Using Formulas and Functions

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Functions

What is a function?

- A function allows you to calculate a result based on one or more input values; functions make it easier to perform more complicated calculations.

Common functions

- Some commonly used functions include:

  **AVERAGE**: Used to determine the average value of the selected cells contents.

  **COUNT**: Used to count how many numbers are in the list.

  **COUNTA**: Used to count the number of cells that are not empty and the values within the list of arguments.

  **COUNTBLANK**: Used to count empty cells within a cell range.

  **MAX**: Used to return the maximum number from a list.

  **MIN**: Used to return the minimum number from a list.

  **SUM**: Used to add the contents of selected cells.

  **IF**: Used to evaluate values and make decisions based on the result of the evaluation.

- To display the available functions, display a blank workbook and then click on the **Formulas** tab and within the **Function Library** group:

  Click on the **Insert Function** icon.
• This will display the **Insert Function** dialog box.

![Insert Function dialog box](image)

• Scroll through the list to see the available functions.

• When you have finished click on the **Cancel** button to close the dialogue box.

• Close the workbook.

It is important that you know how to type the function and understand the structure of the function as you may be asked to do so in the exam.
Sum function

- Open a workbook called **Functions**. If necessary, click on the **Sum** worksheet tab.

- Click on cell **C8**. In this cell we need to sum the values in the column above.

- Click on the **Formulas** tab and within the **Function Library** group click on the **AutoSum** icon.

  ![AutoSum Icon]

  **TIP**: Click on the **AutoSum** icon, not the **down arrow** beside the icon.

- You will see the following displayed on your screen.

  ![Spreadsheet Example]

  - Press the **Enter** key and you will see the AutoSum result in cell **C8**.
  - Click on cell **C8**, and you will see the function displayed in the bar just above your worksheet.

As you can see the function is:

=SUM(C4:C7)

- This function tells Excel to sum the values in the range **C4:C7**.
  - explain why this is the preferred formula instead of **=C4+C5+C6+C7**
Average function

- Click on the **Average** worksheet tab.

- Click on cell C8. In this cell we want to display the average number of sales within the regions.

- Click on the **Formulas** tab and within the **Function Library** group click on the arrow next to the **AutoSum** icon. You will see a drop down list displayed. Click on the **Average** command.

- You will see the following displayed on your screen.

- Press the **Enter** key and you will see the average value displayed in cell C8.
Click on cell C8, and you will see the function displayed in the bar just above your worksheet.

As you can see the function is:

=AVERAGE(C4:C7)

This function tells Excel to calculate the average in the range C4:C7.

Max function

Click on the Max worksheet tab.

Click on cell C8. In this cell we want to display the highest number of sales within a region.

Click on the Formulas tab and within the Function Library group click on the down arrow next to (or under) the AutoSum icon. You will see a drop down list displayed. Click on the Max command.

You will see the following displayed on your screen.
• Press the **Enter** key and you will see the maximum value displayed in cell **C8**.

• Click on cell **C8**, and you will see the function displayed in the bar just above your worksheet.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>Sales Region</strong></td>
<td><strong>No of sales</strong></td>
</tr>
<tr>
<td>4</td>
<td>North</td>
<td>34</td>
</tr>
<tr>
<td>5</td>
<td>South</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>East</td>
<td>84</td>
</tr>
<tr>
<td>7</td>
<td>West</td>
<td>38</td>
</tr>
<tr>
<td>8</td>
<td><strong>Highest no of sales in a region</strong></td>
<td><strong>84</strong></td>
</tr>
</tbody>
</table>

As you can see the function is:

\[ =\text{MAX(C4:C7)} \]

• This function tells Excel to display the maximum value within the range **C4:C7**.

**Min function**

• The **MIN** function will display the minimum number within a range.

• Click on the **Min** worksheet tab.

• Click on cell **C8**. In this cell we want to display the lowest number of sales within a region.

• Click on the **Formulas** tab and within the **Function Library** group click on the **down arrow** next to (or under) the **AutoSum** icon. You will see a drop down list displayed. Click on the **Min** command.

• You will see the following displayed on your screen.
• Press the Enter key and you will see the minimum value displayed in cell C8.

• Click on cell C8, and you will see the function displayed in the bar just above your worksheet.

As you can see the function is:

=MIN(C4:C7)

• This function tells Excel to display the minimum value within the range C4:C7.

Count function

• The Count function will count up the number of cells which contain numbers.

• Click on the Count tab.

• Click on cell C19. In this cell we want to display the number of cells in the column above that contain a number.

• Click on the Formulas tab and within the Function Library group click on the down arrow next to (or under) the AutoSum icon. You will see a drop down list displayed. Click on the Count Numbers command.

• You will see the following displayed on your screen.
WARNING: In all the previous examples, there was a column containing values immediately above the cell into which we inserted the function. In this case some of the cells within the column are empty and Excel, as you can see has only applied the Count function to the range C17:C18. The reason for this is that the next cell up, i.e. cell C16 is empty.

