Repetition Structure Techniques and Common Issues

953103 Programming Logical Thinking

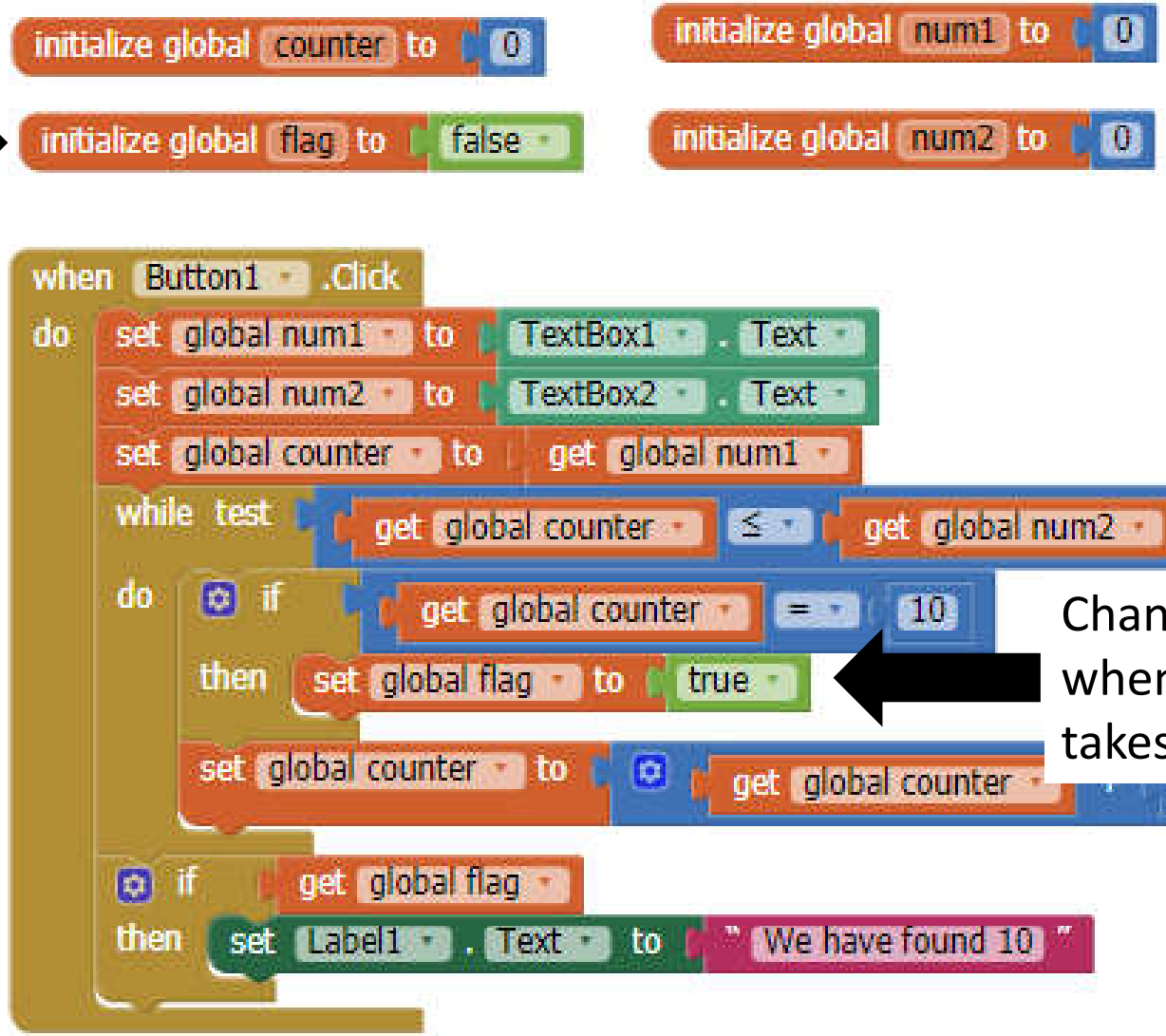
Flag Variable

Flag variable

- A special variable use to indicate a status in the source code.
- The value remain the same until the status changes.
- Generally, the flag variable is a Boolean.
  - True for one status
  - False for one status

Example

Set the initial state



Change the state when an event takes places

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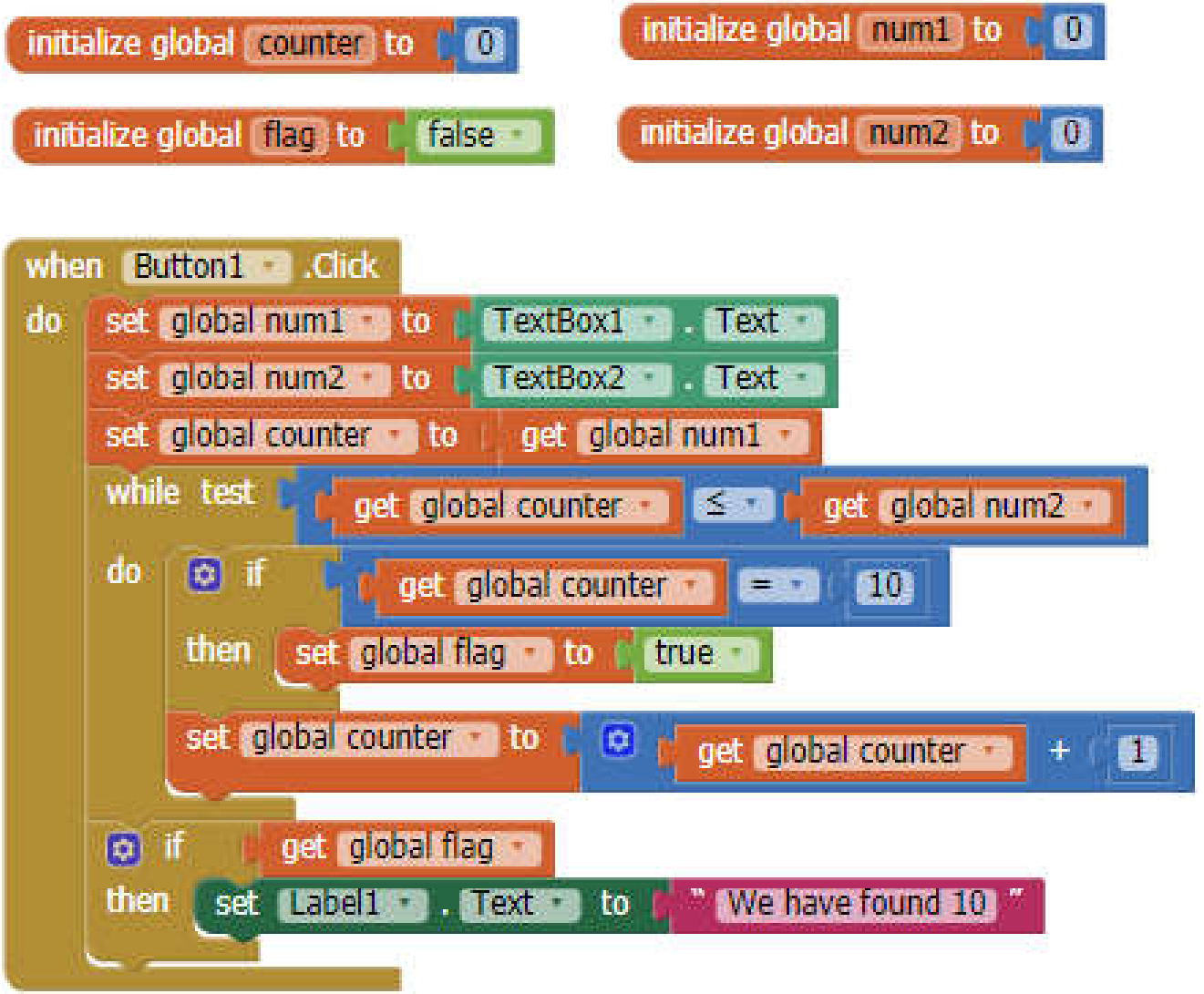
Example

