EXPLORE AI
ACADEMY

Spreadsheet functions

How and when to use spreadsheet functions

Overview

01. Data overview

02. Mixed cell reference

03. Linking sheets

04. The LOOKUP function

05. The SORT function

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Spreadsheet functions

Data overview

> To investigate how we can use spreadsheet functions in data analytics, we will use two datasets; one on food crops and the other on their subsidies.

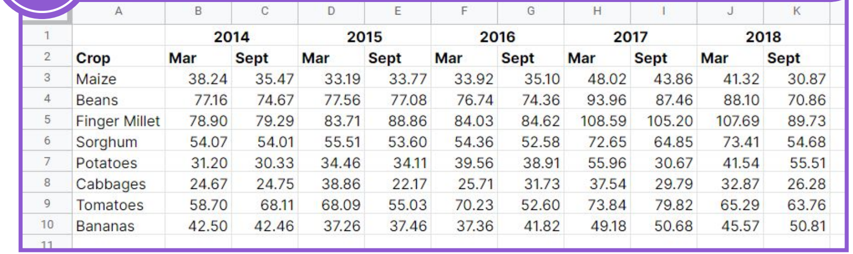
1. **Average retail market prices of selected food crops 2014-2018**

A Kenyan dataset containing prices for selected food crops during the months of March and September for the years 2014-2018.

2. **Food crops subsidies 2014-2018**

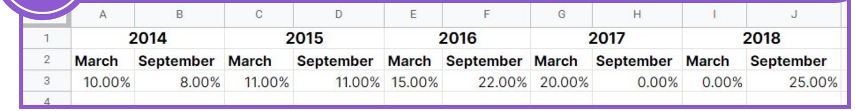
A dataset indicating the subsidies the Kenyan government provided for all food crops during the months of March and September for the years 2014-2018.

Dataset 1



	A	B	C	D	E	F	G	H	I	J	K
1		2014		2015		2016		2017		2018	
2	Crop	Mar	Sept	Mar	Sept	Mar	Sept	Mar	Sept	Mar	Sept
3	Maize	38.24	35.47	33.19	33.77	33.92	35.10	48.02	43.86	41.32	30.87
4	Beans	77.16	74.67	77.56	77.08	76.74	74.36	93.96	87.46	88.10	70.86
5	Finger Millet	78.90	79.29	83.71	88.86	84.03	84.62	108.59	105.20	107.69	89.73
6	Sorghum	54.07	54.01	55.51	53.60	54.36	52.58	72.65	64.85	73.41	54.68
7	Potatoes	31.20	30.33	34.46	34.11	39.56	38.91	55.96	30.67	41.54	55.51
8	Cabbages	24.67	24.75	38.86	22.17	25.71	31.73	37.54	29.79	32.87	26.28
9	Tomatoes	58.70	68.11	68.09	55.03	70.23	52.60	73.84	79.82	65.29	63.76
10	Bananas	42.50	42.46	37.26	37.46	37.36	41.82	49.18	50.68	45.57	50.81
11											

Dataset 2



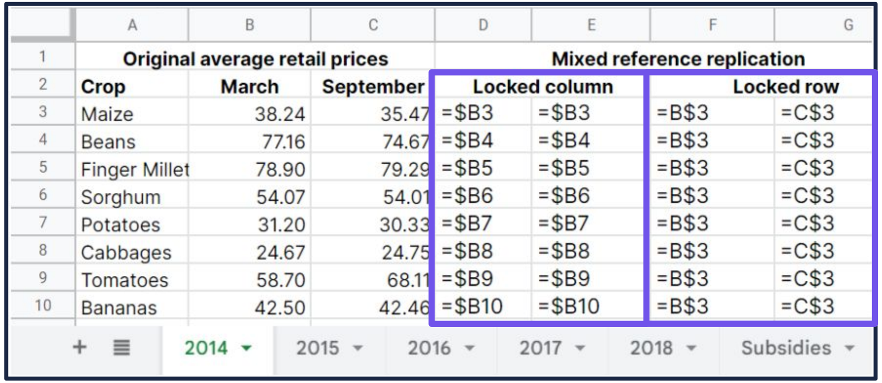
	A	B	C	D	E	F	G	H	I	J
1	2014		2015		2016		2017		2018	
2	March	September	March	September	March	September	March	September	March	September
3	10.00%	8.00%	11.00%	11.00%	15.00%	22.00%	20.00%	0.00%	0.00%	25.00%
4										

Spreadsheet functions

Mixed cell reference

> A **mixed cell reference** is a combination of relative and absolute references. Part of a mixed reference is fixed, either the column or the row, and the other is relative.

- **$B3 locked column** – The column does not change. For example, replicating a cell reference with a locked column from cell **D3** to cell **E10** will indicate a change in row number but not column letter.
- **B$3 locked row** – The row does not change. For example, replicating a cell reference with a locked row from cell **F3** to cell **G10** will indicate a change in column letter but not row number.



	A	B	C	D	E	F	G
1	Original average retail prices			Mixed reference replication			
2	Crop	March	September	Locked column		Locked row	
3	Maize	38.24	35.47	=$B3	=$B3	=B$3	=C$3
4	Beans	77.16	74.67	=$B4	=$B4	=B$3	=C$3
5	Finger Millet	78.90	79.29	=$B5	=$B5	=B$3	=C$3
6	Sorghum	54.07	54.01	=$B6	=$B6	=B$3	=C$3
7	Potatoes	31.20	30.33	=$B7	=$B7	=B$3	=C$3
8	Cabbages	24.67	24.75	=$B8	=$B8	=B$3	=C$3
9	Tomatoes	58.70	68.11	=$B9	=$B9	=B$3	=C$3
10	Bananas	42.50	42.46	=$B10	=$B10	=B$3	=C$3

Mixed references are useful when the same calculations need to be used across rows and columns.

