

Working With SAS® System Date and Time Functions

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Thanks!

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Working with SAS System Date and Time Functions

- Many applications require that operations be performed on data collected in the time domain, such as:
 - determining the frequency with which a phenomenon of interest occurs in time
 - How many babies were born each day in January 2006?
 - determining the time interval which has elapsed between two phenomena
 - How many days elapsed between birth and discharge?

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Working with SAS System Date and Time Functions

operating conditionally on observations in a SAS data set based on values of date and/or time variables

- create a SAS data set containing records for births in January 2006 from a larger data set containing birth records for all of 2006

aggregate observations from one time frequency to another

- from daily records, create a SAS data set containing monthly number of births

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Working with SAS System Date and Time Functions

- *interpolation* of higher frequency observations from data collected at a lower frequency
 - Estimate weekly number of births from a data set containing monthly counts
 - Performed by **PROC EXPAND**, in the SAS/ETS module

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SAS System Tools for Working With Data Collected in the Time Domain

- Programming Language Tools
 - **create** SAS date, time or datetime variables from either raw data or from variables in an existing SAS data set
 - **determine** the interval between two periods
 - **declare** a SAS date or time variable as a constant
 - **extract** 'parts' from a SAS date variable, such as the month, day, or year

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SAS System Tools for Working With Data Collected in the Time Domain

- Formats*
 - **modify** the *external representation* of the **values** of SAS date, time or datetime **variables**
 - over 50 formats are available in SAS 9; customized formats for dates can be created using PROC FORMAT
- Informats*
 - **convert raw data** into SAS date, time or datetime variables

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SAS System Tools for Working With Data Collected in the Time Domain

- Procedures
 - BASE
 - PLOT*
 - TIMEPLOT*
 - Econometrics and Time Series (ETS) Module
 - FORECAST*
 - ARIMA*
 - AUTOREG*
 - EXPAND*

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Key Concept

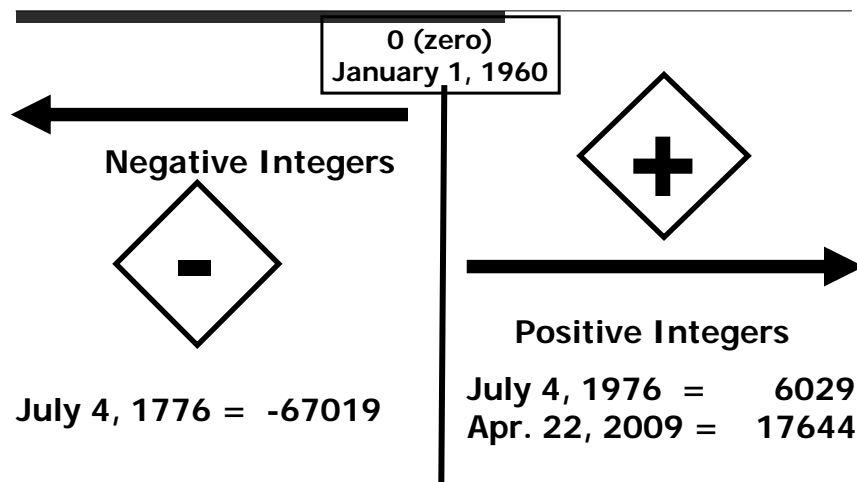
A SAS date, time or date time variable is a special case of the numeric variable

- **Date variable:**
number of days from January 1, 1960
- **Time variable:**
number of seconds from midnight
 - *A time variable is independent of a date variable*
- **Datetime variable:**
number of seconds from midnight 1/1/1960

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How The SAS System Stores the Values of Date Variables



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SAS System Date Variables

Extracting the “**parts**” of a SAS System date variable using the:

- MONTH
- DAY
- YEAR
- QTR
- WEEKDAY

functions

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Extracting the “parts” of a SAS Date, Time or Datetime Variable

Date: 17644 (April 22, 2008)

**SAS Programming
Statements:**

Results:

A = MONTH(TODAY);	4
B = DAY(TODAY);	22
C = YEAR(TODAY);	2008
D = QTR(TODAY);	2
E = WEEKDAY(TODAY);	3

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The WEEKDAY Function

□ Returns a numeric value for the day of the week.