num1 = 11,
num2 = 22

What is the Text of Label1?



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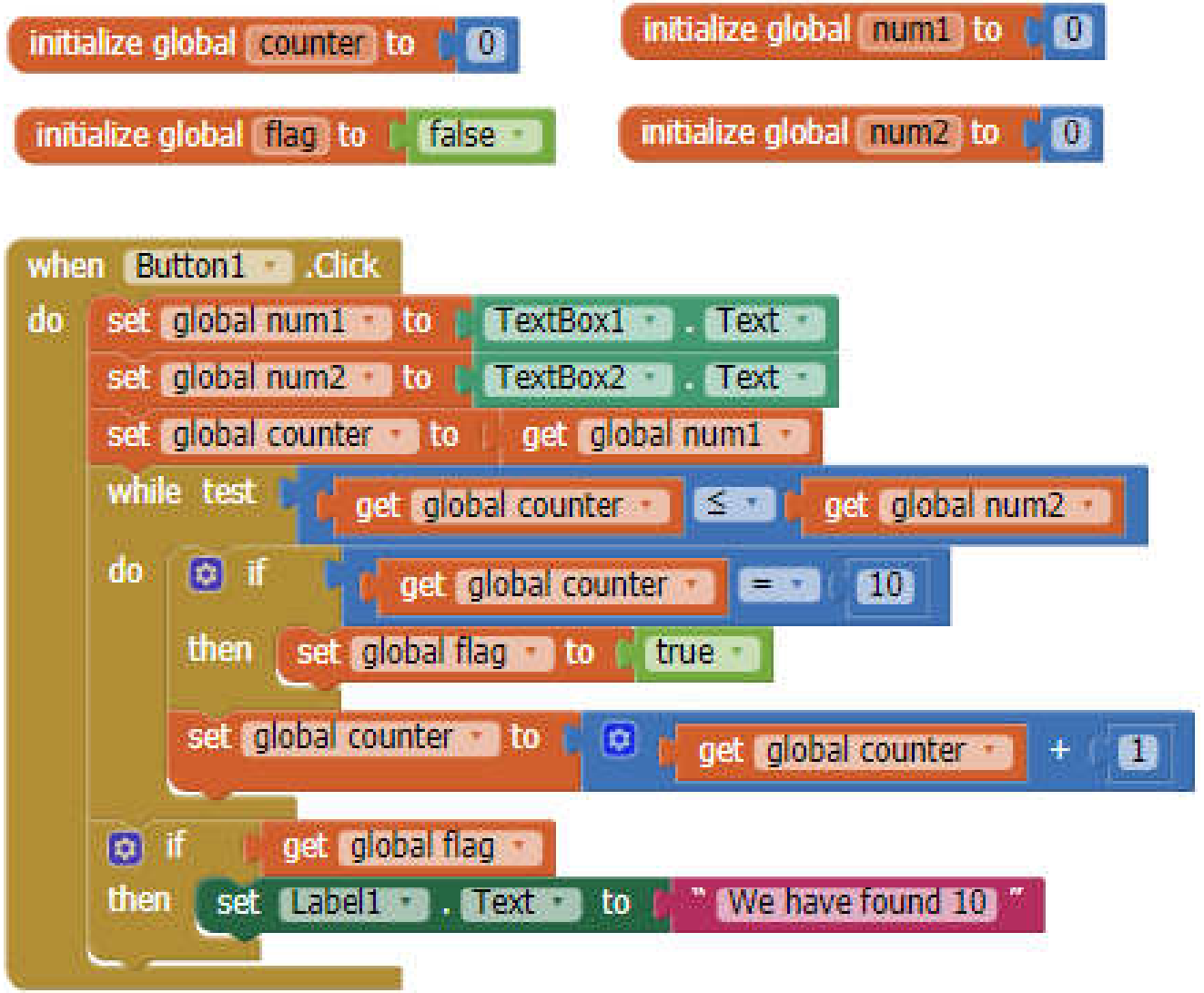
Example

num1 = 1,
num2 =15

What is the Text of Label1?



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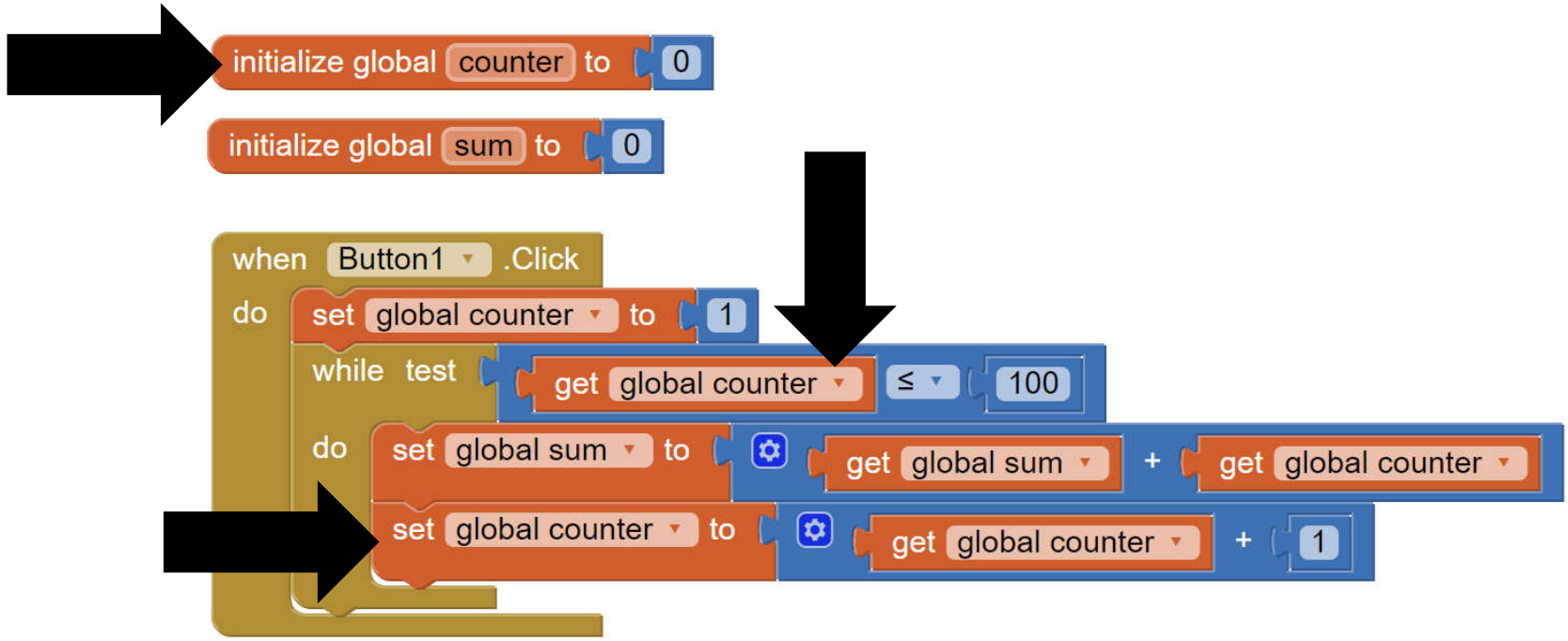
Case study