Spreadsheet functions

Mixed cell reference

Example use:

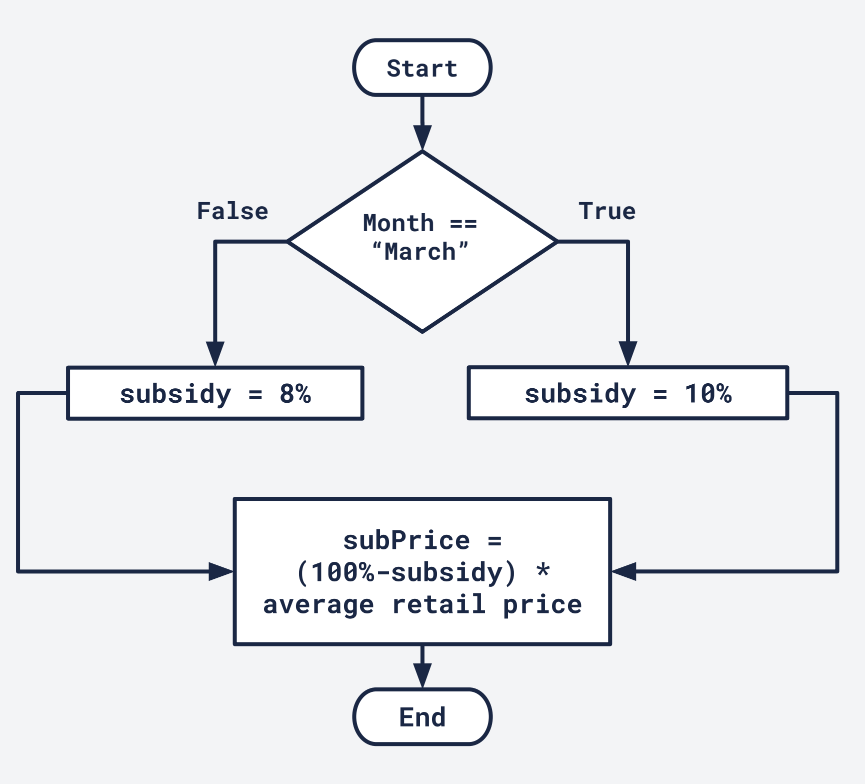
- To calculate a **food crop's subsidised price**, we will use the following formula:

  `subPrice=(100%-subsidy) * average retail price`

- We only have two months' data to concentrate on for the year 2014, which are **March** with a subsidy of **10%** and **September** with a subsidy of **8%**.

```
If month == “March” then
- subsidy = 10%
Else
- subsidy = 8%
subPrice = (100%-subsidy) * average retail price
```

- We can convert this into a one-size-fits-all formula that populates all values of the **Subsidised average retail prices** table for the year 2014.

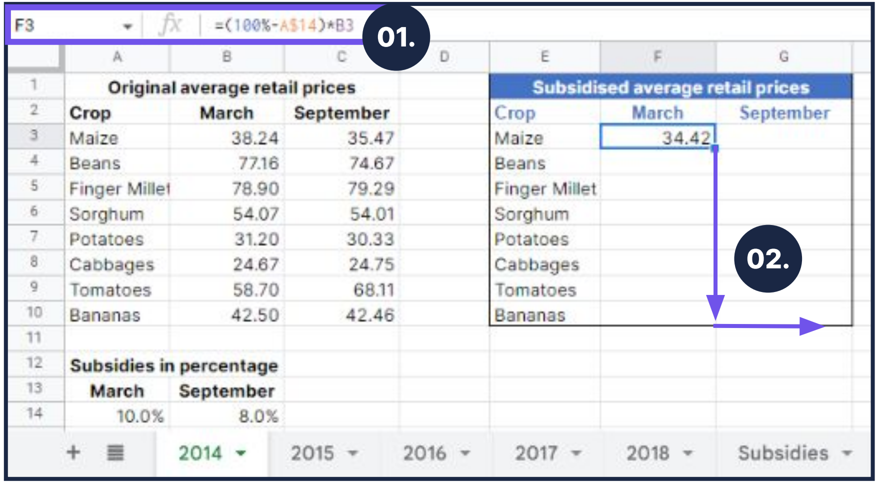


Spreadsheet functions

Mixed cell reference

Example use:

- We will use a **mixed reference** for the **subsidy percentage** value such that the **row number remains fixed** but the column number can change based on the month’s subsidy.
- The **food crop's original price** will be best captured using the **relative reference** since it changes based on the food crop as well as the month.



F3 | fx | =(100%-A$14)*B3

01.

	A	B	C	D	E	F	G
1	Original average retail prices				Subsidised average retail prices		
2	Crop	March	September		Crop	March	September
3	Maize	38.24	35.47		Maize	34.42	
4	Beans	77.16	74.67		Beans		
5	Finger Millet	78.90	79.29		Finger Millet		
6	Sorghum	54.07	54.01		Sorghum		
7	Potatoes	31.20	30.33		Potatoes		
8	Cabbages	24.67	24.75		Cabbages		
9	Tomatoes	58.70	68.11		Tomatoes		
10	Bananas	42.50	42.46		Bananas		
11							
12	Subsidies in percentage						
13	March	September					
14	10.0%	8.0%					

02.

01. Enter `=(100%-A$14)*B3` on cell F3.

02. Replicate the formula to the other rows and column by dragging the fill handle down and the across to September.

We could also have used a **conditional statement**. What spreadsheet function would we use?

