --- |
| 01 | SYSTEM-DATE-AND-TIME. 05 SYS-DATE | PIC | 9(8). |
|  | 05 SYS-TIME | PIC | 9(8). |
| 01 | NEW-FILE-HEADER. 05 | PIC | X(8). |
|  | 05  05 PROGRAMMER-NAME  05 | PIC  PIC PIC | X(8).  X(23).  X(44). |

01 TITLE-LINE1.

05 PIC X(5) VALUE SPACES.

05 TITLE-DATE PIC 99/99/9999.

05 PIC X(22) VALUE SPACES.

05 PIC X(26)

VALUE 'COUNTRYSIDE MEDICAL CLINIC'.

05 PIC X(21) VALUE SPACES.

05 PIC X(5) VALUE 'PAGE '.

05 LINE-COUNT-PAGE PIC Z9.

01 TITLE-LINE2.

05 PIC X(34) VALUE SPACES.

05 PIC X(32)

VALUE 'DATA VALIDATION EXCEPTION REPORT'.

05 PIC X(50) VALUE SPACES.

01 COLUMN-LINE1.

05 PIC X(28)

VALUE 'PATIENT TRAN 1 2'.

05 PIC X(20)

VALUE ' 3 4'.

05 PIC X(20)

VALUE ' 5 6'

05 PIC X(20)

VALUE ' 7 8'.

01 COLUMN-LINE2.

05 PIC X(21)

VALUE 'NUMBER CODE 7890123'.

05 PIC X(70)

VALUE ALL '4567890123'.

01 SUMMARY-TITLE-LINE2.

05 PIC X(40) VALUE SPACES.

05 PIC X(20)

VALUE 'VALIDATED DATA ITEMS'.

05 PIC X(56) VALUE SPACES.

01 DETAIL-LINE.

05 DET-PATIENT-NUM PIC X(5).

05 PIC X(5) VALUE SPACES.

05 DET-TRAN-CODE PIC X.

05 PIC XXX VALUE SPACES.

05 DET-CONTENT PIC X(113).

01 FIRST-ERROR-LINE.

05 PIC X(19) VALUE SPACES.

05 PIC X(20)

VALUE 'ERROR MESSAGES: '. 05 FIRST-ERROR-NAME PIC X(44).

05 PIC X(49) VALUE SPACES.

01 NEXT-ERROR-LINE.

05 PIC X(39) VALUE SPACES.

|  |  |  |  |
| --- | --- | --- | --- |
|  | VALUE | IS | 'PATIENT NUMBER IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'PATIENT NUMBER IS ZERO'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'TRAN-CODE IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'TRAN-CODE VALUE IS OUT OF VALID RANGE'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'ALTER CODE IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'ALTER-CODE VALUE IS OUT OF VALID RANGE'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'PATIENT NAME MISSING - BLANKS FOUND'. |
| 05 |  |  | PIC X(44) |

05 NEXT-ERROR-NAME PIC X(44).

05 PIC X(49) VALUE SPACES.

01 SUMMARY-LINE.

05 PIC X(20).

05 PIC X(7) VALUE 'TOTALS:'.

05 PIC X(5) VALUE SPACES.

05 PIC X(16)

VALUE 'INVALID RECORDS='.