You have to read 2 non-negative integers. The program shall display 'Wow, I have found it' when there exists an number that is divisible by 3 and 17. Otherwise, the program shall display 'So, Sad…'

Sentinel-Controlled Loop

Sentinel-Controlled Loop

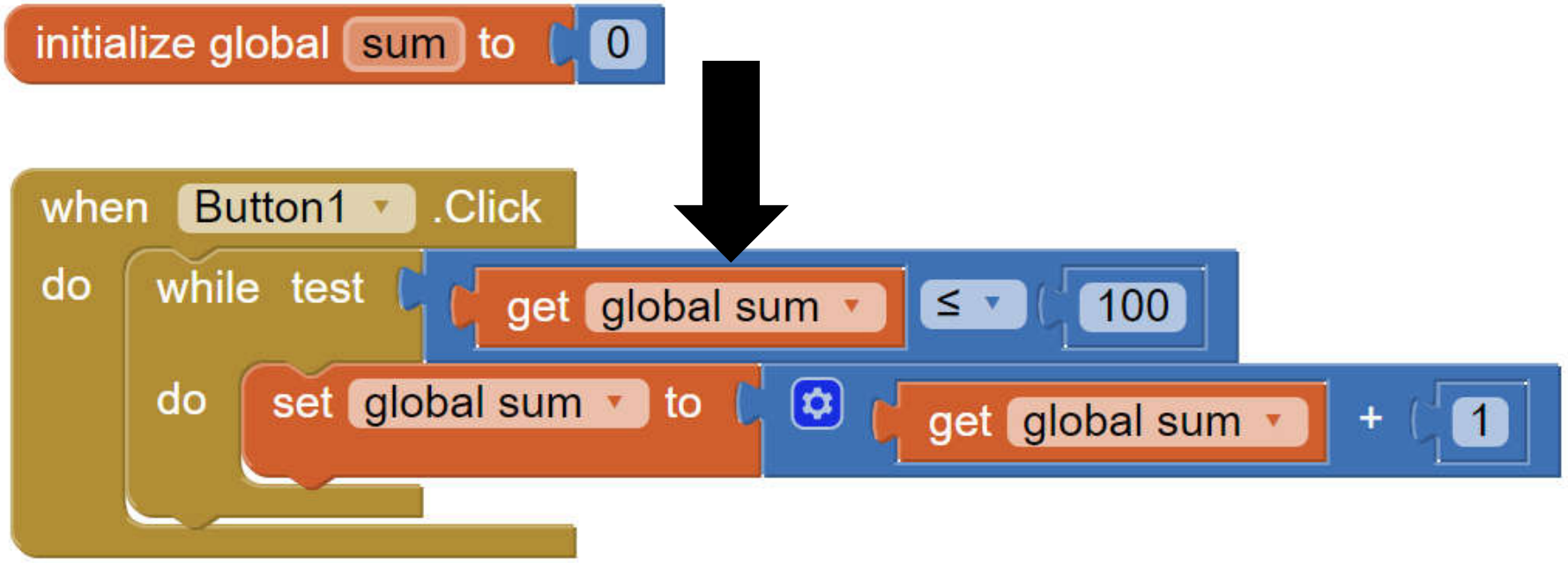
- Generally, the loop is controlled by the iteration.
  - AKA counter-controlled loop



Sentinel-Controlled Loop

- Sentinel-controlled loop
  - AKA Event-controlled loop
  - A type of loop that control by condition
  - The number of iteration is not known until the execution.
  - The iteration is controlled by sentinel.
    - Signal value, flag value

Example


initialize global sum to 0
when Button1 .Click
do
while test
get global sum
≤
100
do
set global sum to
get global sum
+
1

Case study

- Write a flowchart to read the non-negative value from user. The program will terminate when the input is negative.

- Write a pseudocode to read the value from user and add the number to a variable. The program will terminate when summation of all input is equal to 100.