- **1=Sunday** ←
- 2=Monday
- 3=Tuesday
- 4=Wednesday
- 5=Thursday
- 6=Friday
- **7=Saturday** ←

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Extracting the "parts" of a SAS Date, Time or Datetime Variable

Extracting the 'parts' from a SAS System time variable using the

- HOUR
 - MINUTE
 - SECOND
- functions

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Extracting the "parts" of a SAS Date, Time or Datetime Variable

Time: 2:10:23 pm (1410 hours, 23 seconds)

SAS Time Value: 51023

**SAS Programming
Statements**

Results

**A = HOUR(TIME);
B = MINUTE(TIME);
C = SECOND(TIME);**

**14
10
23**



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SAS System Datetime Variables

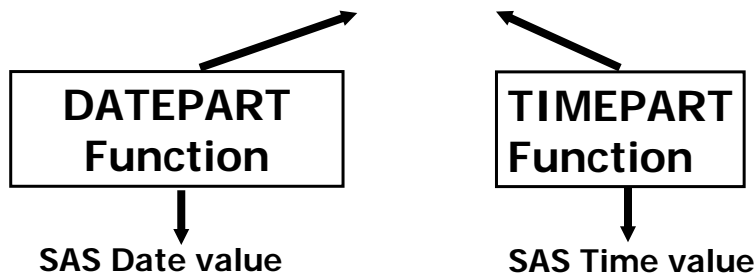
- A SAS System Datetime Variable contains information on both the date and time
 - the number of seconds before/after January 1, 1960
- Extracting the DATE and/or TIME 'parts' of a SAS datetime variable
- **DATEPART** function
 - **TIMEPART** function

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SAS System Datetime Variables

**Tuesday, April 22, 2008
at 1410 hours,23 seconds
1524492623**



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SAS System Datetime Variables

**Tuesday, April 22, 2008 at 1410 hrs, 23
seconds**

1524492623

SAS Programming Statement:	Result:
DATE = DATEPART(TODAY);	17644
TIME = TIMEPART(TODAY);	51023

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SAS System Date Constants

- Declaring a SAS Date, Time or Datetime Constant

X = '01JUN2007'D;	17318
Y = '14:10:37'T;	51038
Z = '14SEP2006:14:10:00'DT;	1496326237

SAS Programming Language Functions

- There are several functions that return the values of dates and/or times from the system clock
 - **TODAY()**, **DATE()** Returns current date from system clock as a SAS date value
 - **DATETIME()** Returns the current date & time from system clock as a SAS datetime value
 - **TIME()** Returns the current time from system clock as a SAS time value

External Representations of SAS System Date, Time and Datetime Variables

- Formats alter the *external representation* of SAS date, time or datetime variables. Over 30 such formats are available in the BASE SAS product

■ Examples: Oct 14, 2004 = **16358**

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External Representations of SAS System Date, Time and Datetime Variables

Format Applied	Formatted_Value
No Format	16358
MMDDYY8. Format	10/14/04
MMDDYY10. Format	10/14/2004
DDMMYY10. Format	14/10/2004
DATE. Format	14OCT04
DATE7. Format	14OCT04
YYQ. Format	2004Q4
YEAR. Format	2004
WORDDATE. Format	October 14, 2004
WEEKDATE. Format	Thursday, October 14, 2004

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Calculating Time Intervals

- Accomplished by one of two methods
 - **arithmetic operation** on SAS date, time or datetime variables, or between a variable and a constant
 - YEARS** = (date2-date1)/365.25;
 - MONTHS** = (date2-date1)/30.4;
 - use of the **INTCK** function



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INTCK Function

- Determines the number of ***interval boundaries*** which have been ***crossed*** between two SAS date, time or date time variables
 - INTCK('interval' , from , to)**
 - 'interval' = character constant or variable name enclosed in single quotes representing the time period of interest
 - from* = SAS date, time or datetime variable identifying the **start** of a **time interval**
 - to* = SAS date, time or datetime variable identifying the **end** of a **time interval**

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Arithmetic Operation vs. INTCK Function

Example: a child is born (and therefore 'admitted' to the hospital) on **December 28, 2003** and discharged on **January 2, 2004**. The child is therefore five days old at discharge.

AGE = '02JAN2004'D - '28DEC2003'D;
yields 5, which is the desired result

BUT, using the **INTCK** function

AGE = **INTCK('YEAR', '28DEC2003'D, '02JAN2004'D)**;
yields **1** as the result. Why?

How old is this child?

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The INTCK Function vs. Direct Operation on SAS Date Variables

Child is born on December 28, 2003 and is discharged on January 2, 2004. How old is the baby?



