Excel: Advanced Functions

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PowerSchool University
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• Welcome & Introductions
• Lookup and Reference Functions
• Logical Functions
• Conditional Math Functions
• Data Validation and Field Protection
• Time for Review
Lookup and Reference Functions
Excel Functions

- Excel functions find, calculate, and manipulate data
- Excel has over 300 built-in functions
The LEN (Length) Function

- Used to find long text entries
- Counts total number of characters in a cell
- Returns a number

=LEN(TEXT)
Lookup Functions

• Use MATCH to find a location in a table
  \[=\text{MATCH}(\text{Value},\text{Array},\text{Match Type})\]

• Use VLOOKUP to return data from a table
  \[=\text{VLOOKUP}(\text{Value},\text{Array},\text{Column Number}, \text{Approximate?})\]
The MATCH Function

=\text{MATCH}(\text{Lookup\_Value}, \text{Lookup\_Array}, \text{Match \ Type})

Look for related data in another table, and return the position

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Math</td>
<td>Biology</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>English</td>
<td>History</td>
</tr>
</tbody>
</table>

=\text{MATCH}(“English”, B2:B3, 0)

Returns 2
A Word About Match Type

Match Type can be one of three values:

- **0** = Exact Match
- **1** = Find the largest value less than “Value” (Must be in ascending order)
- **-1** = Find the smallest value greater than “Value” (Must be in descending order)
Using the MATCH Function

- Does A2 have a corresponding value in the Photos worksheet, column A?
- Values have to be an exact match (0)

=\text{MATCH}(A2, \text{Photos!A2:A427}, 0)\quad \text{Returns 1}
The VLOOKUP Function

=VLOOKUP(Value,Array,Column Number,Approximate?)

Look for related data in the first column of a table, and return the value from another specified column

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Math</td>
<td>Biology</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>English</td>
<td>History</td>
</tr>
</tbody>
</table>

=VLOOKUP(1,A2:C3,3,FALSE)  
Returns “Biology”
Using the VLOOKUP Function

=VLOOKUP(Value,Array,Column Number,Approximate?)

1. **Lookup_Value** is the value you're searching for.

2. **Table_Array** is the range of cells you’re searching in, with the matching value contained in column 1 and other columns containing values to be returned.

3. **Col_Index_Num** is the number of the column in the Table_Array you want to return.

4. **TRUE** is for an approximate match, **FALSE** is for an exact match.
Formula in this cell

PGFinalGrades

Sections

=VLOOKUP (A2
<table>
<thead>
<tr>
<th>Sectionid</th>
<th>Course Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MAT2000</td>
</tr>
<tr>
<td>2</td>
<td>MAT2001</td>
</tr>
<tr>
<td>3</td>
<td>MAT3000</td>
</tr>
<tr>
<td>4</td>
<td>MAT2000</td>
</tr>
<tr>
<td>5</td>
<td>MAT2001</td>
</tr>
<tr>
<td>6</td>
<td>MAT2001</td>
</tr>
<tr>
<td>7</td>
<td>MAT3000</td>
</tr>
<tr>
<td>8</td>
<td>ENG2100</td>
</tr>
<tr>
<td>9</td>
<td>ENG2100</td>
</tr>
<tr>
<td>10</td>
<td>ENG2100</td>
</tr>
<tr>
<td>11</td>
<td>ENG2100</td>
</tr>
<tr>
<td>12</td>
<td>MAT1001</td>
</tr>
<tr>
<td>13</td>
<td>MAT2001</td>
</tr>
</tbody>
</table>

The formula in this cell is:

```
=VLOOKUP (A2, Sections!A$1:B$2651, 2, FALSE)
```
<table>
<thead>
<tr>
<th>Sectionid</th>
<th>Course Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>MAT2000</td>
</tr>
<tr>
<td>3</td>
<td>MAT2001</td>
</tr>
<tr>
<td>4</td>
<td>MAT2000</td>
</tr>
<tr>
<td>5</td>
<td>MAT2001</td>
</tr>
<tr>
<td>6</td>
<td>MAT2001</td>
</tr>
<tr>
<td>7</td>
<td>MAT3000</td>
</tr>
<tr>
<td>8</td>
<td>MAT3000</td>
</tr>
<tr>
<td>9</td>
<td>ENG2100</td>
</tr>
<tr>
<td>10</td>
<td>ENG2100</td>
</tr>
<tr>
<td>11</td>
<td>ENG2100</td>
</tr>
<tr>
<td>12</td>
<td>ENG2100</td>
</tr>
<tr>
<td>13</td>
<td>HEC9</td>
</tr>
<tr>
<td>14</td>
<td>HEC9</td>
</tr>
<tr>
<td>15</td>
<td>HEC9</td>
</tr>
<tr>
<td>16</td>
<td>HEC9</td>
</tr>
<tr>
<td>17</td>
<td>MAT1001</td>
</tr>
<tr>
<td>18</td>
<td>MAT2001</td>
</tr>
</tbody>
</table>

