Fundamentals of Programming with VBA

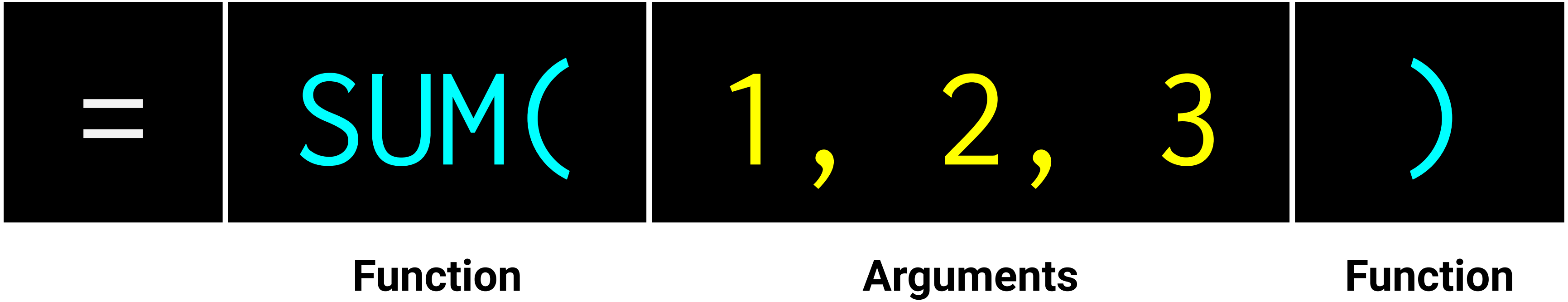
Data Boot Camp

Lesson 2.1

Intro to Programming Logic

Ooh, Coding! (Sort of…)

In a way, using Excel has introduced you to a sort of proto-programming. When writing scripts in VBA, you will rely on `functions` (methods) that do something to or with `arguments`.



=

SUM(

1, 2, 3

)

Function

Arguments

Function

Fundamental Tools of Programming

These structures are found in nearly all programming languages:

- Conditionals
- Iterations
- Functions
- Variables / Arrays

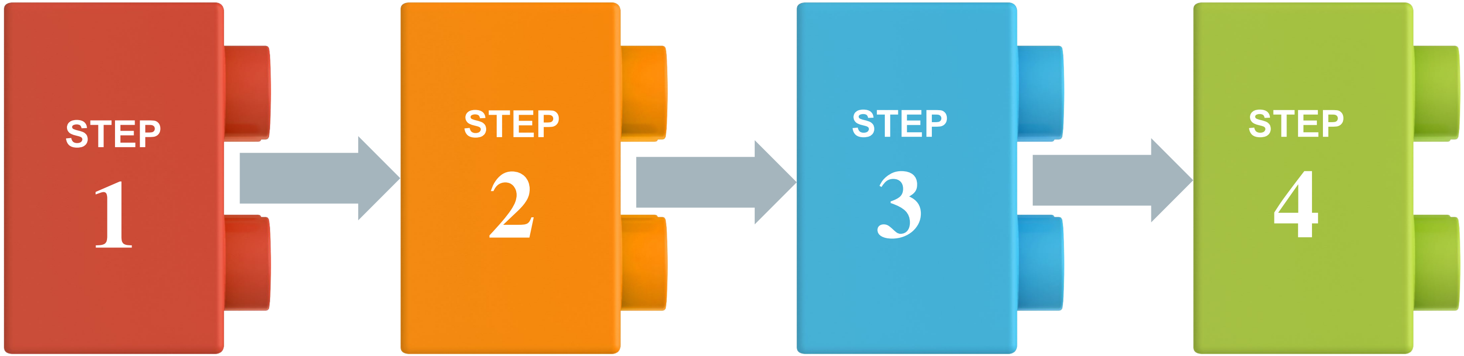
How a Computer Thinks (Procedurally)

Every problem in software development begins with a complex and abstract real-world need.

How a Computer Thinks (Procedurally)

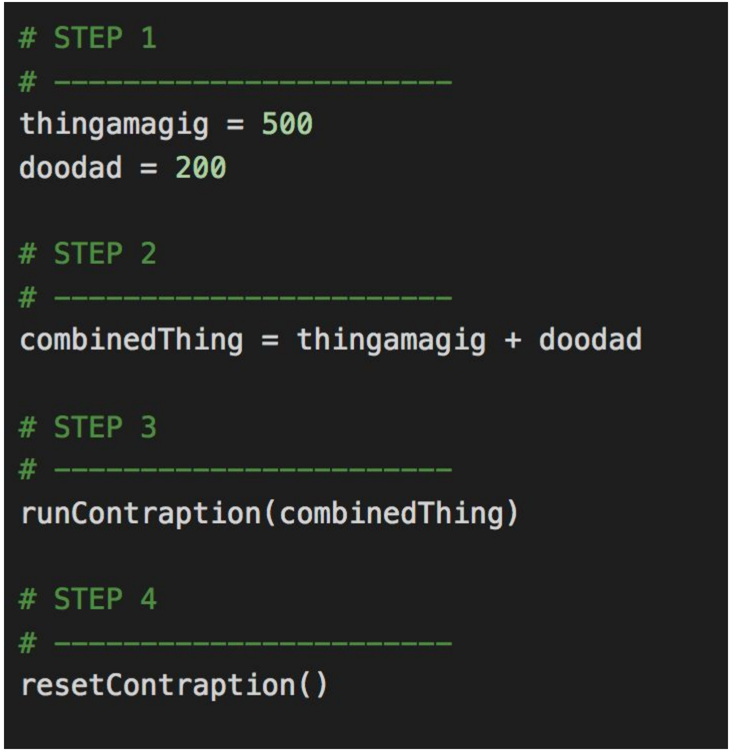
In order for a computer to interpret it, the real-world problem must be broken down into a set of procedural steps.