Alternative solution

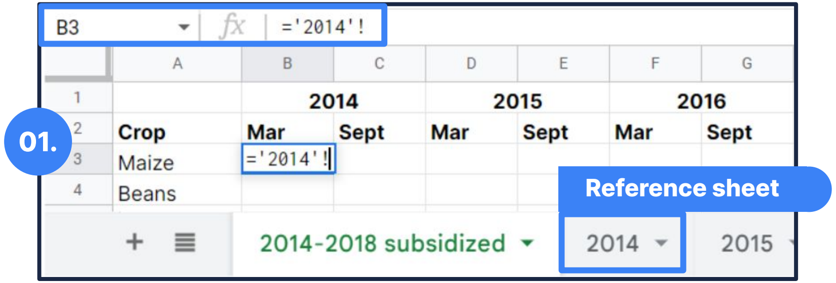
Spreadsheet functions

Linking sheets

> **Linking sheets** is a technique that **uses cell referencing** to link a cell or range of cells **from one sheet to another** using relative, absolute, or mixed referencing.

01. Enter an **equal sign**, type in the **name of the sheet** you'd like to reference in **single quotes**, and type in an exclamation mark.

02. Type in the **relevant cell reference** then press **ENTER**.



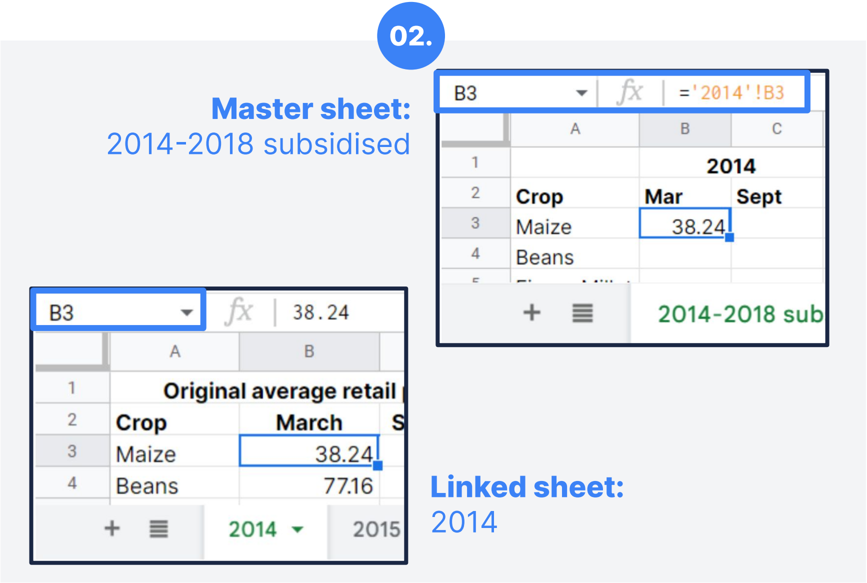
01.

B3 ▾ | fx | ='2014'!

	A	B	C	D	E	F	G
1		2014		2015		2016	
2	Crop	Mar	Sept	Mar	Sept	Mar	Sept
3	Maize	='2014'!					
4	Beans						

Reference sheet

+ ≡ 2014-2018 subsidized ▾ | 2014 ▾ | 2015



02.

Master sheet:
2014-2018 subsidised

B3 ▾ | fx | ='2014'!B3

	A	B	C
1		2014	
2	Crop	Mar	Sept
3	Maize	38.24	
4	Beans		

+ ≡ 2014-2018 sub

B3 ▾ | fx | 38.24

	A	B
1		Original average retail
2	Crop	March
3	Maize	38.24
4	Beans	77.16

+ ≡ 2014 ▾ | 2015

Linked sheet:
2014

Spreadsheet functions

Linking sheets

Example use:

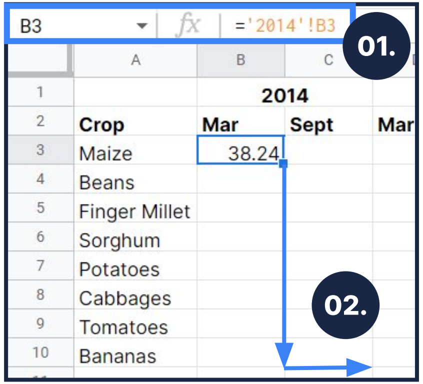
We can create a **master view** of the subsidised retail prices for 2014 to 2018 by **consolidating** information from the respective worksheets into one.

01. Enter the formula **='2014'!B3** on cell B3 of the master sheet to reference data from the 2014 sheet.

02. Replicate the formula to other rows and to the **Sept** column for 2014 by dragging the fill handle down then across.

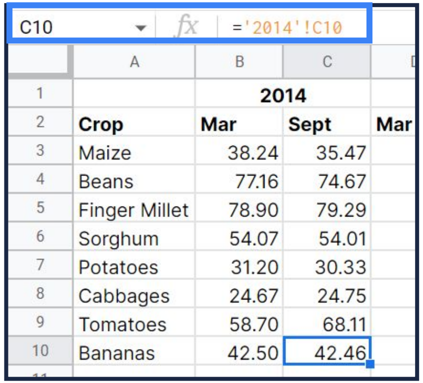
03. Repeat for years 2015 to 2018.

Linking sheets has an **advantage** over copy-pasting in that **changes** made on the original sheet **automatically reflect** on the referencing sheet.