Off-by-one error

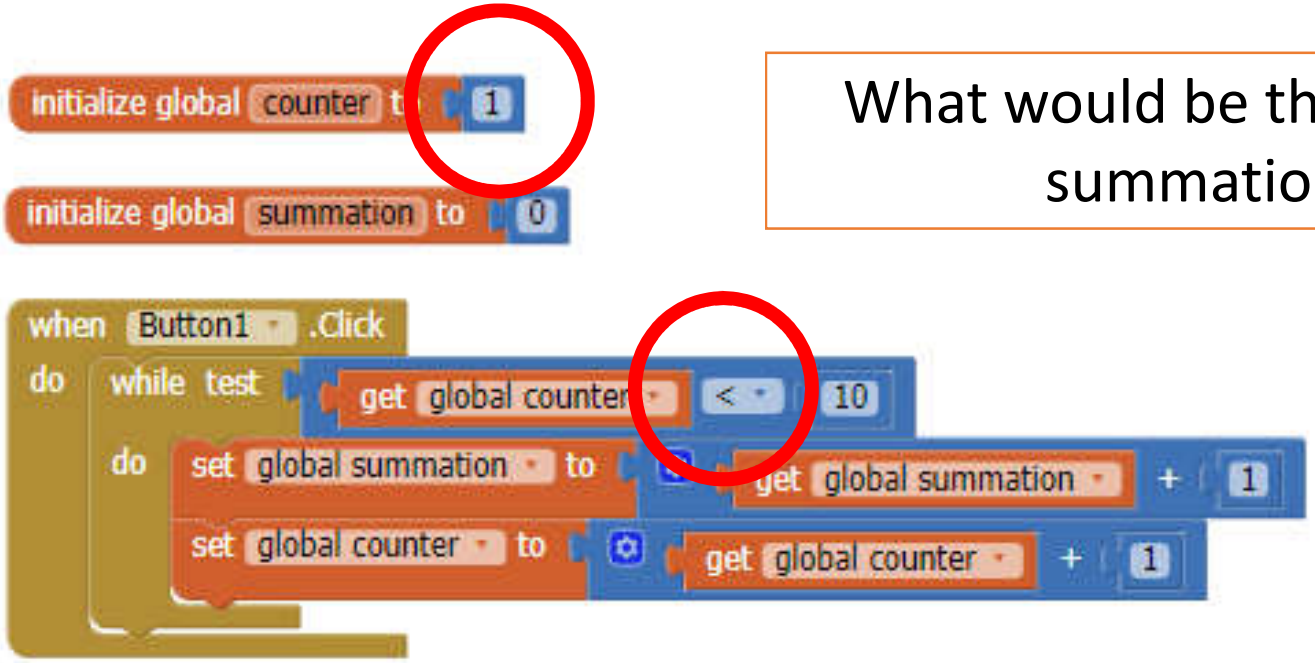
Off-by-one Error

- AKA OBOE, OBOB, OB1
- It is a problem with the boundary of the loop when the loop iterates 1 round too many or too few.
- 2 Main causes
  - Not pay attention to the initial state of the loop
  - Use wrong symbol in the stop condition

Example

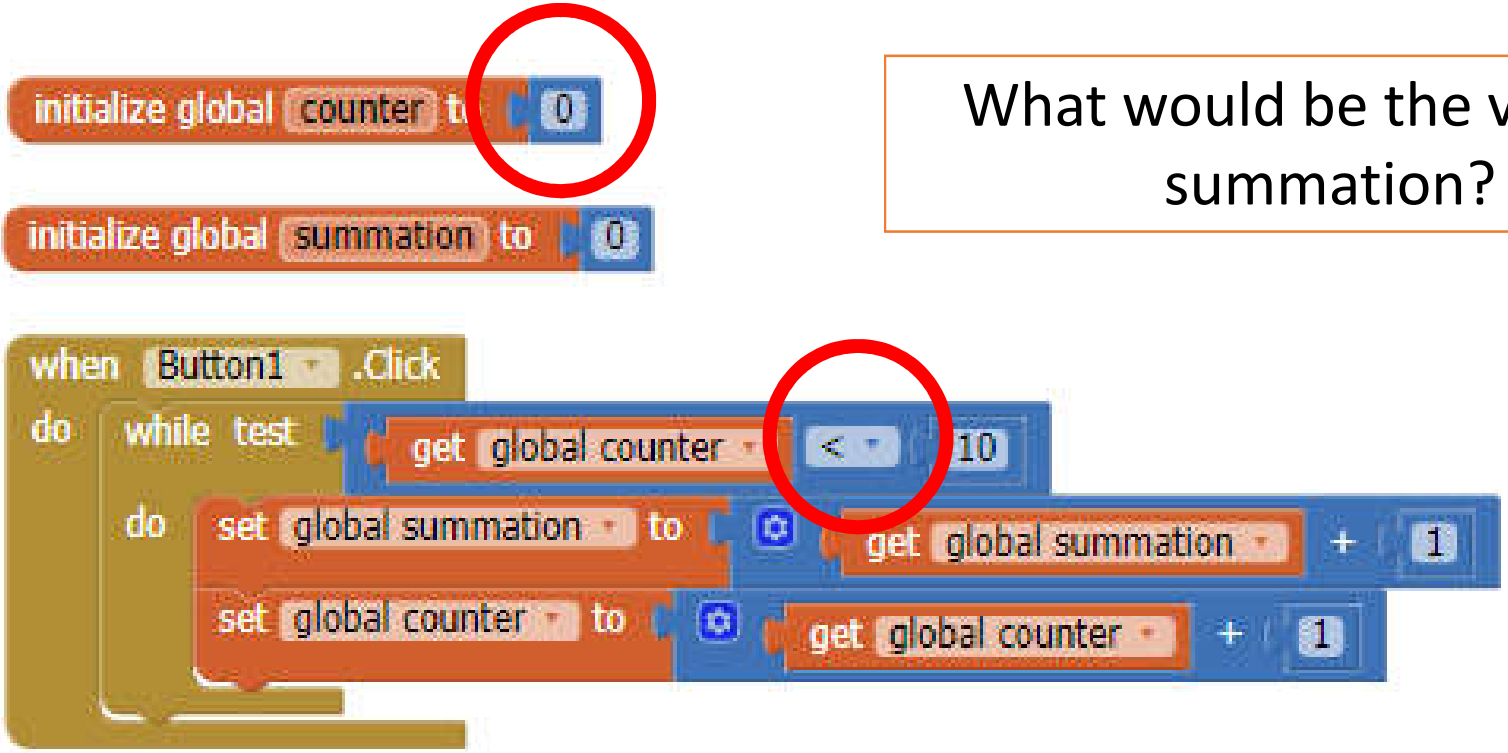
Write a program to add 1 to a variable for 10 times.

