



Arrays Part VI

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Welcome back to the next installment in our continuing discussion about using arrays in Excel formulas. This article builds on the complexity introduced in Part V and uses the same data. Please review the earlier articles in *RCM Advisor* to refresh your memory on arrays. Remember, as you follow the examples in this article, to enter the formulas with **Ctrl+Shift+Enter** to get the curly braces that surround Excel formulas. Manually typing the curly braces will not work. Hopefully you have found more and more ways to use the power of arrays to make your spreadsheets more powerful and your life easier.

Third Next Available New Patient Appointment

In Part V, we calculated the third next available patient appointment using arrays. In Part VI, we will add criteria to the array to make the formula even more powerful and flexible. Assume that a physician has asked to see the third next available appointment for both new patients and established patients. In Figure 1, our objective is cell F13, the third next available new patient appointment. We are adding a qualification to our formula: whether the appointment a new patient appointment. The formula in cell F13 is:

```
{=SMALL(IF($C$3:$C$22="New",$B$3:$B$22),3)}
```

Working from the inside out, the IF statement checks cells C3:C22 to see if the value is New. If it is a new patient appointment, the IF formula will return the corresponding date from column B. There is nothing for the IF formula to do if the statement is false since the appointment is not a new patient appointment. The SMALL function takes the result of the array of new patient appointments and takes the third smallest value, which is the third soonest available appointment.

Adding Criteria: Third Next Available New Patient Appointment at the South Location

It seems like as soon as you can pull off one complicated, helpful trick with a report, users will ask if you can then make it even more complicated. Assume that new a provider wants to know when the third next available new patient appointment is at the south location. Now we have two criteria to look for: a new patient appointment and the south location. One way to calculate this is to use the multiplication rules discussed in Part IV of this series on arrays. Multiplication in an array formula allows us to add conditions and only return "True" if all the conditions are true. Our target is cell F15 in Figure 2. The formula in cell F15 is:

```
{=SMALL(IF(($C$3:$C$22="New")*(D$3:D$22="South"),$B$3:$B$22),3)}
```

FIGURE 1

	A	B	C	D	E	F	G
1	OPEN APPOINTMENT SLOTS						
2	Provider	Date and Time	Appt Type	Location			
3	Dr. Nelson	6/3/2019 2:00PM	Follow Up	South		6/7/2019 7:00AM	3rd Next Available Appointment
4	Dr. Nelson	6/5/2019 10:00AM	Surgery	Hospital			
5	Dr. Nelson	6/7/2019 7:00AM	Surgery	Hospital		6/3/2019 2:00PM	1st Next Available Appointment
6	Dr. Nelson	6/7/2019 1:15PM	Follow Up	South		6/5/2019 10:00AM	2nd Next Available Appointment
7	Dr. Nelson	6/10/2019 11:45AM	Follow Up	Main		6/7/2019 7:00AM	3rd Next Available Appointment
8	Dr. Nelson	6/11/2019 9:00AM	New	Main			
9	Dr. Nelson	6/12/2019 8:00AM	Follow Up	Main		6/3/2019 2:00PM	1st Next Available Appointment
10	Dr. Nelson	6/12/2019 1:00PM	New	Main		6/5/2019 10:00AM	2nd Next Available Appointment
11	Dr. Nelson	6/14/2019 8:15AM	New	Main		6/7/2019 7:00AM	3rd Next Available Appointment
12	Dr. Nelson	6/14/2019 9:30AM	Follow Up	South			
13	Dr. Nelson	6/16/2019 3:15PM	Follow Up	Main		6/14/2019 8:15AM	3rd Next Available NEW Appointment

FIGURE 2

	A	B	C	D	E	F	G
1	OPEN APPOINTMENT SLOTS						
2	Provider	Date and Time	Appt Type	Location			
3	Dr. Nelson	6/3/2019 2:00PM	Follow Up	South		6/7/2019 7:00AM	3rd Next Available Appointment
4	Dr. Nelson	6/5/2019 10:00AM	Surgery	Hospital			
5	Dr. Nelson	6/7/2019 7:00AM	Surgery	Hospital		6/3/2019 2:00PM	1st Next Available Appointment
6	Dr. Nelson	6/7/2019 1:15PM	Follow Up	South		6/5/2019 10:00AM	2nd Next Available Appointment
7	Dr. Nelson	6/10/2019 11:45AM	Follow Up	Main		6/7/2019 7:00AM	3rd Next Available Appointment
8	Dr. Nelson	6/11/2019 9:00AM	New	Main			
9	Dr. Nelson	6/12/2019 8:00AM	Follow Up	Main		6/3/2019 2:00PM	1st Next Available Appointment
10	Dr. Nelson	6/12/2019 1:00PM	New	Main		6/5/2019 10:00AM	2nd Next Available Appointment
11	Dr. Nelson	6/14/2019 8:15AM	New	Main		6/7/2019 7:00AM	3rd Next Available Appointment
12	Dr. Nelson	6/14/2019 9:30AM	Follow Up	South			
13	Dr. Nelson	6/16/2019 3:15PM	Follow Up	Main		6/14/2019 8:15AM	3rd Next Available NEW Appointment
14	Dr. Nelson	6/18/2019 1:00PM	Follow Up	South			
15	Dr. Nelson	6/19/2019 8:00AM	New	South		6/19/2019 3:15PM	3rd Next Available NEW Appointment at SOUTH Location

