Counting Days of the Week - The INTCK Approach

ABSTRACT
The INTCK function is used to obtain the number of time intervals between two dates. The INTCK function comes with arguments and argument-modifiers to enable us to perform variety of date related manipulations. This paper deals with a real time simple usage of INTCK function to calculate frequency of days of the week between start and end day of a trip. The INTCK function with its arguments can directly calculate the number of days of the week as illustrated in this paper. The same usage of INTCK function using PROC SQL is also presented in this paper. All the codes executed/presented in this paper involve Base 9.3 SAS® only.

INTRODUCTION
It is better to avoid lengthy codes and to this effect, it is advised to make best use of the procedures/functions available. SAS has plethora of procedures/functions with options/arguments to make codes simple and short. The INTCK function is one such function used mainly to obtain the number of time interval between two dates. The simplest syntax for the INTCK function is as follows:

INTCK(interval<multiple><.shift>,start-value, end-value)

where,
- interval = date units (day, week, weekday, year etc.) or time units (second, hour, minute) or date time units (dtday, dttweek, dtweekday, dtyear etc.)
- multiple = an optional modifier which can be used to specify multiples of an interval like 3-month intervals (MONTH3) or 10-day intervals (DAY10)
- .shift = an optional parameter that determines the starting point in an interval. For eg. YEAR.5 specifies intervals are yearly but the start point is the month of May enclosed in single quotes
- start-value= SAS date, time or datetime value identifying the start of a time span
- end-value = SAS date, time or datetime value identifying the end of a time span

The above function with interval = weekday and multiple = days of the week (1234567) is used in this paper.

PROBLEM: To obtain the frequency of days of the week (#of Mondays, Tuesdays etc.) during the duration of the trip. The problem is best illustrated in Table 1 where variables tStartDate and tEndDate means trip start date and trip end date respectively and note that both these are SAS dates. The problem in hand is to determine the number of days of week between trip start and end dates which is highlighted by the question marks in Table1. Note that some of the observations have trip start date and end dates the same which means it was a day trip instead of an overnight trip. It is important to account for the day of the day trip taken. In simple terms, the objective is to determine the frequency of days of the week during the trip for each record.

<table>
<thead>
<tr>
<th>resp</th>
<th>tStartDate</th>
<th>tEndDate</th>
<th>tSaturdays</th>
<th>tSundays</th>
<th>tMondays</th>
<th>tTuesdays</th>
<th>tWednesdays</th>
<th>tThursdays</th>
<th>tFridays</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>19109</td>
<td>19113</td>
<td>?</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>3216</td>
<td>19053</td>
<td>19084</td>
<td>?</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>3216</td>
<td>19025</td>
<td>19028</td>
<td>?</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>2060</td>
<td>19086</td>
<td>19090</td>
<td>?</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>2060</td>
<td>19090</td>
<td>19090</td>
<td>?</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>2060</td>
<td>19111</td>
<td>19111</td>
<td>?</td>
<td></td>
<td></td>
<td>?</td>
<td></td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Illustration of the Problem.

SOLUTION: The INTCK function of the form interval = weekday and multiple = days of the week is used to determine the number of days of the week, where weekday1234567W means that only Saturday is to be counted or Saturday is...
the only working day. In the INTCK function, Sunday=1, Monday=2, Tuesday=3, Wednesday=4, Thursday=5, Friday=6 and Saturday=7. The functions to determine the frequency of days of the week are as follows:

\[
\begin{align*}
\text{tSaturdays} & = \text{intck('weekday123456W',tStartDate,tEndDate);} \\
\text{tSundays} & = \text{intck('weekday234567W',tStartDate,tEndDate);} \\
\text{tMondays} & = \text{intck('weekday134567W',tStartDate,tEndDate);} \\
\text{tTuesdays} & = \text{intck('weekday124567W',tStartDate,tEndDate);} \\
\text{tWednesdays} & = \text{intck('weekday123456W',tStartDate,tEndDate);} \\
\text{tThursdays} & = \text{intck('weekday123457W',tStartDate,tEndDate);} \\
\text{tFridays} & = \text{intck('weekday134567W',tStartDate,tEndDate);} \\
\end{align*}
\]

The INTCK approach to solve the problem is simple but one has to be careful as to how the intervals are determined. For the problem in hand, if we use the function as shown above, it will give us the results shown in Table 2. Note that for the first record there are no days of the week even though there was a trip date. As mentioned earlier, the INTCK function calculates the number of times a boundary has crossed. For the first record in Table 2, there is no boundary crossed at all since start and end dates are the same. For records with different start and end dates, the first day of the trip is not accounted.

<table>
<thead>
<tr>
<th>resp</th>
<th>tStartDate</th>
<th>tEndDate</th>
<th>tSaturdays</th>
<th>tSundays</th>
<th>tMondays</th>
<th>tTuesdays</th>
<th>tWednesdays</th>
<th>tThursdays</th>
<th>tFridays</th>
</tr>
</thead>
<tbody>
<tr>
<td>2111</td>
<td>19089</td>
<td>19089</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2111</td>
<td>19094</td>
<td>19094</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2111</td>
<td>19109</td>
<td>19109</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>88</td>
<td>19109</td>
<td>19113</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3216</td>
<td>19053</td>
<td>19084</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3216</td>
<td>19025</td>
<td>19028</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2060</td>
<td>19086</td>
<td>19090</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2060</td>
<td>19090</td>
<td>19090</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2060</td>
<td>19111</td>
<td>19111</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>185</td>
<td>19068</td>
<td>19075</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2. Output of INTCK Function without any Modification to Arguments.