Formula in this cell: 

`=VLOOKUP(A2, Sections!A$1:B$2651, 2)`
The formula in this cell:

```
=VLOOKUP(A2,Sections!A$1:B$2651,2,FALSE)
```

The match must be exact.
Grades and Lookups

- Start with the lowest possible value in the Grade column
- Use the minimum value for each range
- Sort rows in ascending order
- Make sure to account for the uppermost value

<table>
<thead>
<tr>
<th>Grade</th>
<th>Letter Grade</th>
<th>Gr. Pts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>F</td>
<td>0.00</td>
</tr>
<tr>
<td>60</td>
<td>D-</td>
<td>0.67</td>
</tr>
<tr>
<td>61</td>
<td>D</td>
<td>1.00</td>
</tr>
<tr>
<td>69</td>
<td>D+</td>
<td>1.33</td>
</tr>
<tr>
<td>70</td>
<td>C-</td>
<td>1.67</td>
</tr>
<tr>
<td>77</td>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>78</td>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>80</td>
<td>B-</td>
<td>2.67</td>
</tr>
<tr>
<td>82</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>87</td>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>90</td>
<td>A-</td>
<td>3.67</td>
</tr>
<tr>
<td>93</td>
<td>A</td>
<td>4.00</td>
</tr>
</tbody>
</table>
No More Dollar Signs!

- Use Named Ranges to make referring to a table easier
  - Names cannot have more than 255 characters
  - Names cannot have spaces
- Select the cells, then enter the name
Use VLOOKUP to Find Grades

- Match a percentage to its letter grade
- Now that you have a named range, use it instead of having to spell out the cells
- Since you're matching specific values to another value that is less than or equal to it, use TRUE instead of FALSE

=VLOOKUP(G2,grades_list,2,TRUE)
VLOOKUP Limitation

- For VLOOKUP to work, the value you are looking for must be in the first column
- Re-ordering the columns is one way to make it work, but the INDEX function is quicker
INDEX to the Rescue!

=INDEX(Table,Row Number,Column Number)

Returns the value of the intersection of a row and a column from a table

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<td>2</td>
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<td>History</td>
</tr>
</tbody>
</table>

=INDEX(B2:C3,2,1)
Returns “English”
Look Up Values in Any Column with INDEX/MATCH

1. In the INDEX function, define a table
2. For the row, use a MATCH function to define the matching column and return the row
3. Use FALSE, since you want an exact match
4. Specify the column number that contains the value you want returned
In the INDEX function, define a table

=INDEX(Photos!A$2:D$427

Reverse Lookup

Photos
Reverse Lookup

Photos

Use FALSE, since you want an exact match

=INDEX(Photos!A$2:D$427, MATCH(A2, Photos!D$2:D$427, FALSE))
Reverse Lookup

Photos

Specify the column number you want to return a value from

=INDEX(Photos!A$2:D$427, MATCH(A2,Photos!D$2:D$427,FALSE),1)
Now It’s Your Turn

Complete hands-on activities 1-4:

Finding Course Names that Are Too Long

Finding Missing Records Using the MATCH Function

What if You Have Three Lists?

Matching a SectionID to a Course Number and Course Name
Now It’s Your Turn

Complete hands-on activities 5-8:

Matching a Grade to a Letter Grade

No More Dollar Signs in Your Functions!

Look Up the Grade Points Associated with a Percentage

Reverse Lookup
Logical Functions
The IF Function

=IF(Logic Test, True Value, False Value)

- The first argument is the test; does D2 equal Caucasian?
- The second argument is what you want to see if the test is true: "Non-Minority"
- The third argument is what you want to see if the test is false: "Minority"

=IF(D2=Caucasian, "Non-Minority", "Minority")
The AND Function

- Test for multiple conditions (255 max)
- Every condition has to be true for the result to return TRUE
- To test for students who are both American-Indian and female, the formula is:

\[ \text{AND} (D2=\text{"American-Indian"}, E2=\text{"Female"}) \]
Using IF with the AND function

- The AND function by itself returns TRUE or FALSE only
- Use the IF function, along with the AND function, to control the message:

  \[
  \text{=IF(AND(D2="American-Indian",E2="Female"),} \\
  \text{"Eligible"","Not Eligible")}
  \]
The OR Function

=OR(Logic Test1,Logic Test2,...)

• Test for multiple conditions (255 max), just like AND
• Only one of the conditions has to be true for the result to be TRUE
• To test for students who are an ethnic minority or female, the formula is:

=OR(F2="Minority",E2="Female")
Using IF with the OR Function

- Just like the AND function, the OR function by itself can only return TRUE or FALSE
- Use the IF function to customize the message:

  =IF(OR(F2="Minority",E2="Female"),
  "EEOC Group","Non-EEOC Group")
Change the Missing Pictures Message

=ISNA(VALUE)

- In the earlier example, the pictures that weren't found returned the value #N/A
- To get rid of that error message, use the ISNA function:

=ISNA(MATCH(A2,Photos!A$2:A$427,FALSE))
What Happened?!