Example



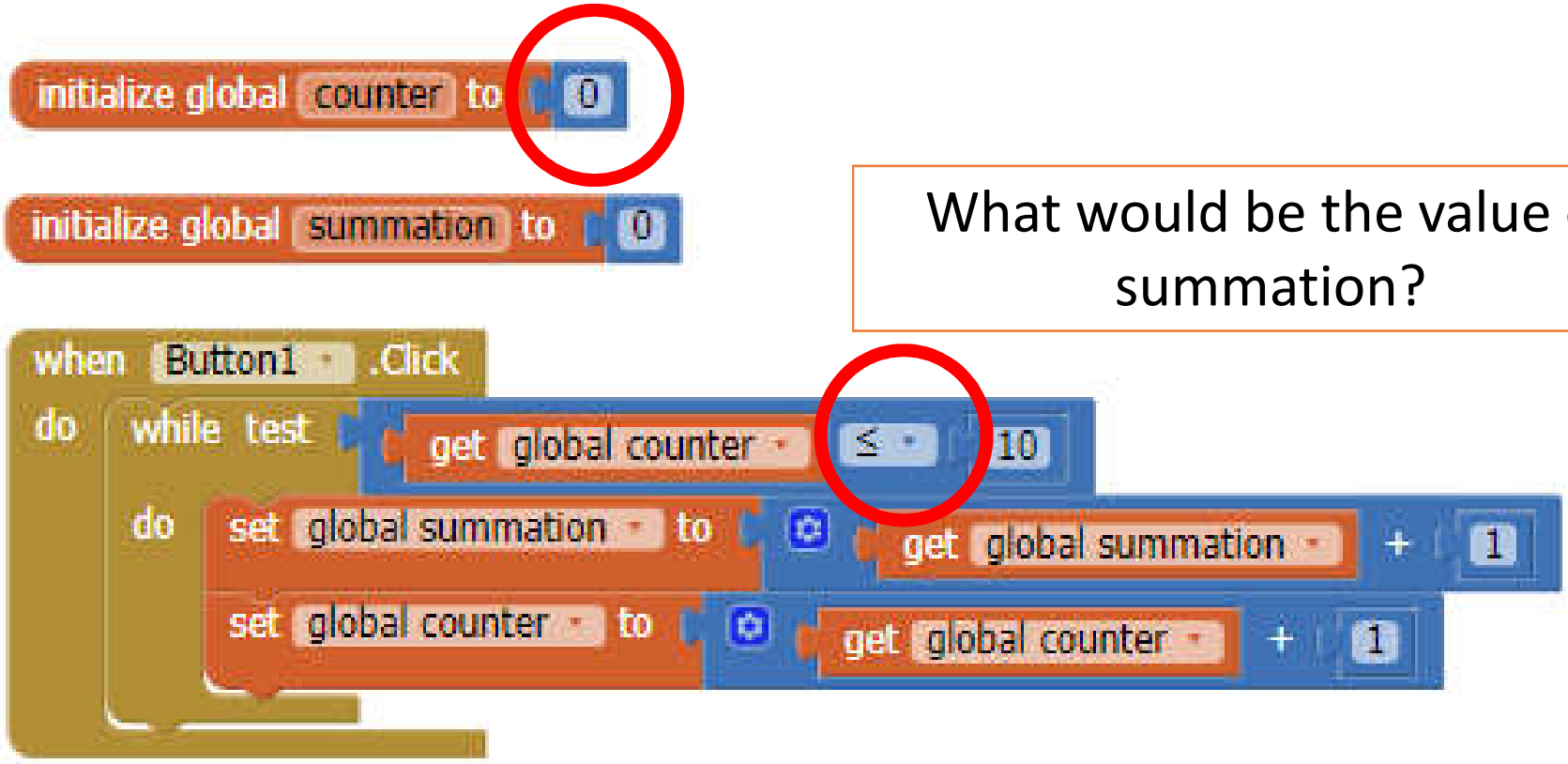
What would be the value of summation?

Example



What would be the value of summation?

Example



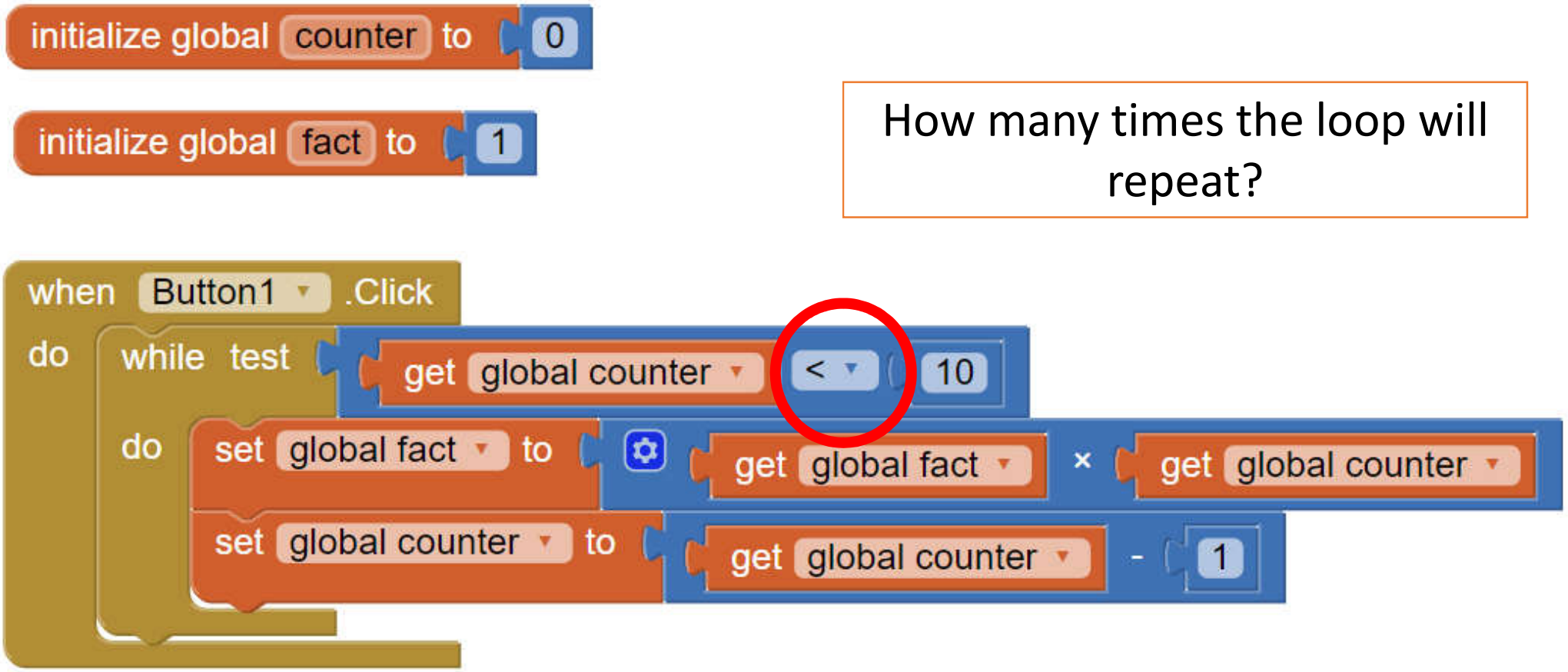
What would be the value of summation?

Infinite Loop

Infinite loop error

- Classic problem when working with loop
- It is a problem when the loop does not terminate.
- 2 Main causes
  - Stop condition is poorly designed.

Example



How many times the loop will repeat?

Is it hard to follow the loop?

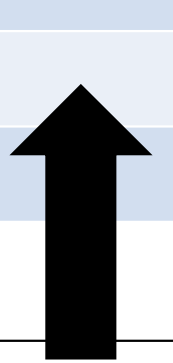
Program Tracing

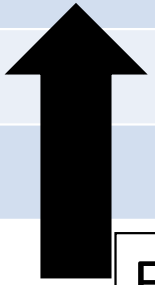
Program tracing

- It is a technique to test the algorithm or program for logical errors.
- Simulates the flow of the execution.
  - Step by step
  - Keep track of the value changes.
- Focus only the value of each variable.