Complex Real-World Problem

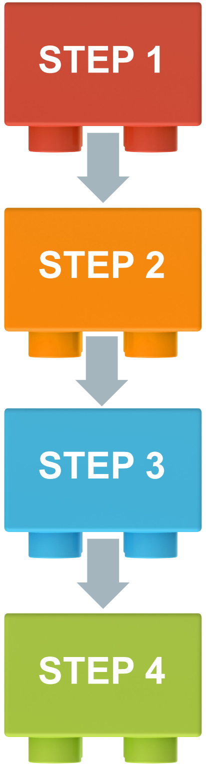


How Code Is Written (Procedurally)

Code (Python)

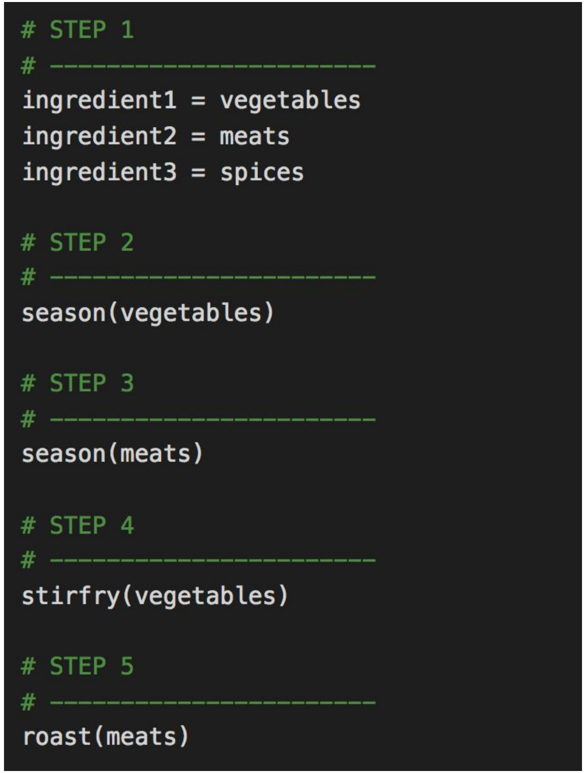


```python
# STEP 1
# -----------------------
thingamagig = 500
doodad = 200

# STEP 2
# -----------------------
combinedThing = thingamagig + doodad

# STEP 3
# -----------------------
runContraption(combinedThing)

# STEP 4
# -----------------------
resetContraption()
```

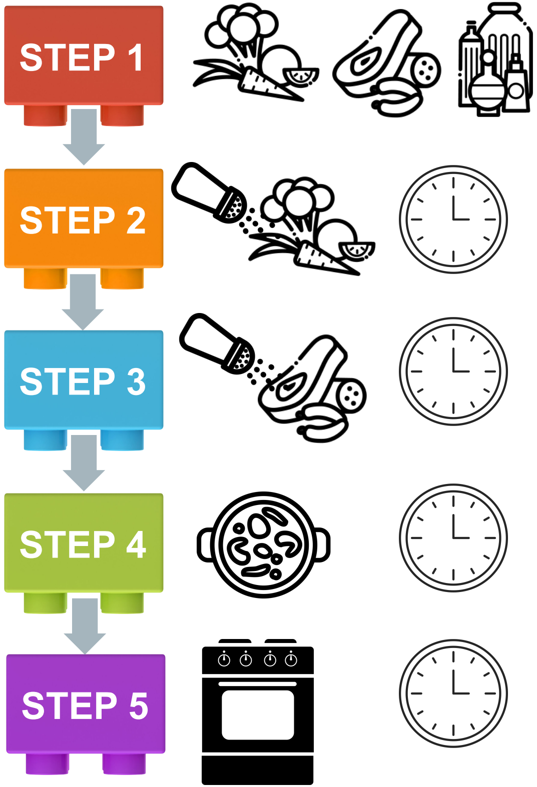


When Procedures Aren’t Enough… We Need More Tools!

Code (Python)



```python
# STEP 1
# ------------------------
ingredient1 = vegetables
ingredient2 = meats
ingredient3 = spices

# STEP 2
# ------------------------
season(vegetables)

# STEP 3
# ------------------------
season(meats)

# STEP 4
# ------------------------
stirfry(vegetables)

# STEP 5
# ------------------------
roast(meats)
```



To Make a Sandwich

To Make a Sandwich

Logical Procedure:

01 Get bread, peanut butter, and jelly from pantry.

02 Lay out bread on table.

03 Open jars of peanut butter and jelly.

04 Get spreading knife.

05 Use knife to spread peanut butter.

06 Use knife to spread jelly.

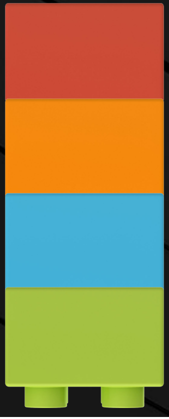
07 Combine bread to create sandwich.

Fundamental Tools Can Help Make the Sandwich

We use these tools as building blocks to make an ideal sandwich procedure:

Conditionals	If peanut butter is crunchy, use less.
Iterations	While there is more peanut butter, add more jelly.
Functions	Spread the condiment using a knife.
Variables / Arrays	The ingredients are bread, peanut butter and jelly.

VBA Building Blocks



Variables and Arrays

Variables: The Nouns of Code

Variables are effectively the items in a procedure.

They can be **physical things** (like an ingredient) or **abstractions** (like a counter).

In VBA, items can be **declared** as variables by using `dim` followed by the type. Then they can be **assigned** a value.