December 28, 2003

January 2, 2004

January 1, 2004

Interval Boundary:
Month
Year
QTR

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Enhancements to the INTCK Function in Release 6.07

- The INTCK Function counts the number of fixed time intervals. Several useful intervals were added in Release 6.07 of SAS System software.
 - WEEKDAY
 - TENDAY
 - SEMIMONTH
 - SEMIYEAR

Using the WEEKDAY Argument to the INTCK Function

- Example One:
 - How many weekdays have elapsed between January 1, 2008 and April 22, 2008?
 - **weekdays =**
intck('weekday', '01jan2008'd, today());
 - Result: **80** weekdays have elapsed

Using the WEEKDAY Argument to the INTCK Function

□ Example Two:

- How many days have elapsed between Jan. 1, 2008 and April 22, 2008, *excluding Sundays*?

- **except_sun =**
intck('weekday1w', '01jan2008'd, today());

Result: 96 ←

WEEKDAY1W as the alignment argument instructs SAS to consider Sunday (weekday value 1) as the only day in the weekend period. WEEKDAY17W is the same as specifying the WEEKDAY argument.

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The INTNX Function

- Creates a SAS date, time or datetime value that is a given number of time intervals from a starting value

`INTNX('interval', from, to)`

Example: on what date should a postcard be sent to the parents of a newborn asking them to schedule a three-month well-baby exam, three months after the child's birthday (BDATE)?

`MAILDATE = INTNX('month', BDATE, 3)`

the result is a SAS date variable representing the first day of the month which is three months past the child's birthday

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The INTNX Function: Enhancements in Release 6.11

- By default, the INTNX Function will return a SAS date value representing the beginning date of the interval supplied in the first argument.
 - The INTNX Function contains options which allow you to specify the *alignment* of the interval.
 - The alignment arguments are:

END	Aligns date to the <i>end</i>
MIDDLE	Aligns date to the <i>midpoint</i>
BEGINNING	Default alignment

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Why are the New Alignment Operators So Useful?

- Suppose we want to create a SAS date variable representing the last day of the month in which a transaction occurred.
- Since there are some months with 30 days, others with 31 days and one month with either 28 or 29 days, a data step approach is tedious and time consuming.

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Determining the Last Day of the Month via the Data Step

```
112 data _null_;
113   trans_date = '15oct2002'd;
114
115   if month(trans_date) in (9,4,6,11) then
116     trans_month = mdy( month(trans_date),30,year(trans_date) );
117
118   else if month(trans_date) = 2 then
119     trans_month = mdy( month(trans_date),28,year(trans_date) );
120
121 else trans_month =
122   mdy( month(trans_date),31,year(trans_date) );
123
124   format trans_month mmdyy10.;
125   put 'TRANSACTION MONTH:' trans_month;
126
127   run;
```

TRANSACTION MONTH: 10/31/2002

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Using Alignment Arguments in the INTNX Function

- Example: Create a SAS date value representing the last day of the month in which a transaction occurred
 - We want to then count the total number of transactions that occurred in that month
 - Solution: INTNX Function and the END Alignment Argument

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Using Alignment Arguments in the INTNX Function

Working with SAS Date and Time Functions
The INTNX Function and Alignment Arguments
First 15 Observations from Credit Card Transaction File

Obs	cardnumber	trans_date	charge_amount
1	9630-5822-5235-4733	11/30/1999	157.64
2	9631-0023-3352-5872	11/23/2000	461.04
3	9631-0025-4470-7986	11/13/2000	770.83
4	9631-0026-7442-3856	03/15/2001	232.25
5	9631-0044-3220-0246	05/18/2000	785.15
6	9631-0053-2794-4875	01/09/2001	376.12
7	9631-0085-2889-2980	03/16/2001	704.37
8	9631-0099-7062-3020	10/25/2000	91.70
9	9631-0100-2045-0045	08/01/2001	501.85
10	9631-0100-2045-0045	09/25/2001	180.16
11	9631-0105-3417-9465	11/18/1999	422.53
12	9631-0111-1194-1036	01/01/2001	102.25
13	9631-0151-7487-4256	11/21/1999	701.25
14	9631-0156-0287-4481	06/14/2001	889.99
15	9631-0157-1188-0747	12/29/2000	470.51

