

DFSORT's NEW GENERATION OF YEAR 2000 FEATURES



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DFSORT's new generation of Year 2000 features makes it much easier to sort, merge, compare and transform two-digit year dates. With the new set of "full date" formats and constants for Releases 13 and 14, you no longer have to split up your dates or use E61 exits.

WOULDN'T it be nice if you could handle your two-digit year dates without splitting them up into year and non-year pieces? What if you could handle special indicators in two-digit year dates without writing and maintaining E61 exits? How about being able to select records based on comparisons of two-digit year dates? Well, DFSORT's new generation of Year 2000 features for Releases 13 and 14 lets you do all of that and more! New "full date" formats and constants make it much easier to use a century window to sort, merge, compare and transform your character, zoned decimal and packed decimal two-digit year dates.

DFSORT's earlier Y2C, Y2Z, Y2S, Y2P, Y2D and Y2B formats only dealt with the year (yy), so they required the date to be split into pieces and could not handle some types of special indicators.

DFSORT's new Y2T, Y2U, Y2V, Y2W, Y2X and Y2Y formats deal with full yyx...x and x...xyy dates such as yyq, yymm, yyddd, yymmdd, qyy, mmyy, dddy and mmddy. And since they deal with full dates, they can handle full date special indicators such as all zeros (e.g., C'0...0') and all nines (e.g., C'9...9'). So with these new Y2 formats, you don't have to split up your dates (even those with the year at the end, like mmddy), and you can throw away those E61 exits. This new generation of DFSORT Year 2000 features is available with PTF UQ22533 for Release 13 and PTF UQ22534 for Release 14.

This article explains how to use DFSORT's new full date formats in the SORT, MERGE, INCLUDE, OMIT and OUTFIL statements, describes how you can use these formats with COBOL, and tells you where to get more information.

FULL DATE FORMATS

The six new formats (f) can be used with various lengths (m) to handle all kinds of yyx...x and x...xyy dates, where y is a year digit (zero through nine) and x is a non-year digit (zero through nine). Figure 1 shows each new Y2 format along with its applicable dates

and special indicators. The only difficult thing about using these new Y2 formats is remembering which one to use for which date; Figure 2 presents a handy reference chart that should help.

For the character and zoned formats Y2T and Y2W, the following special indicators are recognized:

- ◆ **Binary:** X'00...00' (BI zeros), X'40...40' (blanks) and X'FF...FF' (BI ones)
- ◆ **Character:** C'0...0' (CH zeros), Z'0...0' (ZD zeros), C'9...9' (CH nines) and Z'9...9' (ZD nines)

Figure 1: New Y2 Formats, Dates and Indicators

m,f	Applicable dates	Special Indicators
3,Y2T	C'yyx', Z'yyx'	Binary, Character
4,Y2T	C'yyxx', Z'yyxx'	Binary, Character
5,Y2T	C'yyxxx', Z'yyxxx'	Binary, Character
6,Y2T	C'yyxxxx', Z'yyxxxx'	Binary, Character
2,Y2U	P'yyx' (X'yyxs')	Packed
3,Y2V	P'yyxx' (X'yyxxs')	Packed
3,Y2U	P'yyxxx' (X'yyxxxs')	Packed
4,Y2V	P'yyxxxx' (X'0yyxxxxs')	Packed
3,Y2W	C'xyy', Z'xyy'	Binary, Character
4,Y2W	C'xyyy', Z'xyyy'	Binary, Character
5,Y2W	C'xyyyy', Z'xyyyy'	Binary, Character
6,Y2W	C'xyyyyy', Z'xyyyyy'	Binary, Character
2,Y2X	P'xyy' (X'xyys')	Packed
3,Y2Y	P'xyyy' (X'0xyyys')	Packed
3,Y2X	P'xyyyy' (X'xyyyys')	Packed
4,Y2Y	P'xyyyyy' (X'0xyyyyy')	Packed

For the packed formats Y2U, Y2V, Y2X and Y2Y, the following special indicators are recognized:

- ◆ **Packed:** P'0...0' (PD zeros) and P'9...9' (PD nines)

DFSORT will interpret "real" two-digit years (yy) according to the fixed or sliding century window established by the Y2PAST option in effect, but will not use the century window for special indicators. For example, with a century window of 1980 through 2079, p,5,Y2T can be used to have DFSORT treat C'98150' as C'1998150', C'01023' as C'2001023', C'00000' as C'0000000' and C'99999' as C'9999999'.