Variable Declaration

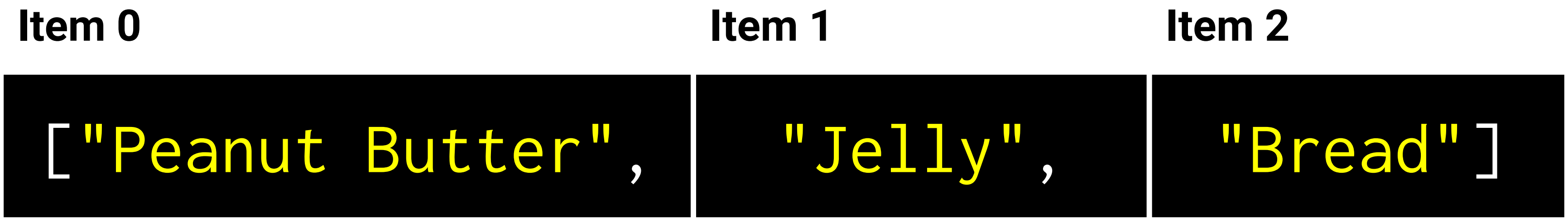
```
dim ing1 as String
dim ing2 as String
dim budget as Double
```

Variable Assignment

```
ing1 = "Peanut Butter"
ing2 = "Jelly"
budget = 5.00
```

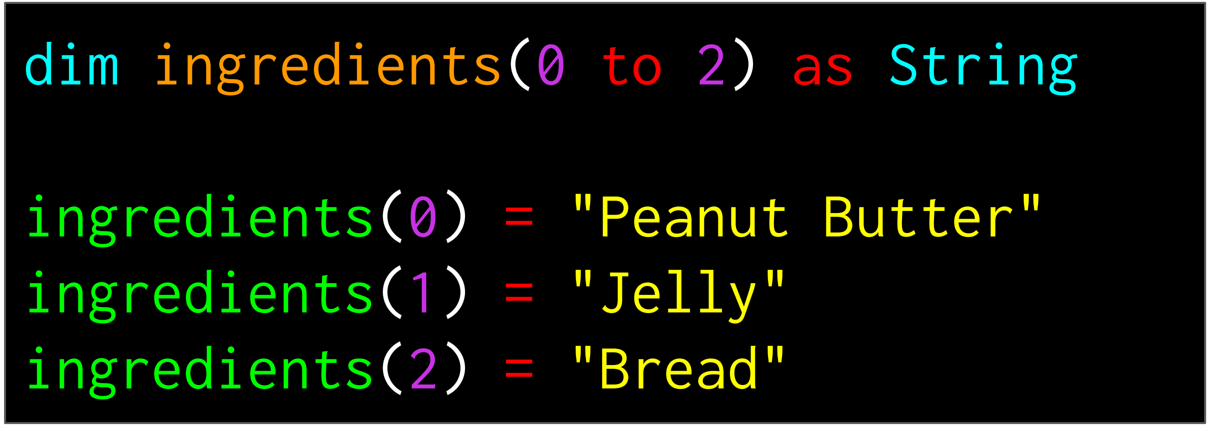
Array: A Collection of Items

Arrays are effectively **groups** of related items. They present another way to store and reference similar pieces of information.



Item 0 **Item 1** **Item 2**

```
["Peanut Butter", "Jelly", "Bread"]
```



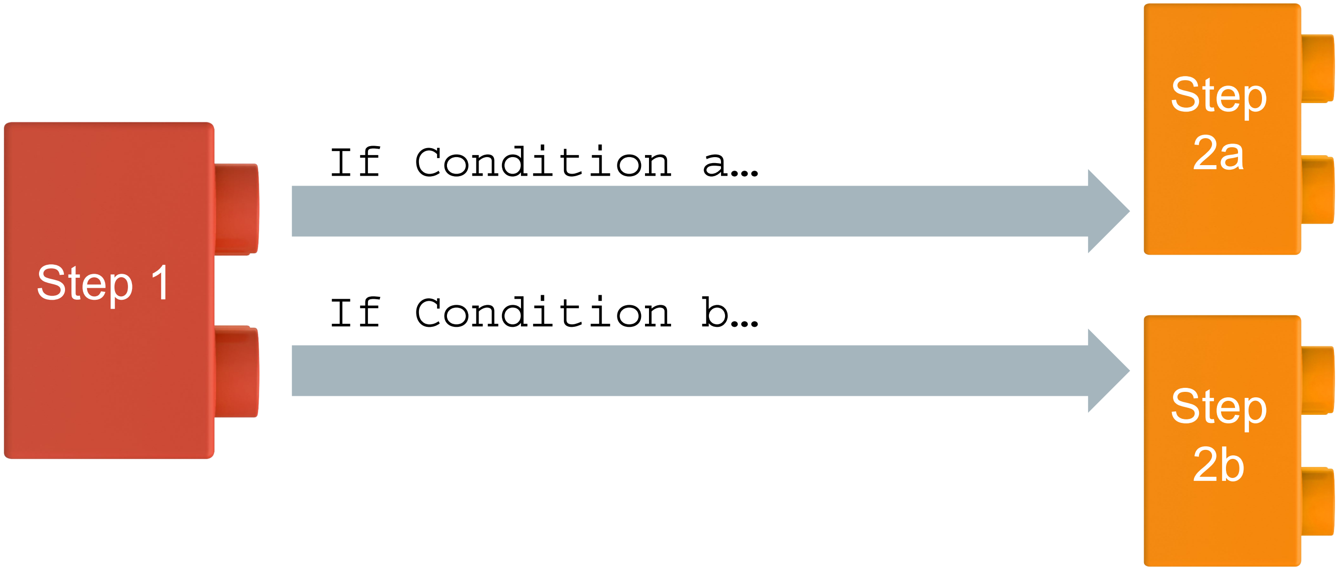
```
dim ingredients(0 to 2) as String

ingredients(0) = "Peanut Butter"
ingredients(1) = "Jelly"
ingredients(2) = "Bread"
```

Conditionals

Conditionals: If This, Then That

Conditionals can control the flow of logic based on certain conditions being met.