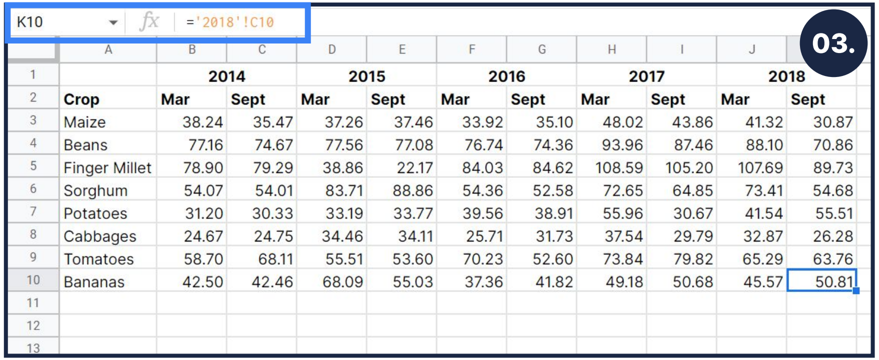
B3 ='2014'!B3

	A	B	C	
1		2014		
2	Crop	Mar	Sept	Mar
3	Maize	38.24		
4	Beans			
5	Finger Millet			
6	Sorghum			
7	Potatoes			
8	Cabbages			
9	Tomatoes			
10	Bananas			



C10 ='2014'!C10

	A	B	C	
1		2014		
2	Crop	Mar	Sept	Mar
3	Maize	38.24	35.47	
4	Beans	77.16	74.67	
5	Finger Millet	78.90	79.29	
6	Sorghum	54.07	54.01	
7	Potatoes	31.20	30.33	
8	Cabbages	24.67	24.75	
9	Tomatoes	58.70	68.11	
10	Bananas	42.50	42.46	



K10 ='2018'!C10

	A	B	C	D	E	F	G	H	I	J	
1		2014		2015		2016		2017		2018	
2	Crop	Mar	Sept	Mar	Sept	Mar	Sept	Mar	Sept	Mar	Sept
3	Maize	38.24	35.47	37.26	37.46	33.92	35.10	48.02	43.86	41.32	30.87
4	Beans	77.16	74.67	77.56	77.08	76.74	74.36	93.96	87.46	88.10	70.86
5	Finger Millet	78.90	79.29	38.86	22.17	84.03	84.62	108.59	105.20	107.69	89.73
6	Sorghum	54.07	54.01	83.71	88.86	54.36	52.58	72.65	64.85	73.41	54.68
7	Potatoes	31.20	30.33	33.19	33.77	39.56	38.91	55.96	30.67	41.54	55.51
8	Cabbages	24.67	24.75	34.46	34.11	25.71	31.73	37.54	29.79	32.87	26.28
9	Tomatoes	58.70	68.11	55.51	53.60	70.23	52.60	73.84	79.82	65.29	63.76
10	Bananas	42.50	42.46	68.09	55.03	37.36	41.82	49.18	50.68	45.57	50.81
11											
12											
13											

Spreadsheet functions

The LOOKUP function

> A **LOOKUP** function is used to search for a value in a range of cells and returns a corresponding value from a specific column or row.

```
=LOOKUP(search_key, search_range|search_result_array, [result_range])
```

- **`search_key`** – The value to search for in the row or column.
- **`search_range`** – The row or column to look through for the search with a second argument **`result_range`**.
- **`search_result_array`** – A combination of **`search_range`** and **`result_range`** where the first row or column is searched and a value is returned from the last row or column in the array.
- **`result_range`** – [OPTIONAL] The range from which to return a result.

The LOOKUP function

Example use:

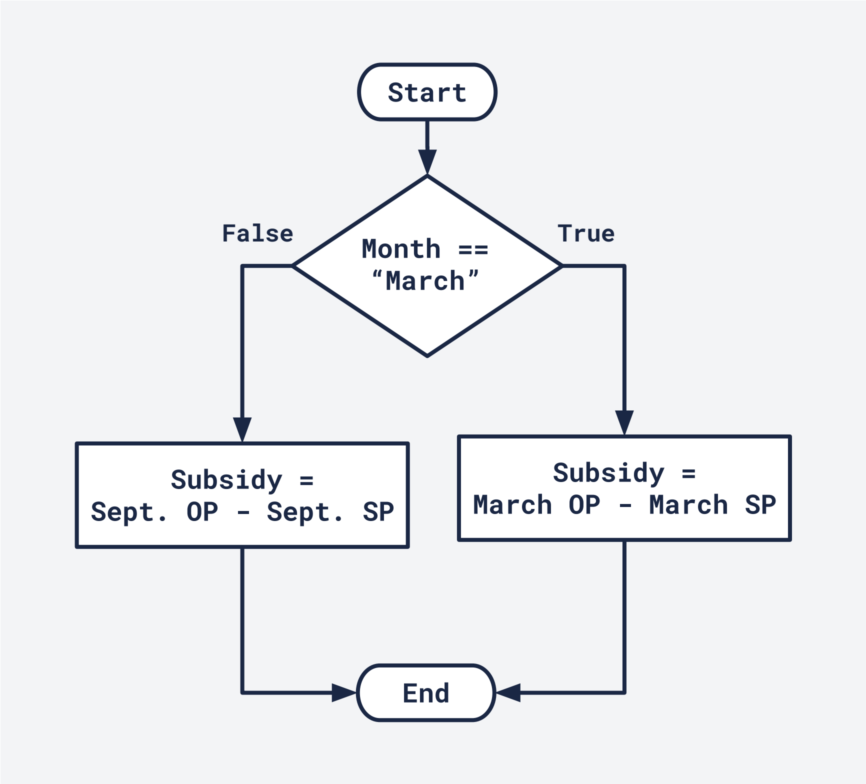
- Create a table that shows the **amount of money** that was **subsidised** for each food crop in **2014**.

- We only have two months’ data to concentrate on for the year 2014; March and September.

  Let a food crop’s *original price* be represented by **OP** and its *subsidised price* be represented by **SP**:

```
If month == “March” then
– Subsidy = March OP - March SP
Else
– Subsidy = Sept. OP - Sept. SP
```

- We will use two **LOOKUP** functions to calculate the price difference. One will search for a crop’s original price and the other for its subsidised price.