05 LINE-ERROR-TOTAL PIC ZZ9.

05 PIC X(5) VALUE SPACES.

05 PIC X(14)

VALUE 'VALID RECORDS='.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 05 LINE-VALID-TOTAL  05 | PIC PIC | ZZ9. X(59). |  | |
| 01 | NEW-RECORD-LINE. 05 | PIC | X(5) | VALUE | SPACES. |
|  | 05 NEW-RECORD-STUFF  05 | PIC PIC | X(83). X(44) | VALUE | SPACES. |
| 01 | FLAGS-SUBS. 05 EOF-FLAG | PIC | X | VALUE | 'N'. |
|  | 05 HEADER-ERROR-FLAG  88 NO-HEADER-ERROR 05 ERROR-FLAG | PIC  PIC | X  X | VALUE  VALUE VALUE | 'N'.  'N'.  'N'. |
|  | 05 ERROR-SUB | PIC | 99. |  |  |
| 01 | TOTALS-COUNTS. 05 ERROR-TOTAL | PIC | 999 | VALUE | 0. |
|  | 05 VALID-TOTAL | PIC | 999 | VALUE | 0. |
|  | 05 COUNT-LINE | PIC | 99 | VALUE | 0. |
|  | 05 COUNT-PAGE | PIC | 99 | VALUE | 0. |
| 01 | ERROR-MESSAGE. 05 | PIC | X(44) |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | VALUE | IS | 'PHYSICIAN NAME MISSING - BLANKS FOUND'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'DATE OF LAST VISIT IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'DATE OF LAST VISIT IS ZERO'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'DIAGNOSIS CODE PART A IS INVALID VALUE'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'DIAGNOSIS CODE PART B IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'DATE OF NEXT VISIT IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'NEW CHARGE IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'AMOUNT PAID BY PATIENT IS NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'AMOUNT PAID BY INSURANCE NOT NUMERIC'. |
| 05 |  |  | PIC X(44) |
|  | VALUE | IS | 'DELETE RECORD IS NOT ALL BLANKS'. |

01 ERROR-TABLE REDEFINES ERROR-MESSAGE.

05 ERROR-NAME PIC X(44) OCCURS 17.

PROCEDURE DIVISION.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 000-MAIN performs a subroutine to check the header on \*
    - the input file. If OK, it then writes a header on the \*
    - valid output file, gets the system date and time, \*
    - writes headers on the error report, does a priming \*
    - read for the first transaction record, and performs a \*
    - subroutine to process transaction records until end of \*
    - file. Finally, it prints the total number of valid \*
    - and invalid records, and then performs a subroutine to \*
    - print out the contents of the valid transaction file. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0000-MAIN.

OPEN INPUT TRAN-FILE. OPEN OUTPUT PRINT-FILE

NEW-FILE. PERFORM 0100-CHECK-HEADER.

IF NO-HEADER-ERROR

MOVE HEADER-RECORD TO NEW-FILE-HEADER MOVE 'LYNN BONNETT' TO PROGRAMMER-NAME WRITE NEW-RECORD FROM NEW-FILE-HEADER MOVE DATE-FIELD TO TITLE-DATE

MOVE FUNCTION CURRENT-DATE(1:16)TO SYSTEM-DATE-AND-TIME

READ TRAN-FILE

AT END MOVE 'Y' TO EOF-FLAG END-READ

PERFORM 0200-PROCESS-RECORD UNTIL EOF-FLAG = 'Y' MOVE ERROR-TOTAL TO LINE-ERROR-TOTAL

MOVE VALID-TOTAL TO LINE-VALID-TOTAL

WRITE PRINT-LINE FROM SUMMARY-LINE AFTER 4

CLOSE NEW-FILE

OPEN INPUT NEW-FILE

PERFORM 0300-PRINT-NEW-FILE END-IF.

CLOSE TRAN-FILE

PRINT-FILE NEW-FILE.

GOBACK.

0000-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0100-CHECK-HEADER reads the first record in the input \*
    - file, makes sure it is present, and that it is a valid \*
    - header record. An error message is displayed if it is \*
    - not valid. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0100-CHECK-HEADER.

READ TRAN-FILE

AT END MOVE 'Y' TO EOF-FLAG END-READ.

IF EOF-FLAG = 'Y'

DISPLAY 'INPUT TRAN FILE IS EMPTY' MOVE 'Y' TO HEADER-ERROR-FLAG

ELSE

IF DATE-BLANKS IS NOT EQUAL TO SPACES DISPLAY 'HEADER KEY FIELD IS INVALID' MOVE 'Y' TO HEADER-ERROR-FLAG

ELSE

IF DATE-FIELD IS NOT NUMERIC

DISPLAY 'HEADER DATE IS INVALID' MOVE 'Y' TO HEADER-ERROR-FLAG

ELSE

IF DATE-MORE-BLANKS NOT EQUAL TO SPACES DISPLAY 'UNEXPECTED DATA IN HEADER' MOVE 'Y' TO HEADER-ERROR-FLAG

END-IF

END-IF END-IF

END-IF.