In most languages, you use **if/else** code for this purpose.



Step 1

If Condition a…

If Condition b…

Step 2a

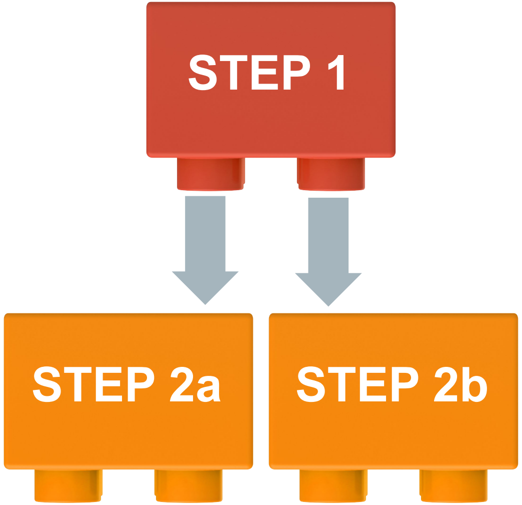
Step 2b

Conditionals: If This, Then That

In VBA, conditionals are declared using the keywords **If**, **Then**, **Elseif**, **Else**, and **End if**.

VBA lets us create far more sophisticated conditional logic than with Excel formulas alone.

```
If (pbThickness > 1.0) Then
   stopSpreading()

Else
   spreadMore()

End if
```

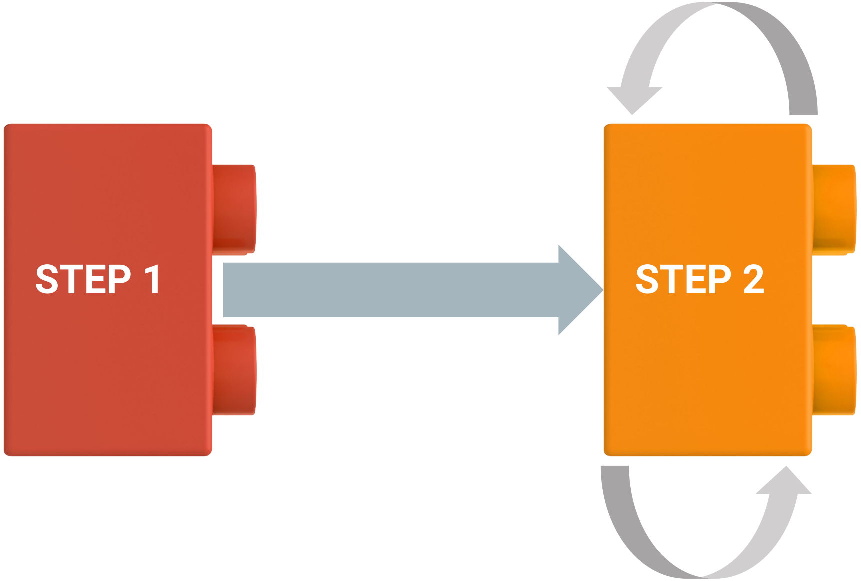


Iteration (Looping)

Iteration: Round and Round We Go!

Iteration is the concept of using loops to perform a group of tasks repeatedly a number of times.

Almost all programming languages use **for loops** and **while loops** for iteration.



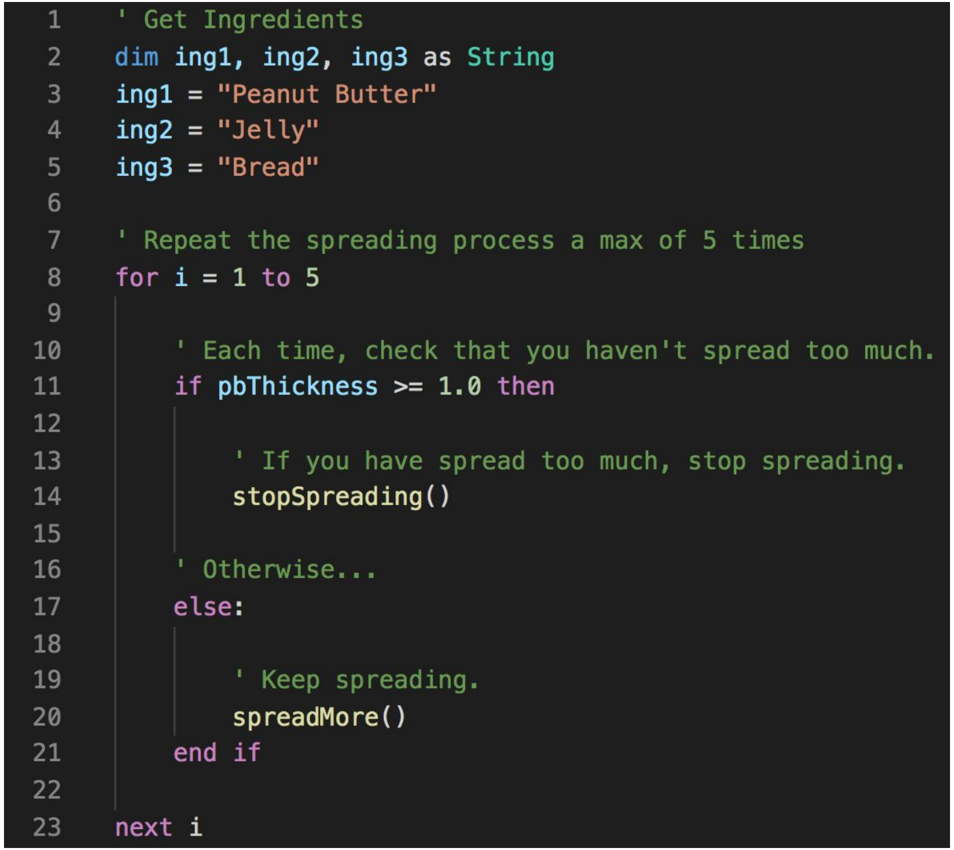
STEP (repeat X times)

Iteration: Round and Round We Go!