Spreadsheet functions

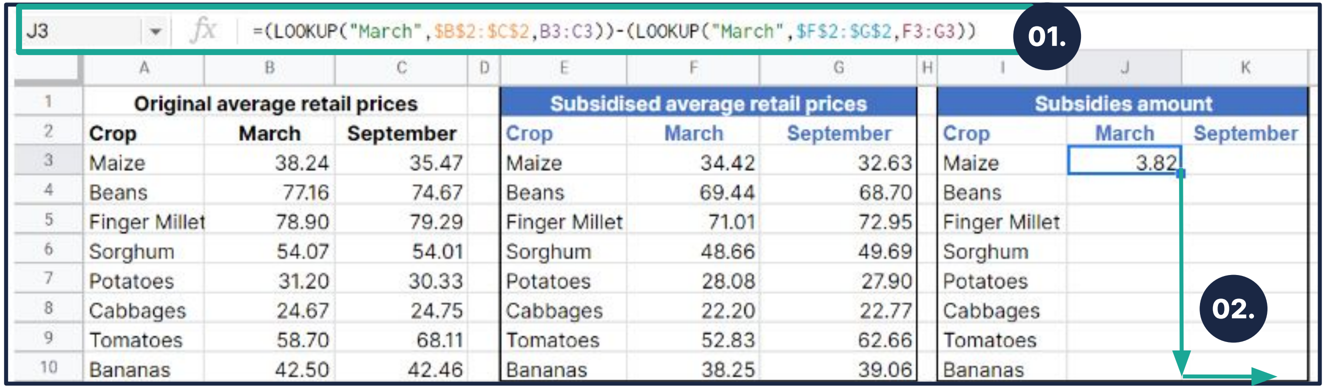
The LOOKUP function

Example use:

- The **LOOKUP** functions will use **absolute references** for the **`search_range`** to ensure we use a single row to search for our key.
- Our **`result_range`** will be best captured using the **relative reference** since it changes based on the food crop as well as the month.

01. Enter the formula `=(LOOKUP("March",$B$2:$C$2,B3:C3))-(LOOKUP("March",$F$2:$G$2,F3:G3))` on cell J3.

02. Replicate the formula to the other rows and **September** column by dragging the fill handle down and then across.



J3 fx =(LOOKUP("March",$B$2:$C$2,B3:C3))-(LOOKUP("March",$F$2:$G$2,F3:G3))

	A	B	C	D	E	F	G	H	I	J	K
1	Original average retail prices				Subsidised average retail prices				Subsidies amount		
2	Crop	March	September		Crop	March	September		Crop	March	September
3	Maize	38.24	35.47		Maize	34.42	32.63		Maize	3.82	
4	Beans	77.16	74.67		Beans	69.44	68.70		Beans		
5	Finger Millet	78.90	79.29		Finger Millet	71.01	72.95		Finger Millet		
6	Sorghum	54.07	54.01		Sorghum	48.66	49.69		Sorghum		
7	Potatoes	31.20	30.33		Potatoes	28.08	27.90		Potatoes		
8	Cabbages	24.67	24.75		Cabbages	22.20	22.77		Cabbages		
9	Tomatoes	58.70	68.11		Tomatoes	52.83	62.66		Tomatoes		
10	Bananas	42.50	42.46		Bananas	38.25	39.06		Bananas		

The alternative LOOKUP functions

> **VLOOKUP** and **HLOOKUP** are used to retrieve **specific** data from a spreadsheet. **VLOOKUP** only searches in a **column** (vertically) while **HLOOKUP** only searches in a **row** (horizontally).

```
=VLOOKUP(search_key, range, index, [is_sorted])
=HLOOKUP(search_key, range, index, [is_sorted])
```

- **`search_key`** – The value to search for.
- **`range`** – The upper and lower values to consider for the search.
- **`index`** – The index of the column (VLOOKUP) or row (HLOOKUP) with the return value of the range. The first column (VLOOKUP) or row (HLOOKUP) in **`range`** is numbered 1. The index must be a positive integer.
- **`[is_sorted]`** – [OPTIONAL - TRUE by default]
  - **FALSE** = Exact match. This is recommended.
  - **TRUE or omitted** = Approximate match. *Important*: Before you use **TRUE**, sort your search key in ascending order. Otherwise, you may get a wrong return value.

Spreadsheet functions

The alternative LOOKUP functions

Example use:

A Compare the **price of maize** in **March and September** 2015

Since March and September values for maize are in columns, we will use two **VLOOKUPs** for this problem. Our **`range`** will consider **three columns**:

a. **column index 1** contains the name of the crops which will be used to locate the row containing data on maize prices;

b. **column index 2** contains the return value for March prices; and

c. **column index 3** contains the return value for September prices.

B Compare the **price of maize and beans** in **March** 2015

For the second problem, we will use two **HLOOKUPs** since the values of maize and beans are in rows. Our **`range`** will consider **nine rows** but we will concentrate on three:

a. **row index 1** contains the name of the months which will be used to locate the column containing data on **March** prices;

b. **row index 2** contains the return value for maize prices; and

c. **row index 3** contains the return value for beans prices.