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Using Alignment Arguments in the INTNX Function

```
35 data new;
36   set sasclass.credit_card_trans_sample(obs=15
37     keep = trans_date cardnumber charge_amount);
38
39 last_day_of_month = INTNX('month',trans_date,0,'end');
40
41 format trans_date last_day_of_month mmdyy10.
42       charge_amount dollar14.2;
43 run;
```

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Using Alignment Arguments in the INTNX Function

Working with SAS Date and Time Functions
The INTNX Function and Alignment Arguments
First 15 Observations from Credit Card Transaction File
Determining the Last Day of the Month Using INTNX

Obs	cardnumber	charge_amount	trans_date	last_day_of_month
1	9630-5822-5235-4733	\$157.64	11/30/1999	11/30/1999
2	9631-0023-3352-5872	\$461.04	11/23/2000	11/30/2000
3	9631-0025-4470-7986	\$770.83	11/13/2000	11/30/2000
4	9631-0026-7442-3856	\$232.25	03/15/2001	03/31/2001
5	9631-0044-3220-0246	\$785.15	05/18/2000	05/31/2000
6	9631-0053-2794-4875	\$376.12	01/09/2001	01/31/2001
7	9631-0085-2889-2980	\$704.37	03/16/2001	03/31/2001
8	9631-0099-7062-3020	\$91.70	10/25/2000	10/31/2000
9	9631-0100-2045-0045	\$501.85	08/01/2001	08/31/2001
10	9631-0100-2045-0045	\$180.16	09/25/2001	09/30/2001
11	9631-0105-3417-9465	\$422.53	11/18/1999	11/30/1999
12	9631-0111-1194-1036	\$102.25	01/01/2001	01/31/2001
13	9631-0151-7487-4256	\$701.25	11/21/1999	11/30/1999
14	9631-0156-0287-4481	\$889.99	06/14/2001	06/30/2001
15	9631-0157-1188-0747	\$470.51	12/29/2000	12/31/2000

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Understanding the YEARCUTOFF SAS System Option

- Specifies the first year of the 100-year span that is used to determine the century of a two-digit year
 - Valid values are from 1582 to 19990
 - Not supported in Version 5 or Release 6.03/6.04
 - Default value is **1900** in Version 6
 - In Version 8 and SAS 9 the “shipped default” value is **1920**

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Understanding the YEARCUTOFF SAS System Option

- If you change the **YEARCUTOFF** System Option Value to 1900, all two digit year values are assumed to have occurred in the 1900's
- What happens if you change the YEARCUTOFF value to 1950?
 - Two digit year values from 00 to 49 will be treated as if they occurred from 2000 to 2049
 - Two digit year values from 50 to 99 will be treated as if they occurred from 1950 to 1999

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Version 8 Enhancements

- DATDIF** and **YRDIF** Functions
 - Returns the number of days (DATDIF) or years (YRDIF) between two dates.
 - Similar to the INTCK Function
 - But, behavior is different
 - More options

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Version 8 Enhancements

- DATDIF(start_date,end_date,basis)
- YRDIF(start_date,end_date,basis)
 - Start_date: period start date
 - End_date: period end date (not included in the calculations)

<i>BASIS</i>	<i>Result</i>
Act/Act	<i>Uses actual number of days</i>
Actual	<i>Same as Act/Act</i>
30/360	<i>Assumes 30 day months and 360 day years</i>
Act/360 (YRDIF Only)	<i>Years=actual # of days/360 day year</i>
Act/365 (YRDIF Only)	<i>Years=actual # of days/365 day year</i>

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Version 8 Enhancements

```
data years;  
  start = '18dec1956'd;  
  stop  = '31oct2001'd;  
intyears = intck('year',start,stop);  
approxyears = (stop-start)/365.25;  
difyears_act = yrdif(start,stop,'actual');  
difyears_360 = yrdif(start,stop,'act/360');  
difyears_365 = yrdif(start,stop,'act/365');  
* put it in the sas log;  
put start = stop= ;  
put intyears= approxyears= ;  
put difyears_act = difyears_360 = difyears_365 = ;  
run;
```

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Version 8 Enhancements

The YEARDIF Function

```
start=-1109  
stop=15628  
intyears=46  
approxyears=45.823408624  
difyears_act=45.824552736  
difyears_360=46.491666667  
difyears_365=45.854794521
```

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Version 8 Enhancements

- The separator character can now be specified with the
 - DDMMYY
 - MMDDYY
 - YYMMDD Formats