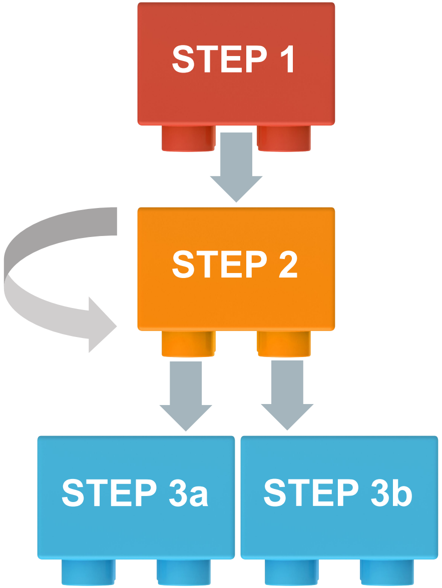
This code will make more sense later. Basically, it’s the VBA way of repeating the same block multiple times.

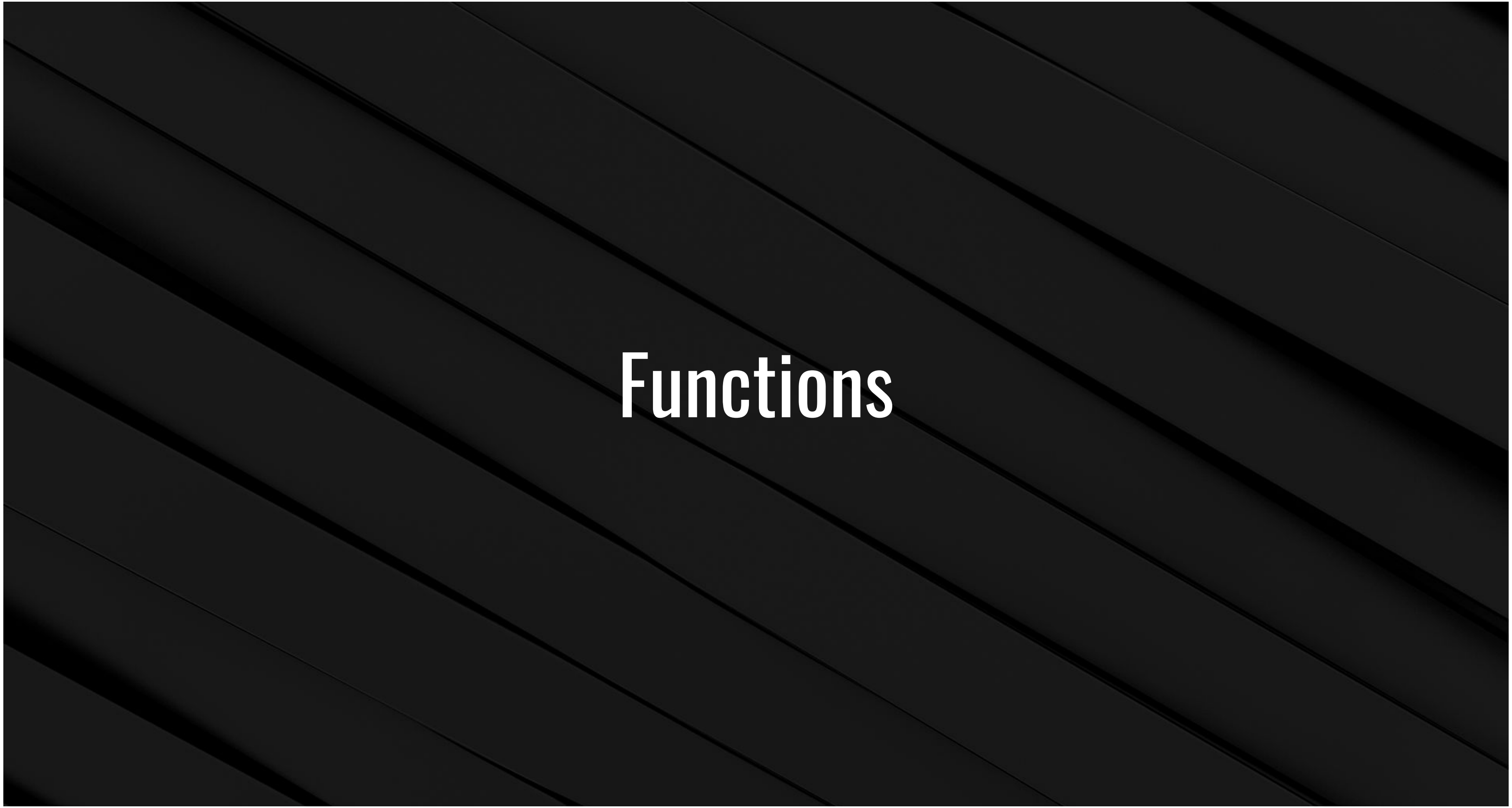
```
' Repeat the same step until i becomes 20
For i = 0 to 20

   ' Each time spread more
   spreadMore()

' Add one to the value of i each time
Next i
```

Build the Program!



```
' Get Ingredients
dim ing1, ing2, ing3 as String
ing1 = "Peanut Butter"
ing2 = "Jelly"
ing3 = "Bread"

' Repeat the spreading process a max of 5 times
for i = 1 to 5

    ' Each time, check that you haven't spread too much.
    if pbThickness >= 1.0 then

        ' If you have spread too much, stop spreading.
        stopSpreading()

    ' Otherwise...
    else:

        ' Keep spreading.
        spreadMore()
    end if

next i
```