- The pictures that are missing are showing the word TRUE
- The pictures that are not missing are showing the word FALSE
Reverse the Polarity

• By using the NOT function, you can change the TRUE cells to FALSE, and the FALSE cells to TRUE

• The revised formula is:

\[=\text{NOT(ISNA(MATCH(A2,Photos!A$2:A$427,FALSE)))}\]
Now It’s Your Turn

Complete hands-on activities 9–14:

The IF Function
The AND Function
Change TRUE or FALSE to a More Meaningful Message
The OR Function
Combining the IF and OR Functions
Missing Pictures, Part 2
Conditional Math Functions
Conditionally Summing Values

=SUMIF(Criteria Range,Criteria,Sum Range)

- **SUM** cells **IF** they meet a condition
- The cells you're checking and the cells you're summing can be different

Find Only Art Supplies Fees

1. Select the Criteria Range: Fee Type
2. Define the Criteria: Art Supplies
3. Select the Sum Range: Fee Amount
=SUMIF(A2:A196, Fee Type, B2:B196)
Define the Criteria:
Art Supplies

=SUMIF(A2:A196,"Art Supplies",
### A Test to Make Sure It Works

1. Turn on AutoFiltering
2. Filter Fee Type for “Art Supplies”
A Test to Make Sure It Works

1. Select all of the Art Supplies fees
2. Check the Status Bar at the bottom of the screen for a quick sum
Finding Duplicate Records

- Count only cells that meet a specified condition
- Find duplicate records (look for cell values that show up more than once)
- If no unique value exists, join together the individual pieces of data

=COUNTIF(Range,Criteria)

=COUNTIF(I$2:I$73,I2)
Find Duplicate Enrollments

1. Make a unique field
2. Use the COUNTIF function; the first argument is the range of cells
3. The second argument is the value to look for
4. Add an IF statement—Does it appear more than once?
5. Flag records that show up more than once as possible duplicates
- $A_2$ is the course number
- $D_2$ is the student number
- $\text{MONTH}(G_2)$ is the numeric month of the DateEnrolled
- $\text{MONTH}(H_2)$ is the numeric month of the DateLeft

$$=A_2 \text{ " " } D_2 \text{ " " } \text{MONTH}(G_2) \text{ &MONTH}(H_2)$$
$I2:I73$ is the range of cells where the unique values are listed.

```excel
=COUNTIF($I$2:$I$73
```
I2 is the current value

=COUNTIF(I$2:I$73,I2)
Does the value show up more than once?

=IF(COUNTIF(I$2:I$73,I2)>1),
If the value does show up more than once, use the words “Possible Duplicate” in the cell; if it does not, use the word “Unique”

=IF(COUNTIF(I$2:I$73, I2) > 1), "Possible Duplicate", "Unique")
Now It’s Your Turn

Complete hands-on activities 15–16:

- Adding the Art Supplies Fees
- Finding Duplicate Records
Data Validation and Field Protection
Data Validation

- Whole Numbers
- Decimals
- List
- Date
- Time
- Text Length
- Custom criteria
Field Protection

- Protects fields from “accidents”
- Great for protecting formulas
- Use Control + ~
- Passwords are optional
Now It’s Your Turn

Complete hands-on activity 17:

Data Validation and Field Protection
Time for Review
Question 1

What function can you use to verify if a record exists in two different lists?

A  INDEX
B  MATCH
C  FIND
D  COMPARE
What function can you use to verify if a record exists in two different lists?

Answer 1

A INDEX
B MATCH
C FIND
D COMPARE
What function can you use to verify a course name isn't too long?

A. LEN
B. PROPER
C. CHAR
D. EXACT
What function can you use to verify a course name isn't too long?

A. LEN
B. PROPER
C. CHAR
D. EXACT
Question 3

True/False: To find the data in a specific cell, use the VLOOKUP function.
Answer 3

To find the data in a specific cell, use the VLOOKUP function.

True!
Question 4
What function can you use to add up numbers that meet a certain condition?

A. SUMPRODUCT
B. COUNTIF
C. SUMIF
D. SUM
What function can you use to add up numbers that meet a certain condition?

A. SUMPRODUCT
B. COUNTIF
C. SUMIF
D. SUM
Question 5

True/False: You can use the IF function to compare data.
Answer 5

Use the IF function to **return different values based on a Logical Test.**

False!
Key Points from Today’s Class

- When using lookup and reference functions, use TRUE for an approximate match and FALSE for an exact match.
- When used with such functions as AND, OR, and NOT, the IF function is a powerful tool.
- When using SUMIF or COUNTIF, make sure to use dollar signs in the first argument to keep the criteria the same, or use named ranges.
Question and Answer
Don’t Forget!!

Navigate to

http://powerschooluniversity.com

and tell us what you think!