SORT AND MERGE

You can use Y2T, Y2U, Y2V, Y2W, Y2X and Y2Y in SORT and MERGE statements for full two-digit year dates with or without special indicators. These new formats are easier to use than the earlier formats, especially for packed dates, dates with the year at the end (e.g., mmdyy) and dates with special indicators.

In the March 1998 issue of *Technical Support*, I explained why an E61 exit was needed to correctly sort and merge two-digit year dates with special indicators (e.g., C'000000' for a C'yymmdd' date). Although an E61 exit can do the job, it can't use the century window established by Y2PAST. It also requires that you write and maintain the E61 exit. DFSORT's new Y2 formats eliminate the need for E61 exits and can use the century window established by Y2PAST.

To illustrate the use of various techniques for sorting two-digit year dates, we'll contrast the use of the earlier year formats with the new full date formats. Let's say you have a P'dddy' (X'dddyC') date field in positions 21 through 23 and you've set the Y2PAST installation option for a century window of 1950 through 2049. If you don't use special indicators for this date field, you can sort it with the following SORT statement using the Y2P year format:

```
SORT FIELDS=(22,2,Y2P,A,21,2,BI,A)
```

Note that you have to split out the year (yy) and day (ddd) parts and put the year part first.

If you use P'00000' as a low indicator or P'99999' as a high indicator for this date field, the Y2P technique shown above will not work as explained in my previous article. Instead, you have to write or obtain an E61 exit that can handle the special indicators as well as the real dates and use the following SORT and MODS statements:

```
SORT FIELDS=(21,3,BI,E)
MODS E61=(E61RTN,400,EXIT)
```

Y2PAST is not used for a BI field, so you'd have to communicate your century window in some other way to your E61 exit.

Instead of going through the hassle of splitting up your dates or using an E61 exit, you can now use DFSORT's new Y2X full date format to sort the P'dddy' date and its special indicators with the following simple SORT statement:

```
SORT FIELDS=(21,3,Y2X,A)
```

The century window established by Y2PAST is used for real dates, but not for special indicators. For the character and zoned

Figure 2: Quick Reference for New Y2 Formats

Type of Date	Example of Type	CH/ZD (m,f)	PD (m,f)
yyx	yyq	3,Y2T	2,Y2U
yyxx	yymm	4,Y2T	3,Y2V
yyxxx	yyddd	5,Y2T	3,Y2U
yyxxxx	yymmdd	6,Y2T	4,Y2V
xyy	qyy	3,Y2W	2,Y2X
xyyy	mmyy	4,Y2W	3,Y2Y
xxxxy	dddy	5,Y2W	3,Y2X
xxxxyy	mmdyy	6,Y2W	4,Y2Y

formats Y2T and Y2W, dates and special indicators will be collated as follows:

- ◆ **Ascending:** BI zeros, blanks, CH/ZD zeros, lower century dates (e.g., 19yy), upper century dates (e.g., 20yy), CH/ZD nines, BI ones
- ◆ **Descending:** BI ones, CH/ZD nines, upper century dates (e.g., 20yy), lower century dates (e.g., 19yy), CH/ZD zeros, blanks, BI zeros

For the packed formats Y2U, Y2V, Y2X and Y2Y, dates and special indicators will be collated as follows:

- ◆ **Ascending:** PD zeros, lower century dates (e.g., 19yy), upper century dates (e.g., 20yy), PD nines
- ◆ **Descending:** PD nines, upper century dates (e.g., 20yy), lower century dates (e.g., 19yy), PD zeros

SORT AND MERGE WITH COBOL

New Millennium Language Extensions (MLE) enhancements to the COBOL compilers allow COBOL to automatically take advantage of DFSORT's new full date formats and their special indicators. These MLE enhancements are available with the following:

- ◆ APAR PQ20139 for the COBOL for MVS & VM compiler
- ◆ APAR PQ20140 for the COBOL for OS/390 & VM compiler

You can also explicitly override the SORT and MERGE statements generated by COBOL with your own statements that use the full date formats.

INCLUDE AND OMIT

DFSORT now supports two-digit year date fields and two-digit year date constants in the INCLUDE and OMIT statements and in the INCLUDE and OMIT operands of the OUTFIL statement. You can use the new and old Y2 formats, along with a new Y constant, to select records by comparing date fields to date constants or other date fields.