0100-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0200-PROCESS-RECORD validates the patient and the \*
    - transaction code. If the transaction code is valid, \*
    - it performs either 0220-TRAN-ADD or 0230-TRAN-ALTER or \*
    - 0240-TRAN-DELETE to validate the rest of the record. \*
    - Then, if no error was found on the transaction, it \*
    - writes the transaction to the valid file and \*
    - increments the count of valid records. Finally, it \*
    - reads the next transaction record. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0200-PROCESS-RECORD.

MOVE 'N' TO ERROR-FLAG.

IF TRAN-PATIENT-NUM IS NOT NUMERIC MOVE 1 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR ELSE

IF TRAN-PATIENT-NUM IS ZERO MOVE 2 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

END-IF END-IF.

IF TRAN-CODE IS NOT NUMERIC MOVE 3 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

ELSE

EVALUATE TRAN-CODE WHEN 1

PERFORM 0220-TRAN-ADD WHEN 2

PERFORM 0230-TRAN-ALTER WHEN 3

PERFORM 0240-TRAN-DELETE WHEN OTHER

MOVE 4 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

END-EVALUATE

END-IF.

IF ERROR-FLAG = 'N'

ADD 1 TO VALID-TOTAL

WRITE NEW-RECORD FROM TRAN-RECORD END-IF.

READ TRAN-FILE

AT END MOVE 'Y' TO EOF-FLAG END-READ.

0200-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0210-PRINT-ERROR checks the error flag to see if this \*
    - is the first error for this transaction ("N" indicates \*
    - first error). For a first error, this routine checks \*
    - whether page and column heads are needed (performing \*
    - 0211-PRINT-TITLE to print them if needed). It adds to \*
    - the count of invalid records. Then it prints two \*
    - lines (one with the transaction data, and one with the \*
    - error message preceded by the words "ERROR MESSAGES:". \*
    - If not the first, it prints only the error message. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0210-PRINT-ERROR.

IF ERROR-FLAG = 'N'

IF COUNT-LINE >= 30

PERFORM 0211-PRINT-TITLE END-IF

ADD 1 TO ERROR-TOTAL

MOVE TRAN-PATIENT-NUM TO DET-PATIENT-NUM MOVE TRAN-CODE TO DET-TRAN-CODE

MOVE TRAN-INFO TO DET-CONTENT

WRITE PRINT-LINE FROM DETAIL-LINE AFTER 2

MOVE ERROR-NAME (ERROR-SUB) TO FIRST-ERROR-NAME WRITE PRINT-LINE FROM FIRST-ERROR-LINE

MOVE 'Y' TO ERROR-FLAG ADD 2 TO COUNT-LINE

ELSE

MOVE ERROR-NAME (ERROR-SUB) TO NEXT-ERROR-NAME WRITE PRINT-LINE FROM NEXT-ERROR-LINE

ADD 1 TO COUNT-LINE END-IF.

0210-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0220-TRAN-ADD checks each field on an add transaction. \*
    - Whenever an error is found, it moves the appropriate \*
    - subscript to ERROR-SUB, and performs 0210-PRINT-ERROR \*
    - to process the error. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0220-TRAN-ADD.

IF TRAN-ADD-PATIENT IS = SPACES MOVE 7 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-DOCTOR IS = SPACES MOVE 8 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-LAST-VISIT IS NOT NUMERIC MOVE 9 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR ELSE

IF TRAN-ADD-LAST-VISIT IS ZERO MOVE 10 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

END-IF END-IF.

IF TRAN-ADD-DXI IS NOT =

'A' AND 'C' AND 'N' AND 'R' AND 'Y' MOVE 11 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-DXII IS NOT NUMERIC MOVE 12 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-NEXT-VISIT IS NOT NUMERIC MOVE 13 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-CHARGE IS NOT NUMERIC MOVE 14 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-PT-PAID IS NOT NUMERIC MOVE 15 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

IF TRAN-ADD-INS-PAID IS NOT NUMERIC MOVE 16 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

0220-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0230-TRAN-ALTER validates the alter code. For each \*
    - possible valid alter code, it checks the appropriate \*
    - field. If the field is not valid, it moves the \*
    - appropriate subscript to ERROR-SUB and performs 500- \*
    - PRINT-ERROR to process the error. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0230-TRAN-ALTER.