FIGURE 3

	A	B	C	D	E	F	G
1	OPEN APPOINTMENT SLOTS						
2	Provider	Date and Time	Appt Type	Location			
3	Dr. Nelson	6/3/2019 2:00PM	Follow Up	South		6/7/2019 7:00AM	3rd Next Available Appointment
4	Dr. Nelson	6/5/2019 10:00AM	Surgery	Hospital			
5	Dr. Nelson	6/7/2019 7:00AM	Surgery	Hospital		6/3/2019 2:00PM	1st Next Available Appointment
6	Dr. Nelson	6/7/2019 1:15PM	Follow Up	South		6/5/2019 10:00AM	2nd Next Available Appointment
7	Dr. Nelson	6/10/2019 11:45AM	Follow Up	Main		6/7/2019 7:00AM	3rd Next Available Appointment
8	Dr. Nelson	6/11/2019 9:00AM	New	Main			
9	Dr. Nelson	6/12/2019 8:00AM	Follow Up	Main		6/3/2019 2:00PM	1st Next Available Appointment
10	Dr. Nelson	6/12/2019 1:00PM	New	Main		6/5/2019 10:00AM	2nd Next Available Appointment
11	Dr. Nelson	6/14/2019 8:15AM	New	Main		6/7/2019 7:00AM	3rd Next Available Appointment
12	Dr. Nelson	6/14/2019 9:30AM	Follow Up	South			
13	Dr. Nelson	6/16/2019 3:15PM	Follow Up	Main		6/14/2019 8:15AM	3rd Next Available NEW Appointment
14	Dr. Nelson	6/18/2019 1:00PM	Follow Up	South			
15	Dr. Nelson	6/19/2019 8:00AM	New	South		6/7/2019 7:00AM	3rd Next Available NEW Appointment at SOUTH Location
16	Dr. Nelson	6/19/2019 9:30AM	New	South			
17	Dr. Nelson	6/19/2019 3:15PM	New	South		6/7/2019 7:00AM	Next Available Appointment
18	Dr. Nelson	6/20/2019 7:00AM	Surgery	Hospital			
19	Dr. Nelson	6/21/2019 9:30AM	Follow Up	Main			
20	Dr. Nelson	6/24/2019 4:15PM	Follow Up	South			
21	Dr. Nelson	6/26/2019 3:00PM	New	Main			
22	Dr. Nelson	6/27/2019 7:00AM	Surgery	Hospital			

Again working from the inside out, there is still an IF statement, but there are two components to the IF statement. The $\$C\$3:\$C\$22="New"$ component checks to see if the appointment is a new patient appointment. The $\$D\$3:\$D\$22="South"$ component checks to see if the appointment is at the south location. If the appointment is

both new and at the south location, the multiplication sign (asterisk) between the two conditions will result in "True." If the IF statement returns True, corresponding cells in $\$B\$3:\$B\22 will be passed to the array. If the appointment is not new or if the location is not at the south location, the IF statement will evaluate to "False" and that row will not be

passed to the array. After the IF statement processes, the SMALL part of the function is the same as our earlier example and the third next available appointment is calculated.

Allowing Users to Choose Criteria

The multiplication in the array statement can be extended to look for even more criteria that all must be true to find the third next available appointment. For example, you could look for the third next available new patient appointment at the south location on a Wednesday. After a few more requests to find specific examples of the third next available appointment, it would be nice to build a tool to let end users find their own next available appointment for any combination of data. Figure 3 has an example that gives users that flexibility.

The formula in cell F17 looks at the input in cells F18:F22 to give end users much more flexibility in finding future appointments. The formula in cell F17 looks scary, but after reviewing these articles on arrays, it is manageable. The formula in cell F17 is:

```
{=SMALL(IF(($C$3:$C$22=F19)*($D$3:$D$22=F20)*($A$3:$A$22=F21)*(WEEKDAY($B$3:$B$22,2)=VLOOKUP(F22,$J$2:$K$6,2,FALSE)),B$3:$B$22),F18)}
```

The array formula has the same structure as our earlier examples, a SMALL function with an IF function inside. The IF function uses multiplication to combine the different criteria. The IF function will only be True if each of the criteria is true. Each of the four criteria are separated by the asterisk multiplication symbol. The first three criteria are relatively straightforward. The \$C\$3:\$C\$22=F19 criteria checks to see if the appointment type in F19 matches the appointment type in cells C3:C22. The \$D\$3:\$D\$22= F20 criteria ensures that the location in F20 matches the location in cells D3:D22. The \$A\$3:\$A\$22= F21 criteria looks to see that the provider in F21 matches the provider in A3:A22.

The fourth criteria is more complicated. The intent is to match weekdays in order to answer questions like the third next available appointment on Wednesdays. The criteria is WEEKDAY(\$B\$3:\$B\$22,2)=VLOOKUP(F22,\$J\$2:\$K\$6,2,FALSE) and has two parts. The WEEKDAY(\$B\$3:\$B\$22,2) function returns a number indicating the day of the week for each open appointment slot. The VLOOKUP function translates that number into an actual weekday by looking up the name of the

FIGURE 4

	I	J	K
1			
2		Monday	1
3		Tuesday	2
4		Wednesday	3
5		Thursday	4
6		Friday	5
7			

weekday in the table shown in Figure 4. If the WEEKDAY result matches the VLOOKUP result, the open appointment slot is on the date the user is searching for and the criteria is true. Finally, note that the formula ends by using F18 in the SMALL function. Referencing a cell instead of hard-coding a number allows end users to look for the first, second, third, or nth next available appointment using the same formula.

The power, flexibility, and application of array formulas is limited only by your imagination. Test the array formulas as you build them and build complexity a step at a time. The time savings can be tremendous. ■

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