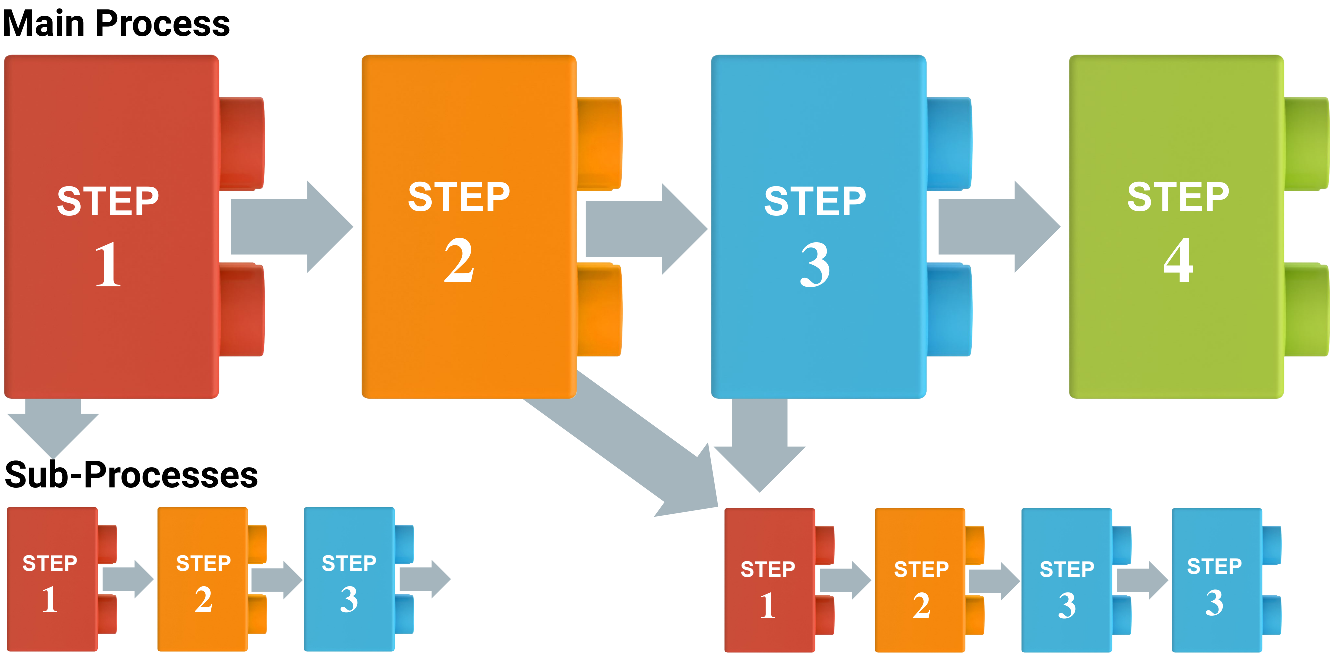




Functions

Functions: When One Block Can't Do It All!

In essence, **functions** are a sort of sub-process. They let you create premade, reusable blocks of code that can be called on demand.



Putting It All Together

To Make a Sandwich

Logical Procedure:

01 Get bread, peanut butter, and jelly from pantry.

02 Lay out bread on table.

03 Open jars of peanut butter and jelly.

04 Get spreading knife.

05 Use knife to spread peanut butter.

06 Use knife to spread jelly.

07 Combine bread to create sandwich.

To Make a Sandwich (Full Logic)

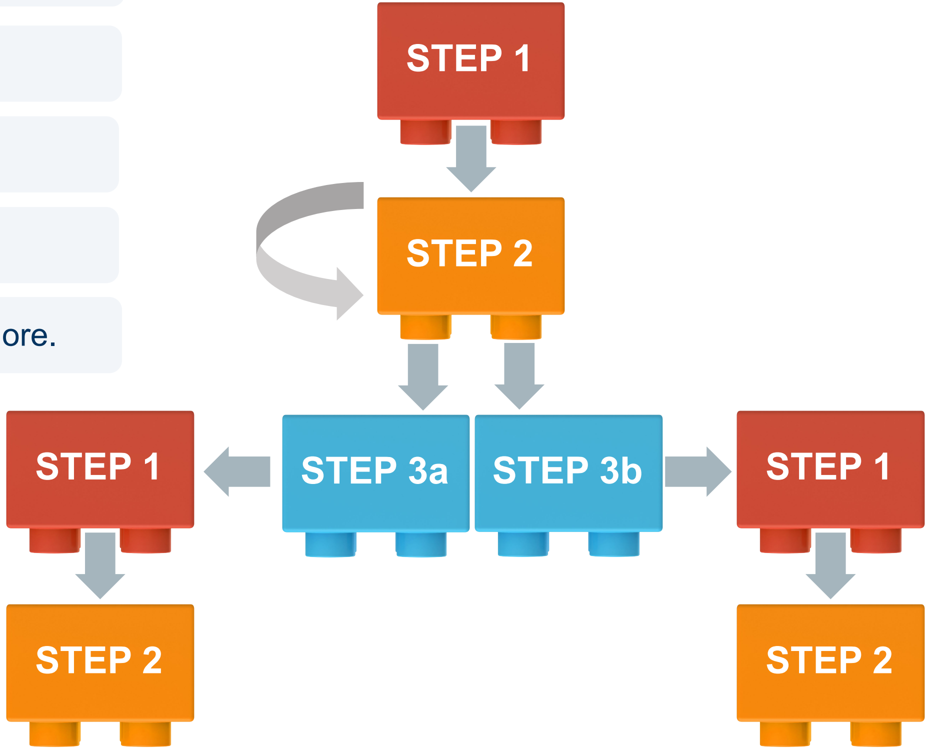
01 Get items.