We need to tell Excel that the range we are interested in, actually extents from C5:C18.

To do this, click on cell C18 and while holding down the mouse button drag up to cell C5. Then release the mouse button. Your screen should now look like this.

Press the Enter key and you will see the count value displayed in cell C19.
Click on cell **C19**, and you will see the function displayed in the bar just above your worksheet.

As you can see the function is:

\[ \text{=COUNT(C5:C18)} \]

This function tells Excel to display the number of cells containing a value within the range **C5:C18**.

**NOTE**: If you made a mistake, click on cell **C19** and press the **Del** key. Then try again.

### The COUNTA function

- The COUNTA function is used to count the number of cells within a range that are not empty/ or contain text.
- Make sure you are still on the **Count** worksheet tab.
- The Count function would only count up the number of cells containing numbers, whereas Counta will count the number of cells containing numbers and letters.
- Click on cell **C20**.

- Click on the **More Functions** icon (contained within the **Function Library** group on the **Formulas** tab).

  From the drop down options displayed, select **Statistical**.

- From the submenu select **COUNTA**.
• This will display the **Functions Arguments** dialog box, as illustrated.

![Functions Arguments dialog box](image)

- Counts the number of cells in a range that are not empty.

  **Value1:** value1, value2, ..., are 1 to 255 arguments representing the values and cells you want to count. Values can be any type of information.

  **Value1:** E12:E49

  **Value2:** number

  = 3

  Formula result = 3

  Help on this function

  ![OK button](image)

• If necessary move the dialog box to one side. The range of cells displayed in the value box is incorrect as we want to count the number of countries listed in column B. Select the cell range **B5:B18**, as illustrated.

![Function Arguments dialog box](image)

- Counts the number of cells in a range that are not empty.

  **Value1:** B5:B18

  **Value2:** number

  = 14

  Formula result = 14

  Help on this function

  ![OK button](image)

• Click on the **OK** button and you will see the following.
As you can see the function has counted every instance of text within the specified cell range.

### The COUNTBLANK function

- The COUNTBLANK function is used to count empty cells within a cell range.

1. Click on cell C21.
2. Click on the More Functions icon (contained within the Function Library group on the Formulas tab).
3. From the drop down displayed, select Statistical. From the submenu select Countblank.
4. This will display the Functions Arguments dialog box, as illustrated.
• If necessary move the dialog box to one side and then select the cell range C5:C18, as illustrated.

• Click on the OK button and you will see that 2 delegates were absent.

• As you can see the function has counted every instance of an empty cell within the specified cell range.
What are 'IF functions'? 

Excel has a number of functions which allow us to evaluate values and make decisions based on the result of the evaluation. The IF( ) function is one of these.

The format (Syntax) of the IF( ) function is as follows:

\[ =IF\text{(LOGICAL\_TEST, ACTION\_IF\_TRUE, ACTION\_IF\_FALSE)} \]

1. **LOGICAL\_TEST**
   The logical\_test evaluates an expression to see if it passes the test, i.e. is TRUE or does not pass the test, i.e. is FALSE.

<table>
<thead>
<tr>
<th>Logical operators</th>
<th>Values for Evaluation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>= (Equal to)</td>
<td>A=B</td>
<td>FALSE</td>
</tr>
<tr>
<td></td>
<td>A=D</td>
<td>TRUE</td>
</tr>
<tr>
<td>&gt; (Greater than)</td>
<td>A&gt;B</td>
<td>TRUE</td>
</tr>
<tr>
<td></td>
<td>A&gt;C</td>
<td>FALSE</td>
</tr>
<tr>
<td>&lt; (Less than)</td>
<td>A&lt;B</td>
<td>FALSE</td>
</tr>
<tr>
<td></td>
<td>A&lt;C</td>
<td>TRUE</td>
</tr>
<tr>
<td>&gt;= (Greater than or Equal to)</td>
<td>A&gt;=B</td>
<td>TRUE</td>
</tr>
<tr>
<td></td>
<td>A&gt;=D</td>
<td>TRUE</td>
</tr>
<tr>
<td>&lt;= (Less than or Equal to)</td>
<td>A&lt;=B</td>
<td>FALSE</td>
</tr>
<tr>
<td></td>
<td>A&lt;=C</td>
<td>TRUE</td>
</tr>
<tr>
<td></td>
<td>A&lt;=D</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

2. **ACTION\_IF\_TRUE**
   Action\_if\_true can be a value or an operation. Whichever, the result is placed in the cell which contains the IF( ) Function if the logical\_test is true.

3. **ACTION\_IF\_FALSE**
   Action\_if\_false can be a value or an operation. Whichever, the result is placed in the cell which contains the IF( ) Function if the logical\_test is false.
Using the IF function

- Click on the **If** worksheet tab.

- In cells **J8:J13** we need to display the word **PASS** or **FAIL**, depending on whether the average is over **70%**.

- Click on cell **J8**.

- Click on the **Logical** icon within the **Function Library** group of the **Formulas** tab. This will display a drop down list. Select the **IF** command.