Spreadsheet functions

The alternative LOOKUP functions

A

01. Enter the formula `=VLOOKUP(F2,A3:C10,2,FALSE)` on cell F3.

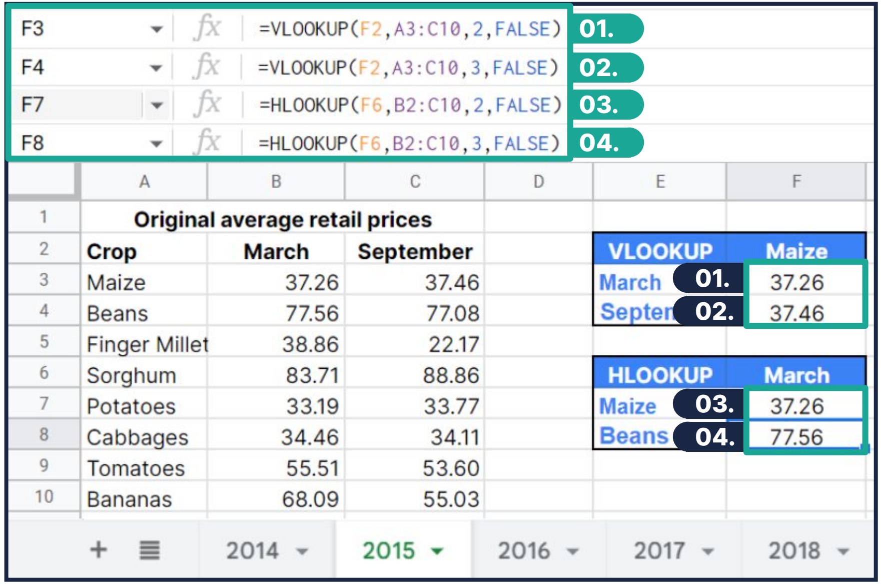
02. Enter the formula `=VLOOKUP(F2,A3:C10,3,FALSE)` on cell F4.

B

03. Enter the formula `=HLOOKUP(F6,B2:C10,2,FALSE)` on cell F7.

04. Enter the formula `=HLOOKUP(F6,B2:C10,3,FALSE)` on cell F8.

Example use:



```
F3  fx  =VLOOKUP(F2,A3:C10,2,FALSE)   01.
F4  fx  =VLOOKUP(F2,A3:C10,3,FALSE)   02.
F7  fx  =HLOOKUP(F6,B2:C10,2,FALSE)   03.
F8  fx  =HLOOKUP(F6,B2:C10,3,FALSE)   04.
```

	A	B	C	D	E	F
1	Original average retail prices					
2	Crop	March	September		VLOOKUP	Maize
3	Maize	37.26	37.46		March 01.	37.26
4	Beans	77.56	77.08		Septen 02.	37.46
5	Finger Millet	38.86	22.17			
6	Sorghum	83.71	88.86		HLOOKUP	March
7	Potatoes	33.19	33.77		Maize 03.	37.26
8	Cabbages	34.46	34.11		Beans 04.	77.56
9	Tomatoes	55.51	53.60			
10	Bananas	68.09	55.03			

Spreadsheet functions

The SORT function

> **SORT** is used to sort the rows of a given range by the values in one or more columns.

```
=SORT(range, sort_column, is_ascending, [sort_column2, …], [is_ascending2, …])
```

- **`range`** – The data to be sorted.
- **`sort_column`** – The index of the column in **`range`** or a range outside of **`range`** containing the values by which to sort.
  - A range specified as a **`sort_column`** must be a single column with the same number of rows as **`range`**.
- **`is_ascending`** – **TRUE** or **FALSE** indicating whether to sort **`sort_column`** in ascending order. **FALSE** sorts in descending order.
- **`sort_column2, is_ascending2`** ... – [OPTIONAL] Additional columns and sort order flags beyond the first, in order of precedence.

Spreadsheet functions

The SORT function

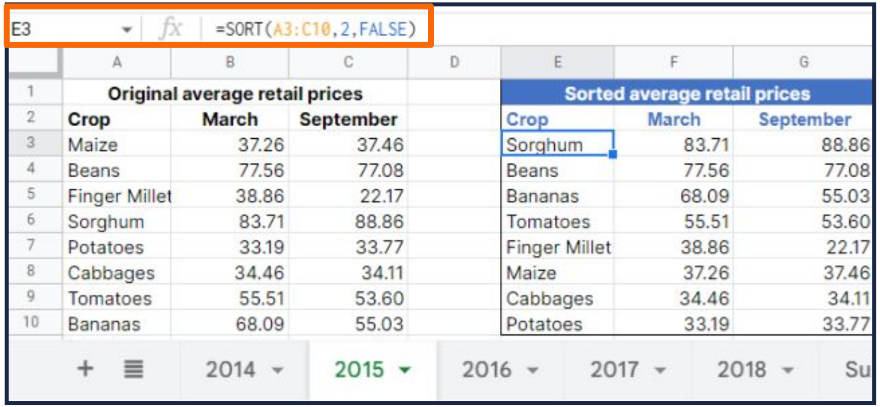
Example use:

Reorder the food crops in **descending order** of the March prices for the year 2015.

- We will select the names of the crops plus their prices (March and September) for our **`range`** because we want to make sure that all crops move with their respective prices during the sort.
- The **`sort_column`** will be the range of prices for March.
- Since we want to sort in descending order, we will use **FALSE** as our **`is_ascending`** `value.`

01. Enter the formula **`=SORT(A3:C10,2,FALSE)`** on cell E3.

02. Press **Enter**.



E3 =SORT(A3:C10,2,FALSE)

	A	B	C	D	E	F	G
1	Original average retail prices				Sorted average retail prices		
2	Crop	March	September		Crop	March	September
3	Maize	37.26	37.46		Sorghum	83.71	88.86
4	Beans	77.56	77.08		Beans	77.56	77.08
5	Finger Millet	38.86	22.17		Bananas	68.09	55.03
6	Sorghum	83.71	88.86		Tomatoes	55.51	53.60
7	Potatoes	33.19	33.77		Finger Millet	38.86	22.17
8	Cabbages	34.46	34.11		Maize	37.26	37.46
9	Tomatoes	55.51	53.60		Cabbages	34.46	34.11
10	Bananas	68.09	55.03		Potatoes	33.19	33.77

Spreadsheet functions

The alternative SORT function

> **SORTN** returns the **first n** items in a dataset after sorting it.

```
=SORTN(range, [n], [display_ties_mode], [sort_column], [is_ascending],
[sort_column2, …], [is_ascending2, …])
```

- **`range`** – The data to be sorted.
- **`[n]`** – The number of items to return.
- **`[sort_column]`** – [OPTIONAL] The column containing the values to sort by.
- **`[is_ascending]`** – [OPTIONAL] Indicates if **`sort_column`** is ascending or descending.
- **`[sort_column2, …], [is_ascending2, …]`** – [OPTIONAL] Additional columns to sort.
- **`[display_ties_mode]`** – [OPTIONAL] A number representing how to display ties:
  - 0: Only show the first n rows.
  - 1: Show first n rows, plus any additional rows that are identical to the nth row.
  - 2: Show first n rows with no duplicates.
  - 3: Show at most the first n unique rows, but show every duplicate of these rows.