When you compare Y2 fields to Y constants or other Y2 fields, you can use the EQ, NE, GT, GE, LT or LE comparison operators. A Y2 field can be compared to a Y constant with the same number of non-year (x) digits (e.g., a C'yxxxx' field or P'xxxxy' field can be compared to a Y'yxxxx' constant). A Y2 field can also be compared to any other Y2 field with the same number of non-year digits (e.g., a P'xxxxy' field can be compared to a Z'xxxxy' field or a P'yxxxx' field). Figure 3 shows the type of field-to-constant and

Figure 3: Y2 Fields and Y Constants

Type of Date	Fields	(m,f)	Y Constant
yyx and xyy	3,Y2T 3,Y2W	2,Y2U 2,Y2X	Y'yyx'
yyxx and xxyy	4,Y2T 4,Y2W	3,Y2V 3,Y2Y	Y'yyxx'
yyxxx and xxxyy	5,Y2T 5,Y2W	3,Y2U 3,Y2X	Y'yyxxx'
yyxxxx and xxxxyy	6,Y2T 6,Y2W	4,Y2V 4,Y2Y	Y'yyxxxx'
yy	2,Y2C 2,Y2S 1,Y2D	2,Y2Z 2,Y2P 1,Y2B	Y'yy'

Figure 4: p,m,Y2x and p,m,Y2x(c) Output

Type of Date	Fields	(m,f)	Output for p,m,Y2x	Output for p,m,Y2x(/)
yyx	3,Y2T	2,Y2U	C'yyyyx'	C'yyyy/x'
yyxx	4,Y2T	3,Y2V	C'yyyyxx'	C'yyyy/xx'
yyxxx	5,Y2T	3,Y2U	C'yyyyxxx'	C'yyyy/xxx'
yyxxxx	6,Y2T	4,Y2V	C'yyyyxxxx'	C'yyyy/xx/xx'
xyy	3,Y2W	2,Y2X	C'xyyy'	C'x/yyy'
xxyy	4,Y2W	3,Y2Y	C'xxyyy'	C'xx/yyy'
xxxyy	5,Y2W	3,Y2X	C'xxxyyy'	C'xxx/yyy'
xxxxyy	6,Y2W	4,Y2Y	C'xxxxyyy'	C'xx/xx/yyy'

Figure 5: p,m,Y2xP Output

Type of Date	Fields	(m,f)	Output
yyx	3,Y2TP	2,Y2UP	P'yyyyx'
yyxx	4,Y2TP	3,Y2VP	P'yyyyxx'
yyxxx	5,Y2TP	3,Y2UP	P'yyyyxxx'
yyxxxx	6,Y2TP	4,Y2VP	P'yyyyxxxx'
xyy	3,Y2WP	2,Y2XP	P'xyyy'
xxyy	4,Y2WP	3,Y2YP	P'xxyyy'
xxxyy	5,Y2WP	3,Y2XP	P'xxxyyy'
xxxxyy	6,Y2WP	4,Y2YP	P'xxxxyyy'
yy	2,Y2PP		P'yyyy'
yy	1,Y2DP		X'yyyy'

field-to-field comparisons you can use. The fields shown for any type of date (e.g., yyx and xyy) can be compared to any other fields shown for that type of date or to the Y constant shown for that type of date.

The century window established by Y2PAST is used for real dates in fields and constants, but not for special indicators. You can use Y constants for special indicators as follows:

- ◆ Y'0...0' (CH/ZD/PD zeros) and Y'9...9' (CH/ZD/PD nines) can be used with Y2T, Y2U, Y2V, Y2W, Y2X and Y2Y fields. You must use the same number of digits as the type of date (e.g., Y'000' for yyq or qyy, Y'0000' for yymm or mmyy, etc.).
- ◆ Y'LOW' (BI zeros), Y'BLANKS' (blanks) and Y'HIGH' (BI ones) can be used with Y2T, Y2W and Y2S fields.

The collation order of dates and special indicators used for comparisons is the same as the ascending collation order shown earlier for the SORT and MERGE statements.