- This will display the **Function Arguments** dialog box.

- In the **LOGICAL_TEST** section of the dialog box, we enter the logical test, i.e. **I8>70**

- In the **VALUE_IF_TRUE** section of the dialog box, we enter the word **PASS**.

- In the **VALUE_IF_FALSE** section of the dialog box, we enter the word **FAIL**.
• Your dialog box will now look like this.

![Function Arguments dialog box]

- Logical_test: 18 > 70 = FALSE
- Value_if_true: "PASS" = "PASS"
- Value_if_false: "FAIL" = "FAIL"

Checks whether a condition is met, and returns one value if TRUE, and another value if FALSE.

Value_if_true is the value that is returned if Logical_test is TRUE. If omitted, TRUE is returned. You can nest up to seven IF functions.

Formula result = FAIL

Help on this function

[OK] [Cancel]

• Click on the OK button to continue. Your screen will now look like this.

<table>
<thead>
<tr>
<th>STUDENTS</th>
<th>Mathematics</th>
<th>English</th>
<th>History</th>
<th>Geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hadiya</td>
<td>68</td>
<td>78</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>Dai</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>67</td>
</tr>
<tr>
<td>Aaron</td>
<td>76</td>
<td>78</td>
<td>79</td>
<td>87</td>
</tr>
<tr>
<td>Rowan</td>
<td>67</td>
<td>86</td>
<td>58</td>
<td>66</td>
</tr>
<tr>
<td>Aaliyah</td>
<td>85</td>
<td>77</td>
<td>87</td>
<td>78</td>
</tr>
<tr>
<td>Gabriela</td>
<td>59</td>
<td>68</td>
<td>78</td>
<td>89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average grades</th>
<th>Passed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>FAIL</td>
</tr>
<tr>
<td>69</td>
<td>FAIL</td>
</tr>
<tr>
<td>80</td>
<td>PASS</td>
</tr>
<tr>
<td>69</td>
<td>FAIL</td>
</tr>
<tr>
<td>82</td>
<td>PASS</td>
</tr>
<tr>
<td>74</td>
<td>PASS</td>
</tr>
</tbody>
</table>

Use the normal Excel drag techniques to extend this function to the cells I9:J13. Your screen will now look like this.

• Save your changes and close the workbook.
Further Practice

- Open the Workbook **Functions 2** and go to the **Short Courses** worksheet.
- Insert a formula in **G2** to calculate total cost of course and replicate down.
- Enter a function in cell **B11** to find average cost of a course.
- Enter a function in cell **B12** to find the cheapest course.
- Enter a function in cell **B13** to find the most expensive course.
- Enter a function in cell **B14** to find how many courses are on offer.
- Enter the **IF** function in cell **H2**
  
  If the total income generated from the course is less than **£250** then the course is not financially viable and will not run. Enter ‘**yes**’ if the course income is more than 250 and enter ‘**no**’ if the course income is not more than 3250.

  Replicate this function down to **H8**.
- Go to the **Badminton** worksheet.
  Enter the **sum** function in cells **B13, C13** and **D13** to find out the totals.
- Enter a **counta** function in cell **B16** to find out how many days the badminton sessions are running.
- Delete row **11** and see how the result of **B16** (and the totals) all change.
- Enter average functions in cells **B17** and **B18**.
- We currently have 3 coaches who work with 30 children. Sessions that have more than 30 children will require an extra coach.

  Enter the **IF** function in **E6** the argument is:
  if there are more than 30 tickets sold an extra coach is required
  if yes, enter the text ‘**Extra coach**’
  if no, leave blank

  Replicate this function down to **E11**.
- Go to the **Market** worksheet.
  Enter a sum function in **I4** (revision from last time) and replicate down to **I11**.
  Enter a sum function in **B12** to find the total sales for the day – replicate across to **I12**.
- Enter **average** functions and replicate across to **H2**.
- Enter the count function in **B16** to find out how many different fruits were on sale.
- Enter an **IF** function in **J4** – the argument is:
  IF the total sale (**I4**) is more than **£350** the vendor has to pay an additional **5%** surcharge (**I4*5%**).
  If not, leave blank.
The vendor is thinking of closing down the stall on Wednesdays. But first they must find out how much money they normally make on this day before reaching a decision.

Enter the **Average**, **Min** and **Max** functions for **Wednesday** only in cells **B19**, **B20** and **B21**.

Go to the **Donations** worksheet. Insert a function in **H2** for the following argument:
- IF the Age of the donor is less than 65 they will be eligible for Gift Aid
- if Yes, enter **Gift Aid**
- if No, enter **No**
- Replicate this down

Go to **I2** – each donor will receive a special thank you card if they have donated more than £20 – if they have donated less than 20 they will get a receipt.
- if yes – enter ‘**card**’
- if no – enter ‘**receipt**’

Enter a function in **L3** to count how many donated and how many did not donate in **L4**

Enter the highest donation in **L7** and the lowest donation in **L8**.