

Getting Started with Java Using Alice

Use the IF and WHILE Control Structures

Objectives

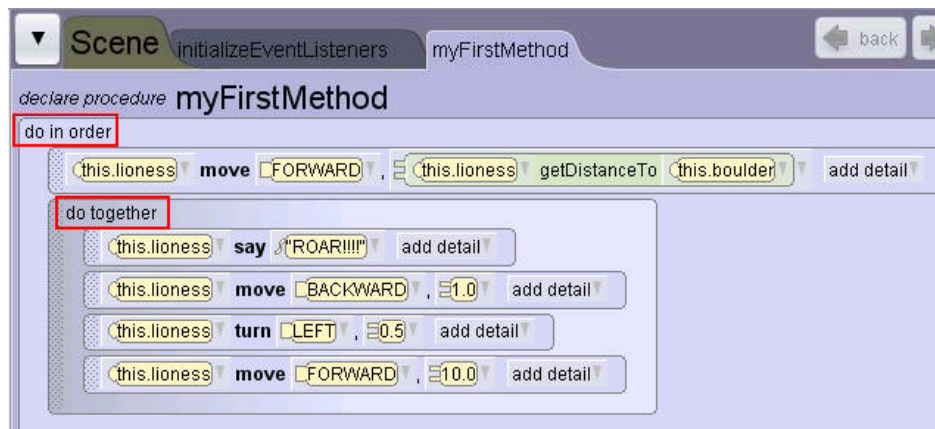
This lesson covers the following objectives:

- Use the IF control structure to effect execution of instructions
- Use the WHILE control structure to create a conditional loop for repetitive behavior

Control Structures

Control structures are pre-defined statements that determine the order in which programming instructions are executed.

You should be familiar with the Do together and Do in order control structures from previous topics.



Control Structures Available in Alice 3

Available pre-defined control structures include:

- Do in order
- Count
- While
- For each in
- While
- Do together
- Each in together

Control Structures Display

You can drag a control structure to myFirstMethod before or after creating the programming instructions that will be included in the control structure.



Control Structures Example

For example, if you create a move and turn instruction for an object, and later decide that the actions should execute simultaneously, you can insert a Do together control structure and reposition the move and turn instructions within the control structure.

Or, you can anticipate that you are going to need a Do together control structure, insert the control structure, and then create and position the programming instructions within the control structure.

Nesting Control Structures

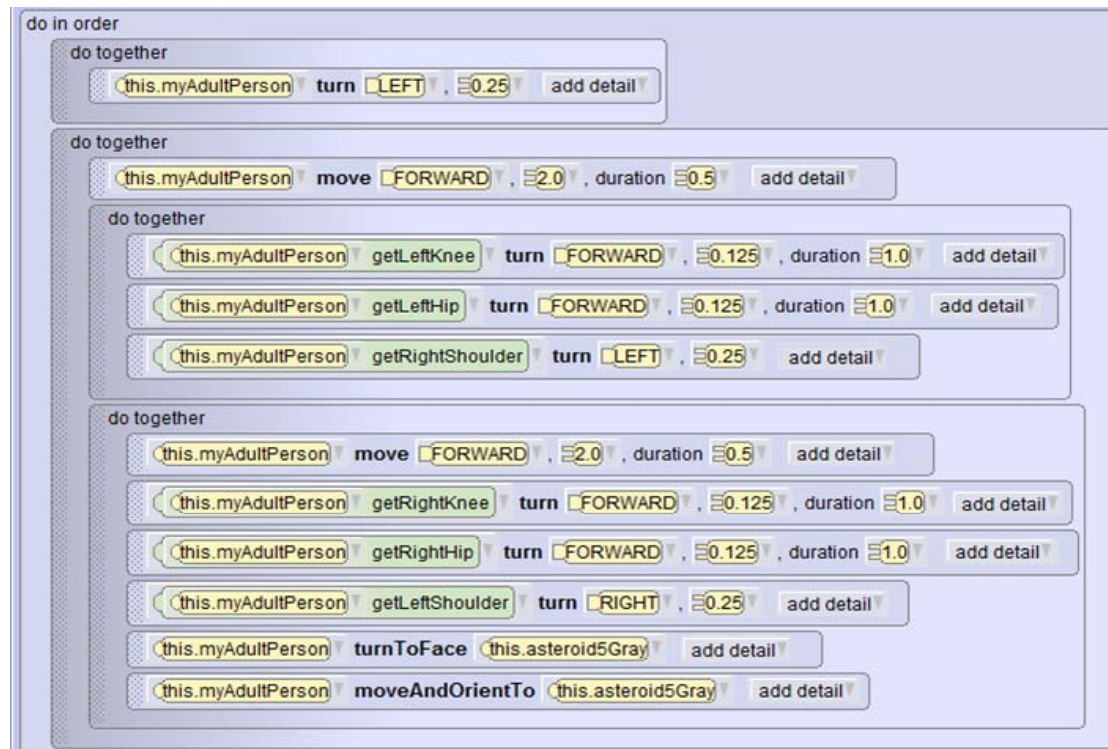
Control structures may be nested, meaning that one structure is contained within another.