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Version 8 Enhancements

```
data x;  
nov5 = '05nov2001'd;  
put " " nov5 mmddy10.;  
put "B " nov5 mmddyb10.;  
put "C " nov5 mmddyc10.;  
put "P " nov5 mmddyyp10.;  
run;
```

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Version 8 Enhancements

```
969 nov5 = '05nov2001'd;  
970 put " " nov5 mmddy10. ;  
971 put "B " nov5 mmddyb10. ;  
972 put "C " nov5 mmddyc10. ;  
973 put "P " nov5 mmddyyp10. ;  
974 run;  
  
11/05/2001  
  
B 11 05 2001  
  
C 11:05:2001  
  
P 11.05.2001
```

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Version 8 Enhancements

- New Date Formats in Release 8.2
 - DTWKDATX
 - Displays the Weekday, Month, Day and Year of a Datetime Variable
 - DTDATE
 - Displays the Day, Month and Year of a Datetime Variable

- Eliminate the need to use the DATEPART function in the Data Step to “extract” the date “part” from a SAS datetime variable.

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Version 8 Enhancements

```
data _null_;  
datetime1 = '15sep2003:08:00:00'dt;  
datetime2 = datetime1;  
format datetime1 dtwkdatx.  
          datetime2 dtdate.;  
put datetime1= datetime2=;  
run;
```

```
datetime1=Friday, 21 November 2003  
datetime2=21NOV03
```

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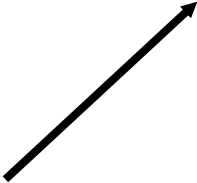
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Version 8 Enhancements

- The %SYSFUNC (system function) capability was added in V6 and can be used to execute SAS Functions within the SAS Macro Facility
 - Example: Format today's date in the TITLE
 - Use the %SYSFUNC facility and the DATE() SAS Programming Language Function
 - Apply the WORDDATE. Format

Version 8 Enhancements

```
options nocenter ls=80;
proc print data=mwsug.cardtrans(obs=10);
title1 'MWSUG 2003 Conference: Minneapolis';
title2 "Report Prepared on %SYSFUNC(date()),worddate.";
title3 "Report Run Time: %SYSFUNC(time()),time.";
run;
```



Version 8 Enhancements

MWSUG 2003 Conference: Minneapolis 22:53 Sunday, September 14, 2003 4
Report Prepared on September 15, 2003
Report Run Time: 6:50:39

Obs	trans_ type	card_ type	cardnumber	charge_ amount	transaction_ datetime	year	LOB01
1	2	12	9630-0420-1039-0391	452.34	08APR99:23:59:59	1999	0
2	1	12	9630-0420-1039-0391	955.20	24MAY99:23:59:59	1999	0
3	1	12	9630-0420-1039-0391	413.37	03AUG99:23:59:59	1999	0
4	1	12	9630-0420-1039-0391	795.78	12AUG99:23:59:59	1999	0
5	1	12	9630-0420-1039-0391	898.87	07SEP99:23:59:59	1999	0
6	1	12	9630-0420-1039-0391	361.14	11SEP99:23:59:59	1999	0
7	1	12	9630-0420-1039-0391	93.42	14OCT99:23:59:59	1999	0
8	1	12	9630-0420-1039-0391	386.35	28DEC99:23:59:59	1999	0
9	1	12	9630-0420-1039-0391	409.61	05JAN00:23:59:59	2000	0
10	1	12	9630-0420-1039-0391	190.32	11JAN00:23:59:59	2000	0

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New in SAS 9.1

DTRESET SAS System Option

- Useful with long SAS jobs. Re-sets the date and time information displayed in the Output Window.

- Smallest increment is minutes
- Reset occurs when page is being written to the Output Window

- Default is **NODTRESET**

- SASLOG displays date/time of session initialization

ANYDATE, ANYTIME Informat

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New in SAS 9.1

ANYDTDTEw

- Reads and extract date values from “messy” raw data.
- DATE, DATETIME, DDMMYY, JULIAN, MMDDYY, MONYY, TIME, YYMMDD, YYQ informat values

ANYDTEw

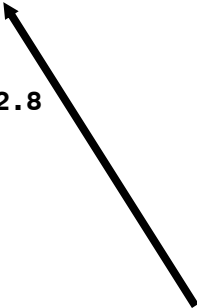
ANYDTMEw

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55

New in SAS 9.1

```
data messy;  
input date anydtdte21.;  
date2 = date;  
datalines;  
14JAN2004  
14JAN2004 12:24:32.8  
14012004  
2004014  
01142004  
20040114  
04Q1  
;  
run;
```