02 **Repeatedly** “spread the peanut butter.”

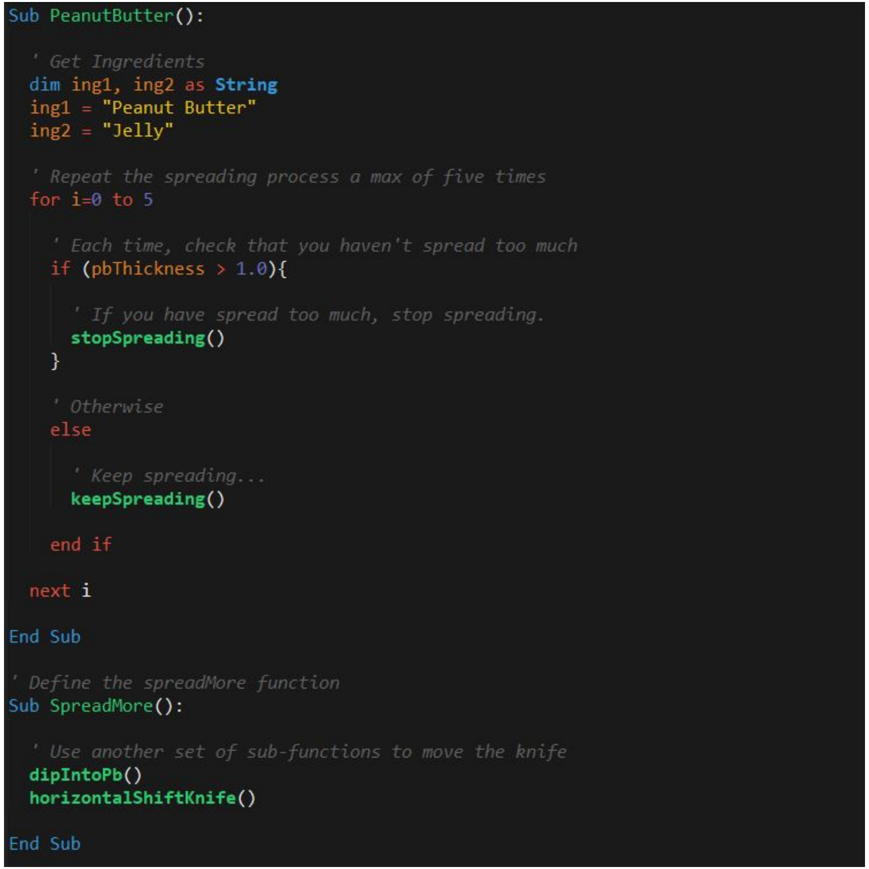
03 Check if thickness **condition** is met.

3a If thickness condition is met, run stop **function**.

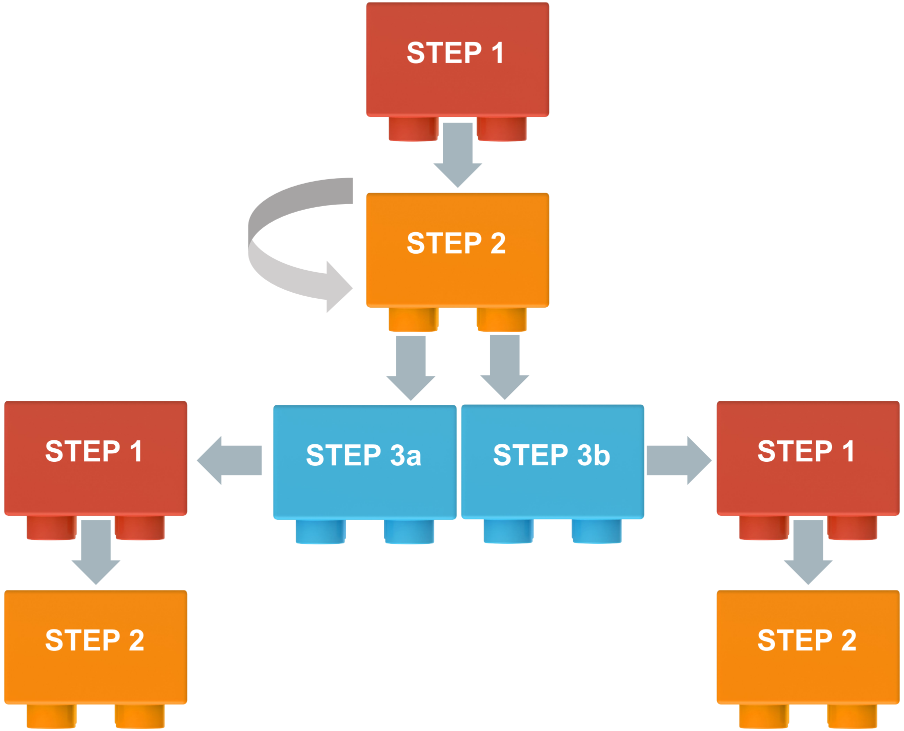
3b If thickness condition is **not** met, then spread more.



To Make a Sandwich (in Code)



```
Sub PeanutButter():

  ' Get Ingredients
  dim ing1, ing2 as String
  ing1 = "Peanut Butter"
  ing2 = "Jelly"

  ' Repeat the spreading process a max of five times
  for i=0 to 5

    ' Each time, check that you haven't spread too much
    if (pbThickness > 1.0){

      ' If you have spread too much, stop spreading.
      stopSpreading()
    }

    ' Otherwise
    else

      ' Keep spreading...
      keepSpreading()

    end if

  next i

End Sub

' Define the spreadMore function
Sub SpreadMore():

  ' Use another set of sub-functions to move the knife
  dipIntoPb()
  horizontalShiftKnife()

End Sub
```



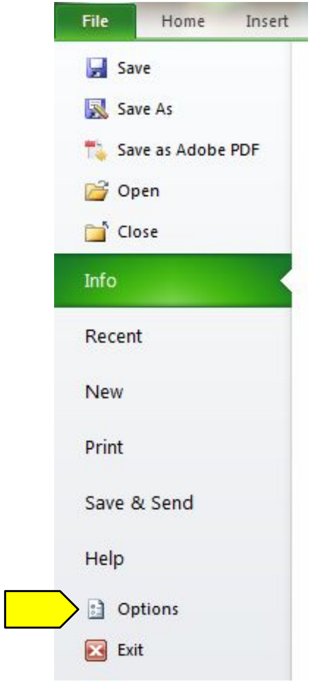
Big Picture!