To illustrate the use of date comparisons for record selection, let's say you have a C'yymm' date field in positions 18 through 21 and you want to select records for which this date is between January 1999 and December 2003. Assuming you want to use a century window of 1967 through 2066, you could use the following control statements:

```
OPTION Y2PAST=1967,COPY
INCLUDE FORMAT=Y2T,
COND=(18,4,GE,Y'9901',AND,
      18,4,LE,Y'0312')
```

If you decided to also select records for which the C'yymm' date is all CH zeros (i.e., C'0000'), you could change your control statements to:

```
OPTION Y2PAST=1967,COPY
INCLUDE FORMAT=Y2T,
COND=(18,4,GE,Y'9901',AND,
      18,4,LE,Y'0312',OR,
      18,4,EQ,Y'0000')
```

OUTFIL OUTREC

You can use Y2T, Y2U, Y2V, Y2W, Y2X and Y2Y in the OUTREC operand of the OUTFIL statement to transform character, zoned and packed two-digit year dates to character four-digit year dates, with or without separators (e.g., transform Z'mmddy' to C'mmddy' or C'mm/dd/yyyy'). In addition, you can use new OUTFIL OUTREC formats Y2TP, Y2UP, Y2VP, Y2WP, Y2XP, Y2YP, Y2PP and Y2DP to transform character, zoned and packed two-digit year dates to packed four-digit year dates (e.g., transform P'yyddd' to P'yyyddd'). These new formats can be used in the following ways:

- ◆ p,m,Y2x transforms a CH, ZD or PD two-digit year date to a CH four-digit year date (e.g., p,3,Y2T transforms Z'973' to C'19973'). Figure 4 shows the output produced when p,m,Y2x is used.
- ◆ p,m,Y2x(c) transforms a CH, ZD or PD two-digit year date to a CH four-digit year date with separators (e.g., p,3,Y2X(-) transforms P'15205' to C'152-2005'). Here c can be any character except a blank. Figure 4 shows the output produced when p,m,Y2x(/) is used (that is, Y2x(c) with / for c).
- ◆ p,m,Y2xP transforms a CH, ZD or PD two-digit year date to a PD four-digit year date (e.g., p,3,Y2VP transforms P'0211' to P'200211'). Figure 5 shows the output produced when p,m,Y2xP is used.

The century window established by Y2PAST is used for real dates, but special indicators are expanded appropriately (e.g., p,6,Y2T(/) expands C'000000' to C'0000/00/00').

All of these new formats give you lots of flexibility to display dates in different ways in reports or to permanently transform your two-digit year date fields to four-digit year date fields.

To illustrate how dates can be transformed with OUTFIL OUTREC, let's say you have a P'yyddd' date field in positions 15 through 17. You love dates so much that you want to create output records with three different versions of your dates:

- ◆ as a C'yyyyddd' date in positions 2 through 8
- ◆ as a C'yyyy-ddd' date in positions 10 through 17
- ◆ as a P'yyyyddd' date in positions 21 through 24

You could use this control statement for your date-fest:

```
OUTFIL OUTREC=(2:15,3,Y2U,
               10:15,3,Y2U(-),
               21:15,3,Y2UP)
```

FOR MORE INFORMATION

A detailed discussion of all of DFSORT's Year 2000 features and examples of the control statements needed to sort, merge, compare and transform many types of dates can be found in my SORT2000 paper. You can browse SORT2000 on the DFSORT Web site at www.ibm.com/storage/dfsor/ or download text and postscript versions from the DFSORT FTP site using a link on the home page or directly from <ftp://index.storsys.ibm.com/dfsor/mvs/>.

SUMMARY

DFSORT's new generation of Year 2000 features make it much easier to sort, merge, compare and transform two-digit year dates. With the new set of "full date" formats and constants for releases 13 and 14, you no longer have to split up your dates or use E61 exits. Just specify the length and format that matches each yy...x and x...xy date you're using and DFSORT will do the rest.

REFERENCES

DFSORT/MVS home page www.ibm.com/storage/dfsor/
 DFSORT/MVS FTP site <ftp://index.storsys.ibm.com/dfsor/mvs/>
 "Year 2000: Sorting Special Indicators With DFSORT's E61," by Frank Yaeger, *Technical Support*, March 1998

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NaSPA member Frank L. Yaeger is an IBM senior programmer. He has spent the last 16 of his 28 years with IBM designing and implementing functional enhancements to DFSORT such as Year 2000 features, Symbols, OUTFIL and ICETOOL. He is also responsible for the DFSORT home pages on the web. Frank can

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