Spreadsheet functions

The alternative SORT function

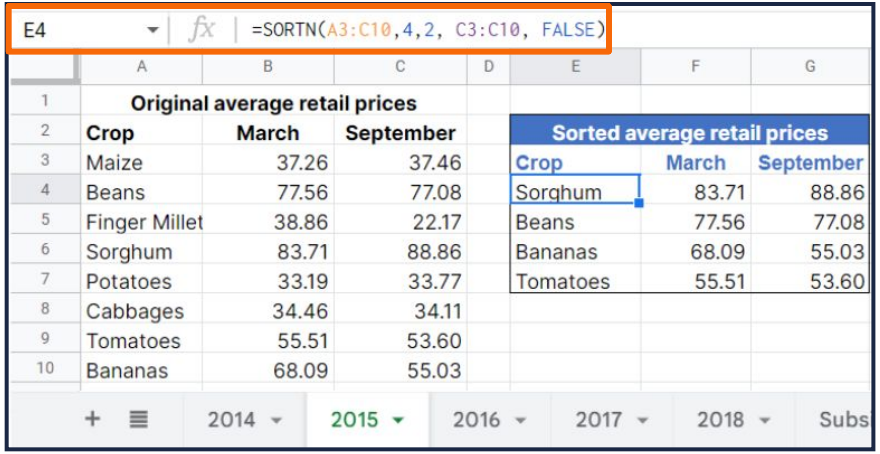
Example use:

Create a list of the **four priciest** crops, in **descending** order, for September 2015.

- Our solution will look a lot like that of **SORT.**
- However, we will have to make sure we change the function to **SORTN**, specify that we only want **4** items to be returned, and change the **`sort_column`** to September price range.
- We will also add **2** as our **`display_ties_mode`** just in case our dataset has duplicates.

01. Enter the formula **`=SORTN(A3:C10,4,2, C3:C10, FALSE)`** on cell E4.

02. Press **Enter**.



E4 | =SORTN(A3:C10,4,2, C3:C10, FALSE)

	A	B	C	D	E	F	G
1	Original average retail prices						
2	Crop	March	September		Sorted average retail prices		
3	Maize	37.26	37.46		Crop	March	September
4	Beans	77.56	77.08		Sorghum	83.71	88.86
5	Finger Millet	38.86	22.17		Beans	77.56	77.08
6	Sorghum	83.71	88.86		Bananas	68.09	55.03
7	Potatoes	33.19	33.77		Tomatoes	55.51	53.60
8	Cabbages	34.46	34.11				
9	Tomatoes	55.51	53.60				
10	Bananas	68.09	55.03				

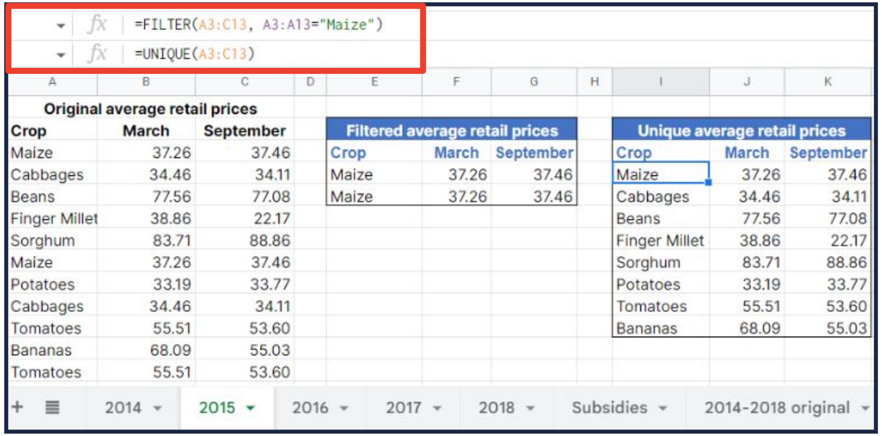
Spreadsheet functions

The FILTER and UNIQUE functions

> **FILTER** returns only **rows or columns** from the source range that **meet** the specified filtering **conditions** while **UNIQUE discards duplicate** rows and only **returns unique** rows in the provided source range.

```
=FILTER(range, condition1, [condition2, …])
=UNIQUE(range)
```

- `range` – The data to be filtered.
- `condition1` – A row or column containing **TRUE** or **FALSE** values corresponding to the first column or row of `range`.
- `condition2` – [OPTIONAL] Additional rows or columns containing boolean values.



```
=FILTER(A3:C13, A3:A13="Maize")
=UNIQUE(A3:C13)
```

Original average retail prices

Crop	March	September
Maize	37.26	37.46
Cabbages	34.46	34.11
Beans	77.56	77.08
Finger Millet	38.86	22.17
Sorghum	83.71	88.86
Maize	37.26	37.46
Potatoes	33.19	33.77
Cabbages	34.46	34.11
Tomatoes	55.51	53.60
Bananas	68.09	55.03
Tomatoes	55.51	53.60