Coding = creating building blocks and putting them together

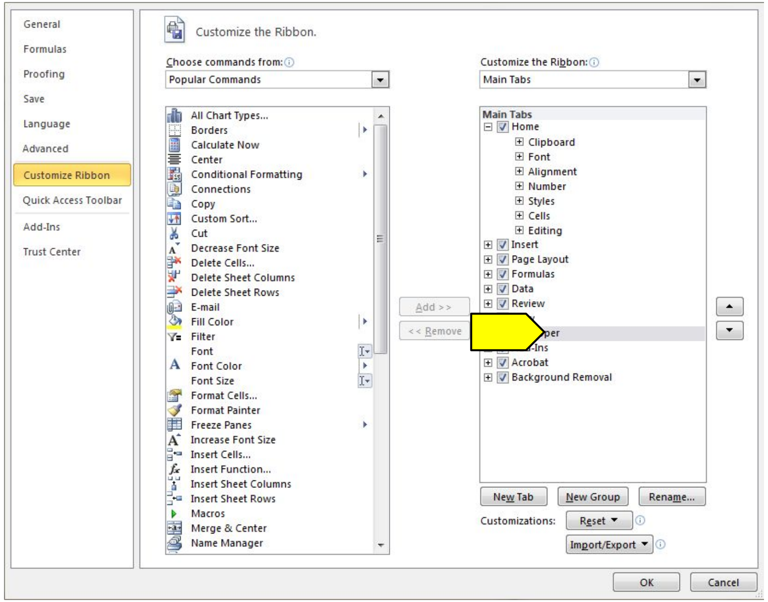
Let’s Get Coding!

Add Developer Tools: Windows

01 Go to **File > Excel Options**.



02 Then go to **Customize Ribbon**, choose **Main Tabs** in the right pane, and make sure **Developer** is checked.

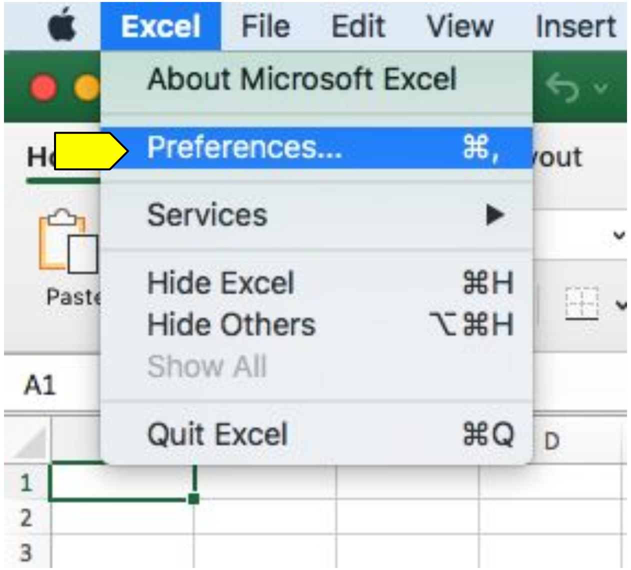

Customize the Ribbon.

Choose commands from: Popular Commands

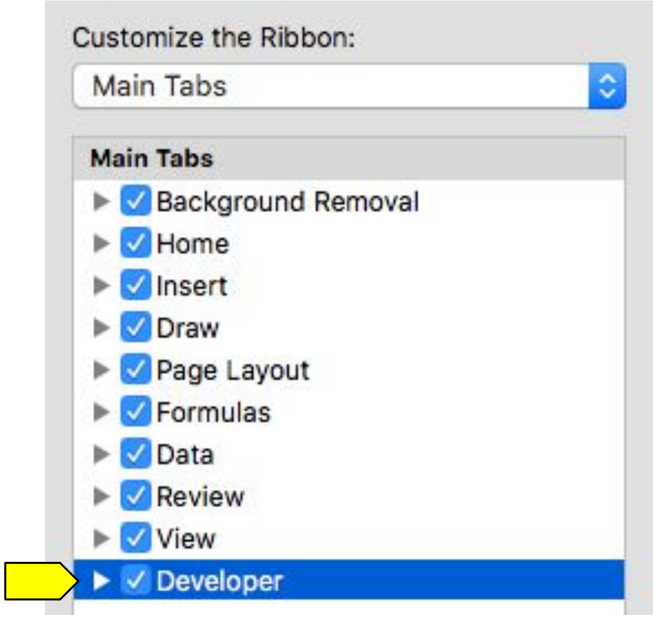
Customize the Ribbon: Main Tabs

Add Developer Tools: Mac

01 Go to **Excel > Preferences**.



02 Then go to **Ribbon & Toolbar**, select **Main Tabs** in the right pane, and make sure **Developer** is checked.


Customize the Ribbon: Main Tabs

Main Tabs

- ▶ ☑ Background Removal
- ▶ ☑ Home
- ▶ ☑ Insert
- ▶ ☑ Draw
- ▶ ☑ Page Layout
- ▶ ☑ Formulas
- ▶ ☑ Data
- ▶ ☑ Review
- ▶ ☑ View
- ▶ ☑ Developer

Questions?

Questions?