Example: Trace table

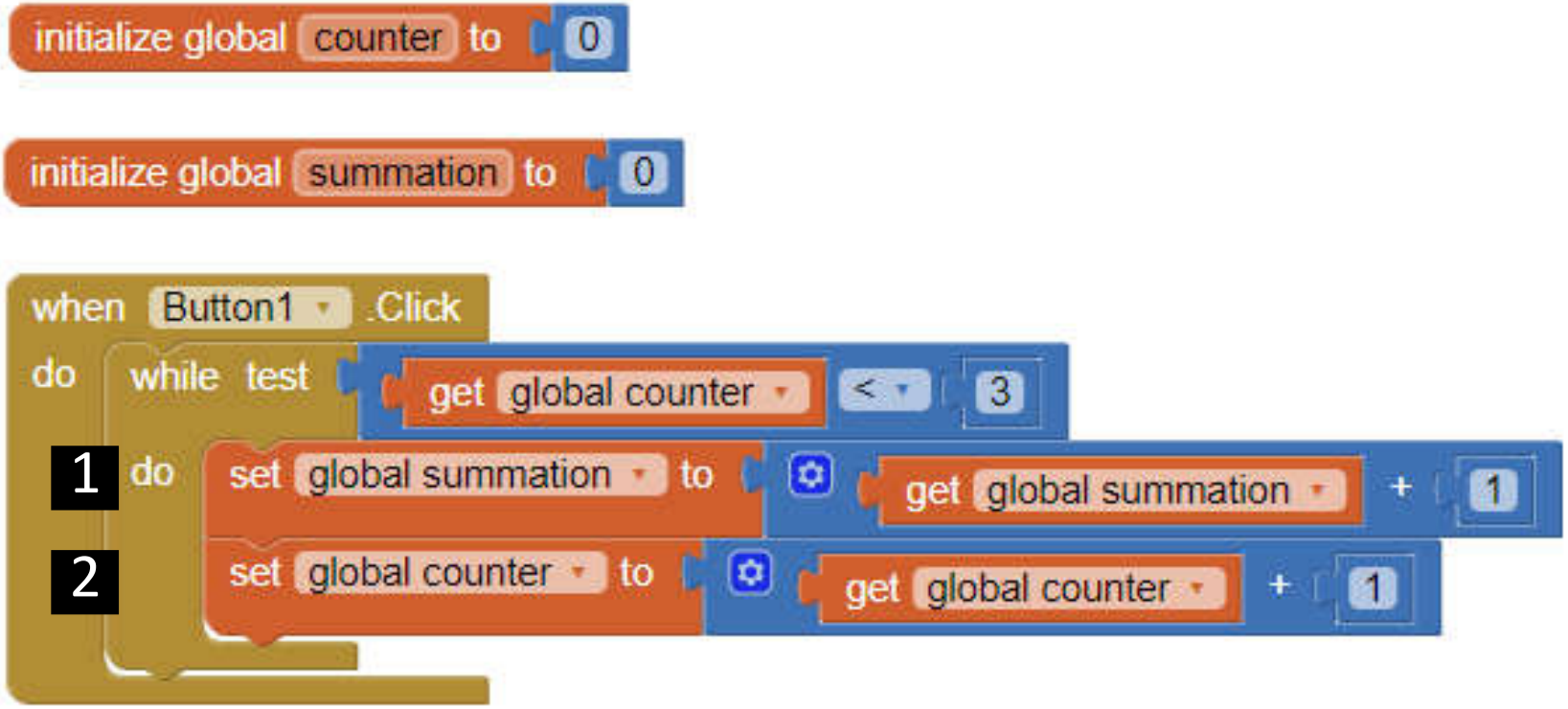
Step	Variable 1	Variable 2	…	Variable n

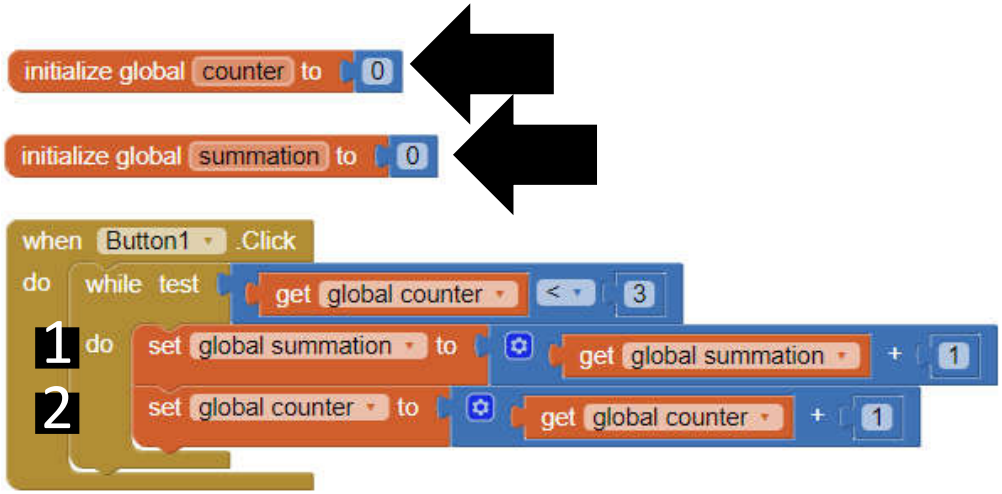




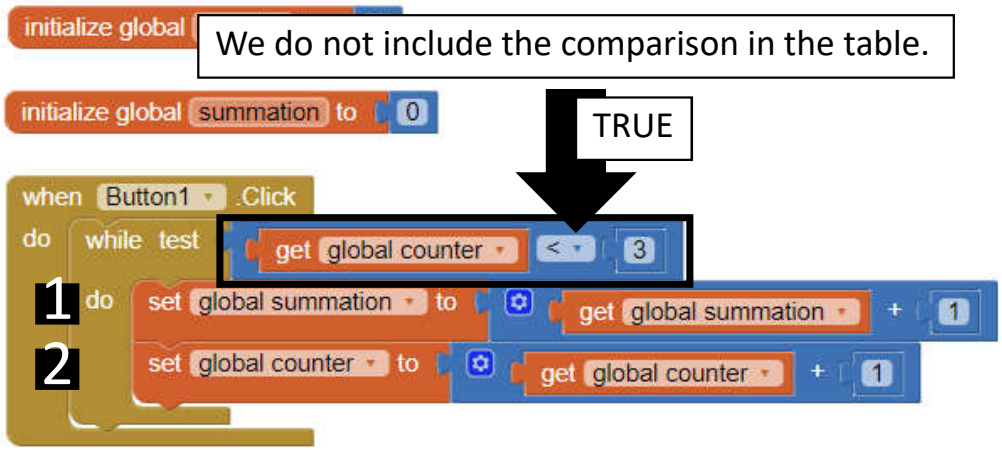
Fill the value of the corresponding variable