Filtered average retail prices

Crop	March	September
Maize	37.26	37.46
Maize	37.26	37.46

Unique average retail prices

Crop	March	September
Maize	37.26	37.46
Cabbages	34.46	34.11
Beans	77.56	77.08
Finger Millet	38.86	22.17
Sorghum	83.71	88.86
Potatoes	33.19	33.77
Tomatoes	55.51	53.60
Bananas	68.09	55.03

The FILTER and UNIQUE functions

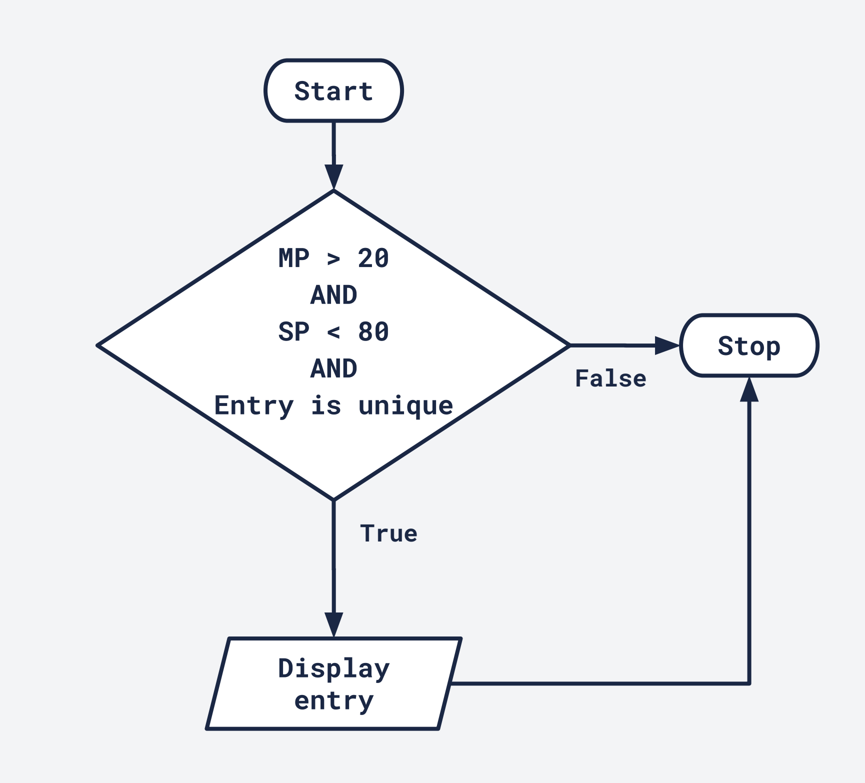
Example use:

Create a table that lists food crops whose prices were **greater than** KSh 20 in March and **less than** KSh 80 in September of 2015.

Make sure that this table has **no duplicate** entries.

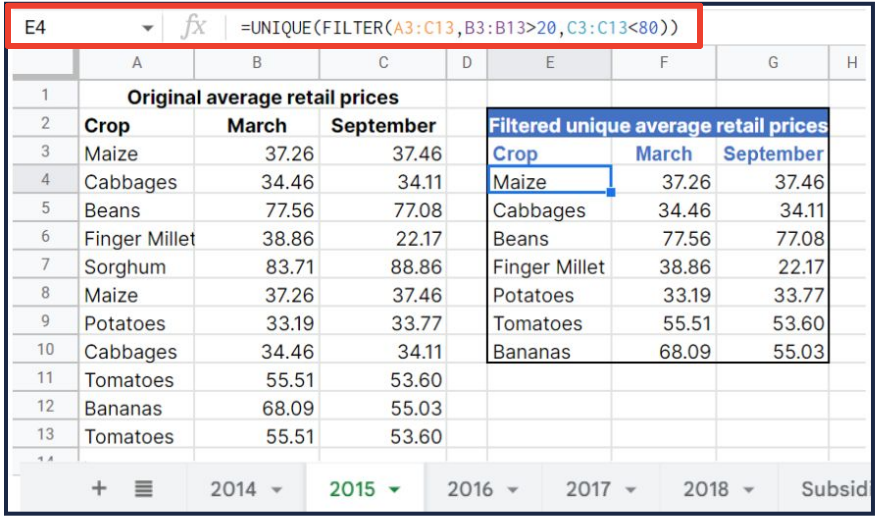
Let a *March price* be represented by **MP** and *September price* by **SP**:

```
If MP > 20 AND SP < 80 AND entry is unique
- Display entry
```



Spreadsheet functions

The FILTER and UNIQUE functions



E4 =UNIQUE(FILTER(A3:C13,B3:B13>20,C3:C13<80))

	A	B	C	D	E	F	G	H
1	**Original average retail prices**							
2	**Crop**	**March**	**September**		**Filtered unique average retail prices**			
3	Maize	37.26	37.46		**Crop**	**March**	**September**	
4	Cabbages	34.46	34.11		Maize	37.26	37.46	
5	Beans	77.56	77.08		Cabbages	34.46	34.11	
6	Finger Millet	38.86	22.17		Beans	77.56	77.08	
7	Sorghum	83.71	88.86		Finger Millet	38.86	22.17	
8	Maize	37.26	37.46		Potatoes	33.19	33.77	
9	Potatoes	33.19	33.77		Tomatoes	55.51	53.60	
10	Cabbages	34.46	34.11		Bananas	68.09	55.03	
11	Tomatoes	55.51	53.60					
12	Bananas	68.09	55.03					
13	Tomatoes	55.51	53.60					

Example use:

- We will use the **FILTER** function to list all food crop entries with prices that are **greater than** KSh 20 in March and **less than** KSh 80 in September.
- We will then wrap the **FILTER** function with a **UNIQUE** function to make sure that no duplicate entries are included in our list.

01. Enter the formula **`=UNIQUE(FILTER(A3:C13, B3:B13>20, C3:C13<80))`** in cell E4.

02. Press **Enter**.