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New in SAS 9.1

Working with SAS Date and Time Functions The ANYDTDTE Informat, New in SAS 9.1

Obs	date	date2
1	16084	January 14, 2004
2	16084	January 14, 2004
3	16084	January 14, 2004
4	16084	January 14, 2004
5	16084	January 14, 2004
6	16084	January 14, 2004
7	16071	January 1, 2004

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New in SAS 9.1

The WEEK Function

- Returns the week number from a SAS date
 - Default: First Sunday of the year is WEEK 1
 - For dates prior to the first Sunday, the value returned by the WEEK Function is 0 (zero)
- Optional Descriptors
 - Change the basis for determining the first week of the year
 - See the SAS 9.1 Documentation for the WEEK Function

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Appendix: Reading Date Data

□ Examples:

- Text/Character Strings Representing Dates
 - In Raw Data
 - In SAS Data sets
- Numeric Date Strings Representing Dates
 - In Raw Data
 - In SAS Data Sets

Appendix: Reading Date Data

```
11 * character strings in a raw data file;
12 data dates1;
13 input @1 shipdate mmdyy10. @12 orderdate yymmdd10.;
14 datalines;
15 04/28/2005 2005/05/10
16 05-06-2006 2006.08.29
17 ;
18 run;
19
20 proc print data=dates1;
21 title 'Working with SAS Date and Time Functions';
22 title2 'Using INFORMATs in an INPUT Statement';
23 title3 'to Convert Text Strings to SAS Date Values';
24 run;
```

Appendix: Reading Date Data

Working with SAS Date and Time Functions Using INFORMATs in an INPUT Statement to Convert Text Strings to SAS Date Values

Obs	shipdate	orderdate
1	16554	16557
2	16927	17015

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Appendix: Reading Date Data

```
26 * text strings in a SAS data set;
27 data dates2;
28 input shipdate $ orderdate $;
29 datalines;
30 04/28/2005 2005/05/10
31 05-06-2006 2006.08.29
32 ;
33 run;
34
35 proc print data=dates2;
36 title2 'Dates as Character Strings in a SAS Data Set';
37 run;
```

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Appendix: Reading Date Data

Working with SAS Date and Time Functions Dates as Character Strings in a SAS Data Set

Obs	shipdate	orderdate
1	04/28/2005	2005/05/10
2	05-06-2006	2006.08.29

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Appendix: Reading Date Data

```
42 data dates3;
43   set dates2;
44   orderdate_new = input(orderdate,mmdyy10.);
45   shipdate_new = input(shipdate,ymmdd10.);
46 run;
47
48 proc print data=dates3;
49   title2 'Using the INPUT Function to Convert Text Strings';
50   title3 'to Numeric SAS Data Values';
51 run;
```

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Appendix: Reading Date Data

Working with SAS Date and Time Functions Using the INPUT Function to Convert Text Strings to Numeric SAS Data Values

Obs	shipdate	orderdate	orderdate_new	shipdate_new
1	2005/05/10	04/28/2005	16554	16566
2	2006.08.29	05-06-2006	16927	17042

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Appendix: Reading Date Data

```
55 data dates4;  
56 input orderdate shipdate;  
57 datalines;  
58 04282005 20050510  
59 05062006 20060829  
60 ;  
61 run;  
62  
63 proc print data=dates4;  
64 title2 'Numeric Date Strings';  
65 run;
```

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Appendix: Reading Date Data

Working with SAS Date and Time Functions Numeric Date Strings

Obs	orderdate	shipdate
1	4282005	20050510
2	5062006	20060829

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Appendix: Reading Date Data

```
70 data dates5;
71   set dates4;
72   * z informat pads string w/leading zeros;
73   orderdate_new = input(put(orderdate,z8.),mmdyy10.);
74   shipdate_new = input(put(shipdate,$10.),yymmdd10.);
75 run;
76
77 proc print data=dates5;
78 title2 'Converting Numeric Date Strings to SAS Date Values';
79 run;
```

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Appendix: Reading Date Data

Working with SAS Date and Time Functions Converting Numeric Date Strings to SAS Date Values

Obs	orderdate	shipdate	orderdate_new	shipdate_new
1	4282005	20050510	16554	16566
2	5062006	20060829	16927	17042

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Thanks for Attending !

Questions ?

Comments ?

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