Associate with the algorithm or program

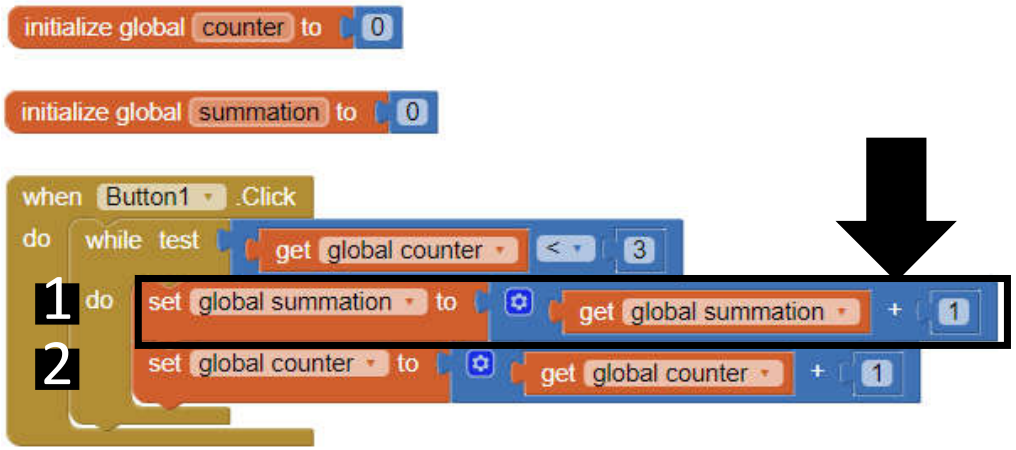

initialize global counter to 0
initialize global summation to 0
when Button1 .Click
do while test get global counter < 3
1 do set global summation to get global summation + 1
2 set global counter to get global counter + 1



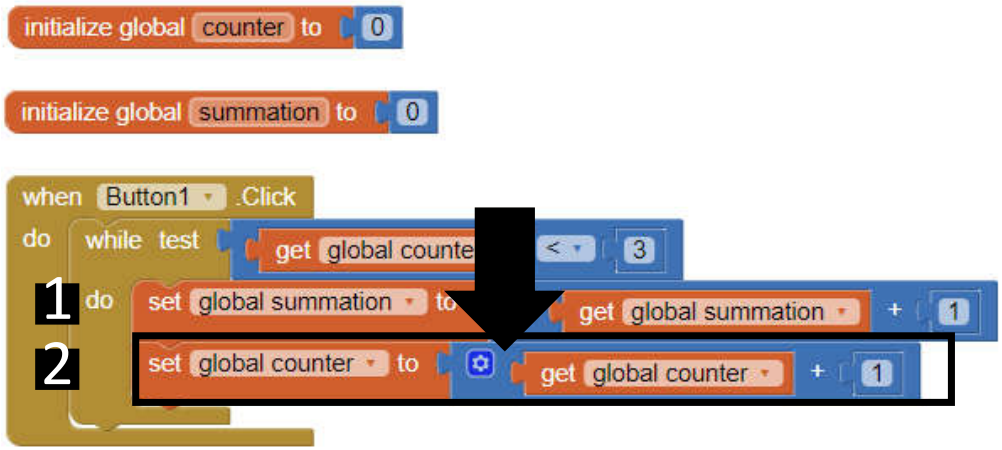
Step	Counter	Summation
initialization	0	0



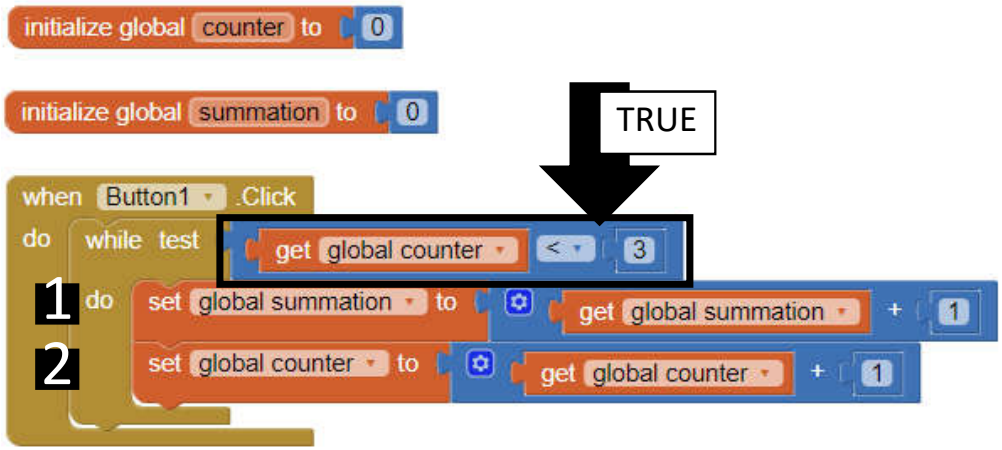
Step	Counter	Summation
initialization	0	0



Step	Counter	Summation
initialization	0	0
1	0	1



Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1



Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1

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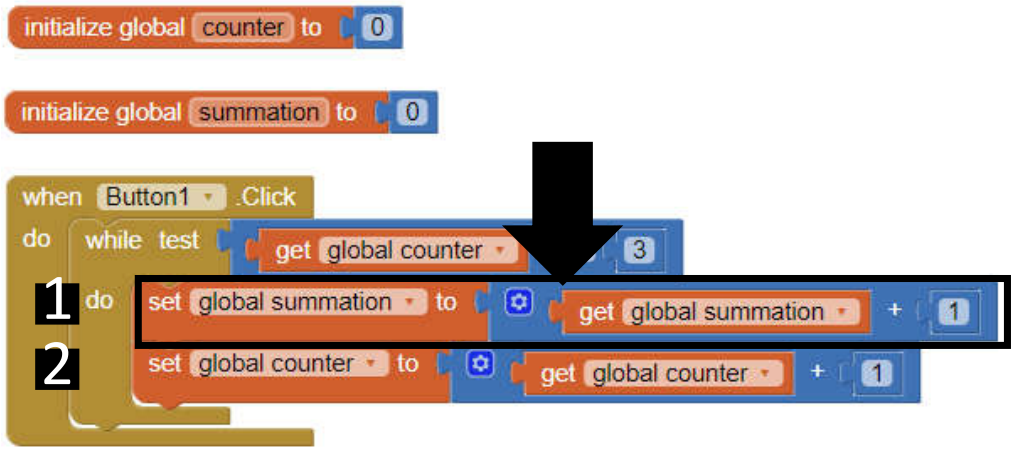

Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1
1	1	2

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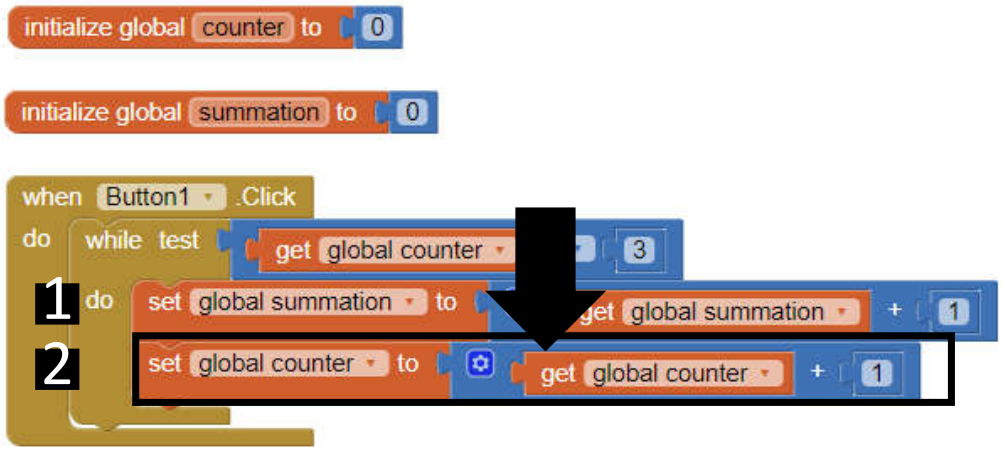
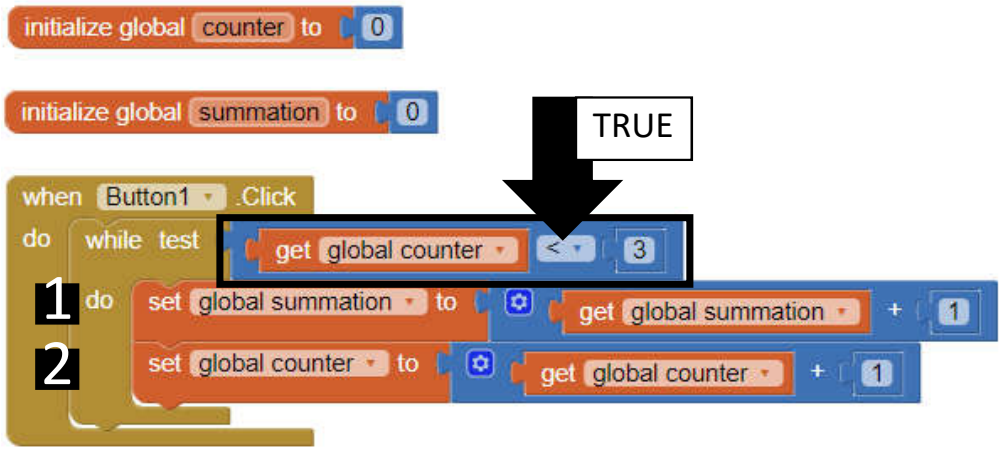
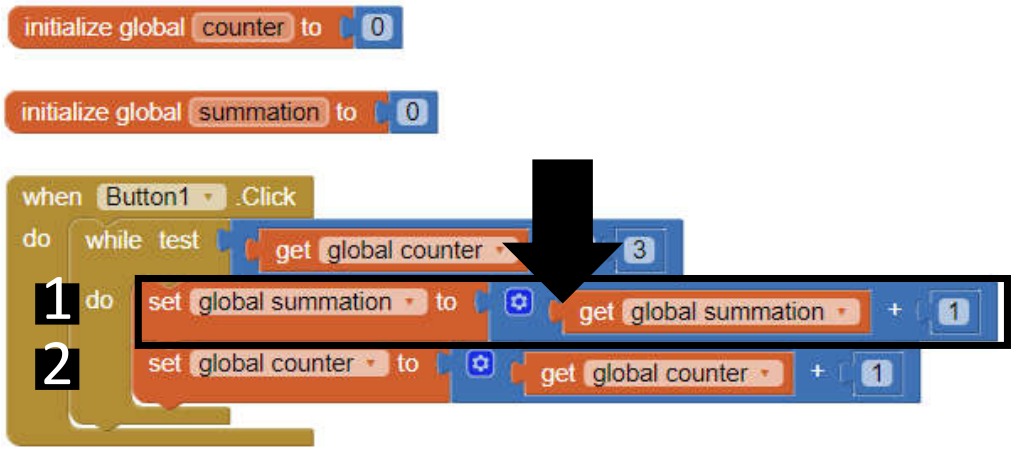


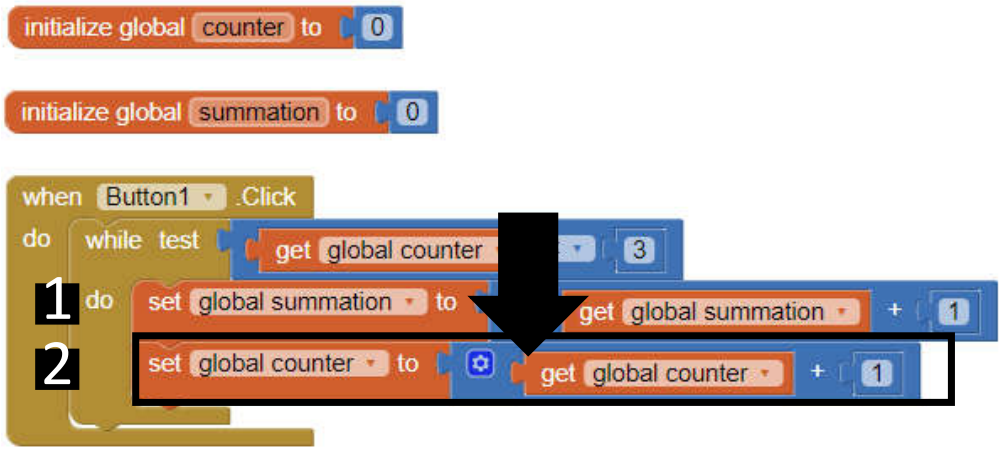
Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1
1	1	2
2	2	2



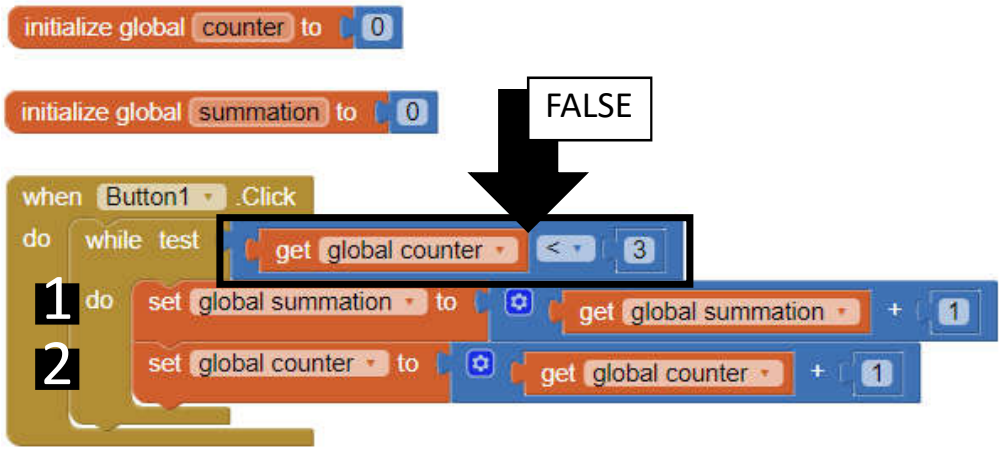
Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1
1	1	2
2	2	2



Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1
1	1	2
2	2	2
1	2	3



Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1
1	1	2
2	2	2
1	2	3
2	3	3



Step	Counter	Summation
initialization	0	0
1	0	1
2	1	1
1	1	2
2	2	2
1	2	3
2	3	3

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Try this !!!

- Group of 2 students
- On a piece of paper.
- Create and complete the trace table.