IF TRAN-ALTER-CODE IS NOT NUMERIC MOVE 5 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR

ELSE

EVALUATE TRAN-ALTER-CODE WHEN 1

IF TRAN-NEW-NAME IS = SPACES MOVE 7 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

END-IF WHEN 2

IF TRAN-NEW-DOCTOR IS = SPACES MOVE 8 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

WHEN 3

IF TRAN-NEW-LAST-VISIT IS NOT NUMERIC MOVE 9 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR ELSE

IF TRAN-NEW-LAST-VISIT = ZEROES MOVE 10 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

END-IF WHEN 4

IF TRAN-NEW-DXI IS NOT = 'A' AND 'C' AND 'N' AND 'R' AND 'Y'

MOVE 11 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

END-IF

IF TRAN-NEW-DXII IS NOT NUMERIC MOVE 12 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

WHEN 5

IF TRAN-NEW-NEXT-VISIT IS NOT NUMERIC MOVE 13 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

WHEN 6

IF TRAN-NEW-CHARGE IS NOT NUMERIC MOVE 14 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

WHEN 7

IF TRAN-NEW-PT-PAID IS NOT NUMERIC MOVE 15 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

WHEN 8

CONTINUE WHEN 9

IF TRAN-NEW-INS-PAID IS NOT NUMERIC MOVE 16 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF

WHEN OTHER

MOVE 6 TO ERROR-SUB PERFORM 0210-PRINT-ERROR

END-EVALUATE END-IF.

0230-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0240-TRAN-DELETE checks the rest of the delete \*
    - transaction. If the rest of the record is not all \*
    - spaces, it places the appropriate subscript in \*
    - ERROR-SUB and performs 0210-PRINT-ERROR to process the \*
    - error. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0240-TRAN-DELETE.

IF TRAN-DELETE-BLANKS IS NOT EQUAL TO SPACES MOVE 17 TO ERROR-SUB

PERFORM 0210-PRINT-ERROR END-IF.

0240-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0211-PRINT-TITLE prints page and column headers, adds 1 \*
    - to the page counter and resets the line counter. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0211-PRINT-TITLE.

WRITE PRINT-LINE FROM SYSTEM-DATE-AND-TIME AFTER PAGE. ADD 1 TO COUNT-PAGE.

MOVE 0 TO COUNT-LINE.

MOVE COUNT-PAGE TO LINE-COUNT-PAGE.

WRITE PRINT-LINE FROM TITLE-LINE1 AFTER 2. WRITE PRINT-LINE FROM TITLE-LINE2.

WRITE PRINT-LINE FROM COLUMN-LINE1 AFTER 2. WRITE PRINT-LINE FROM COLUMN-LINE2.

0211-EXIT. EXIT.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - 0300-PRINT-NEW-FILE prints out the contents of the new \*
    - disk file containing the valid transactions. It puts page \*
    - page and column heads on the first page of this output. \*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 0300-PRINT-NEW-FILE.

WRITE PRINT-LINE FROM SYSTEM-DATE-AND-TIME AFTER PAGE. ADD 1 TO COUNT-PAGE.

MOVE COUNT-PAGE TO LINE-COUNT-PAGE.

WRITE PRINT-LINE FROM TITLE-LINE1 AFTER 2. WRITE PRINT-LINE FROM SUMMARY-TITLE-LINE2. MOVE SPACES TO PRINT-LINE.

WRITE PRINT-LINE.

MOVE 'N' TO EOF-FLAG. READ NEW-FILE

AT END MOVE 'Y' TO EOF-FLAG END-READ.

PERFORM UNTIL EOF-FLAG = 'Y'

MOVE NEW-RECORD TO NEW-RECORD-STUFF WRITE PRINT-LINE FROM NEW-RECORD-LINE

READ NEW-FILE

AT END MOVE 'Y' TO EOF-FLAG END-READ

END-PERFORM.

0300-EXIT. EXIT.