By modifying the arguments of start-date of the INTCK function that is altering only the start date one day earlier (tStartDate-1), we can overcome the above shortcomings and the desired output is shown in Table 3.

\[
\begin{align*}
\text{tSaturdays} & = \text{intck('weekday123456W',tStartDate-1,tEndDate);} \\
\text{tSundays} & = \text{intck('weekday234567W',tStartDate-1,tEndDate);} \\
\text{tMondays} & = \text{intck('weekday134567W',tStartDate-1,tEndDate);} \\
\text{tTuesdays} & = \text{intck('weekday124567W',tStartDate-1,tEndDate);} \\
\text{tWednesdays} & = \text{intck('weekday123456W',tStartDate-1,tEndDate);} \\
\text{tThursdays} & = \text{intck('weekday123457W',tStartDate-1,tEndDate);} \\
\text{tFridays} & = \text{intck('weekday134567W',tStartDate-1,tEndDate);} \\
\end{align*}
\]

<table>
<thead>
<tr>
<th>resp</th>
<th>tStartDate</th>
<th>tEndDate</th>
<th>tSaturdays</th>
<th>tSundays</th>
<th>tMondays</th>
<th>tTuesdays</th>
<th>tWednesdays</th>
<th>tThursdays</th>
<th>tFridays</th>
</tr>
</thead>
<tbody>
<tr>
<td>2111</td>
<td>19089</td>
<td>19089</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2111</td>
<td>19094</td>
<td>19094</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2111</td>
<td>19109</td>
<td>19109</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>88</td>
<td>19109</td>
<td>19113</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3216</td>
<td>19053</td>
<td>19084</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3216</td>
<td>19025</td>
<td>19028</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2060</td>
<td>19086</td>
<td>19090</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2060</td>
<td>19090</td>
<td>19090</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2060</td>
<td>19111</td>
<td>19111</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>185</td>
<td>19068</td>
<td>19075</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3. Desired Output of INTCK Function by Modifying the Argument.

The output shown in Table 3 has at least one weekday counted for each record as required. The SAS code for the program is presented in the appendix of this paper.
For regular users of the PROC SQL, the same results can be achieved by using the INTCK function in PROC SQL as follows:

```sql
SELECT tstartdate, tenddate, INTCK('WEEKDAY123456W', tstartdate-1, tenddate) AS tSaturdays FROM MAIN_DATA;
```

where tSaturdays is the variable/column created for the number of Saturdays during the trip. In the same way, we can determine the frequency for all days of the week between start and end dates. The SAS code for the INTCK implementation using PROC SQL is presented in the Appendix of this paper.

**CONCLUSION**

Using SAS Base’s INTCK function, one can write efficient codes to determine the frequency of the days of the week between two time intervals as illustrated with a real time example in this paper.

**REFERENCES**


**ACKNOWLEDGMENTS**

The author would like to thank Carl Kaufmann and Nandini Nadkarni for their valuable input reviewing this paper.

**CONTACT INFORMATION**

Your comments and questions are valued and encouraged. Contact the author at:

Jinson J. Erinjeri  
D.K. Shifflet and Associates Ltd.  
1750 Old Meadow Rd., Suite, 620  
Mclean, VA 22102  
Work Phone: 703-536-0924  
Fax: 703-536-0580  
E-mail: jerinjeri@dksa.com  
Web: [www.dksa.com](http://www.dksa.com)

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration. Other brand and product names are trademarks of their respective companies.

**APPENDIX**

The SAS code for counting days of the week using INTCK function for both Data Step and PROC SQL is given below:

```sql
libname wk 'j:\tmperms';
/*INTCK Function in Data Step*/
data may;
  set wk.may12; /*data set*/
  dayst=weekday(tstartdate);
  dayend=weekday(tenddate);
  tSaturdays= intck('weekday123456W',tstartdate-1,tenddate);
  tSundays= intck('weekday234567W',tstartdate-1,tenddate);
  tMondays= intck('weekday134567W',tstartdate-1,tenddate);
  tTuesdays= intck('weekday124567W',tstartdate-1,tenddate);
  tWednesdays= intck('weekday123567W',tstartdate-1,tenddate);
  tThursdays= intck('weekday123467W',tstartdate-1,tenddate);
  tFridays= intck('weekday123457W',tstartdate-1,tenddate);
```

keep resp tstartdate tenddate tripnumb staynum vendor dayst dayend sdays
tdays tsaturdays tsundays tmondays ttuesdays twednesdays tthursdays tfridays;
run;
/*for checking the frequency of days of the week */
proc freq data=may;
  table t;;
run;
/*INTCK Function in PROC SQL*/
data may1;
  set wk.trmay12;
run;
ods listing close;
ods output SQL_Results = may1_sql;
proc sql;
  SELECT tstartdate, tenddate, INTCK('WEEKDAY123456W', tstartdate-1, tenddate) AS tSaturdays,
  INTCK('WEEKDAY234567W', tstartdate-1, tenddate) AS tSundays,
  INTCK('WEEKDAY134567W', tstartdate-1, tenddate) AS tMondays,
  INTCK('WEEKDAY124567W', tstartdate-1, tenddate) AS tTuesdays,
  INTCK('WEEKDAY123567W', tstartdate-1, tenddate) AS tWednesdays,
  INTCK('WEEKDAY123467W', tstartdate-1, tenddate) AS tThursdays,
  INTCK('WEEKDAY123457W', tstartdate-1, tenddate) AS tFridays
  FROM may1;
quit;
ods output close;
ods listing;
/*for checking the frequency of days of the week */
proc freq data=may1_sql;
  table t;;
run;