For example, if a person is going to wave his left hand and then his right hand while he is moving forward, nested control structures would be necessary.



Nesting Control Structures Code Example

Examine the programming instructions below.



Conditional Execution Using Control Structures

Conditional control structures allow you to control execution based on a condition, or a decision being made.

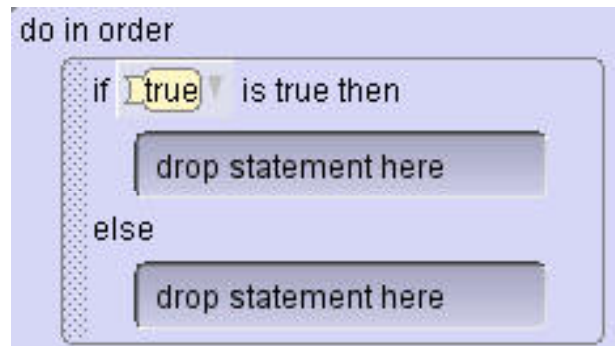
Consider these examples:

- If the current color of an object is blue, change the color to orange.
- If the width to the rock is less than 1 meter, move forward 1/2 meter.
- If the object opacity is 0, change the opacity to 1.

IF Control Structure

The IF control structure requires a condition of true or false when the structure is dragged into the program.

- This initial condition is a placeholder. You will need to establish the condition to be evaluated.



IF Control Structure Parts

The IF control structure has two parts: the IF part, and the ELSE part.

- If the IF part is executed, the ELSE part is never executed.
- If the ELSE part is executed, the IF part is never executed.
- Both the IF part and the ELSE part of an IF statement can contain another nested IF control structure.

WHILE Control Structure

The WHILE statement executes instructions repeatedly in a loop while a condition is true. This conditional execution is also known as “repetition.”

The WHILE condition:

- Acts like a gatekeeper to an event.
- Must be true to allow the programming instructions within the loop to execute.

WHILE Control Structure and Repetitive Execution

After all of the programming instructions within a loop are executed, the WHILE condition is evaluated again for repetitive execution.

- If the condition is still true, execution will repeat.
- If the condition is false, the loop will be skipped and execution will continue with the next programming statement following the WHILE control structure.

Interpret an IF Control Structure

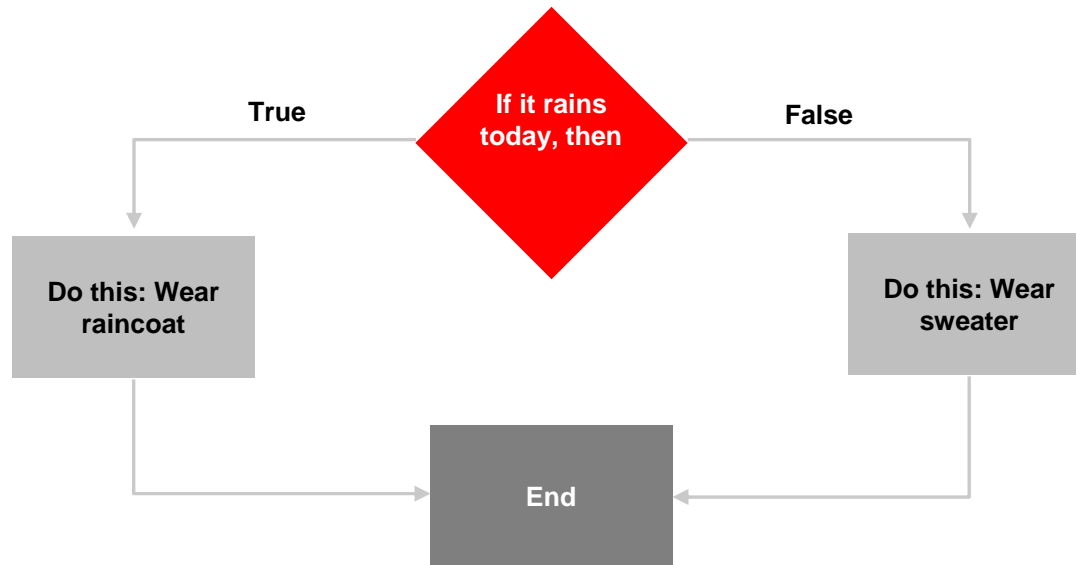
An IF control structure is a decision based on a condition.

- Example condition: If it rains today I will wear a raincoat. Otherwise, I will wear a sweater.
- IF control structures can be interpreted using a process flow.

A process flow is a graphical representation of a process model. Process flows use shapes to represent the actions in the model.

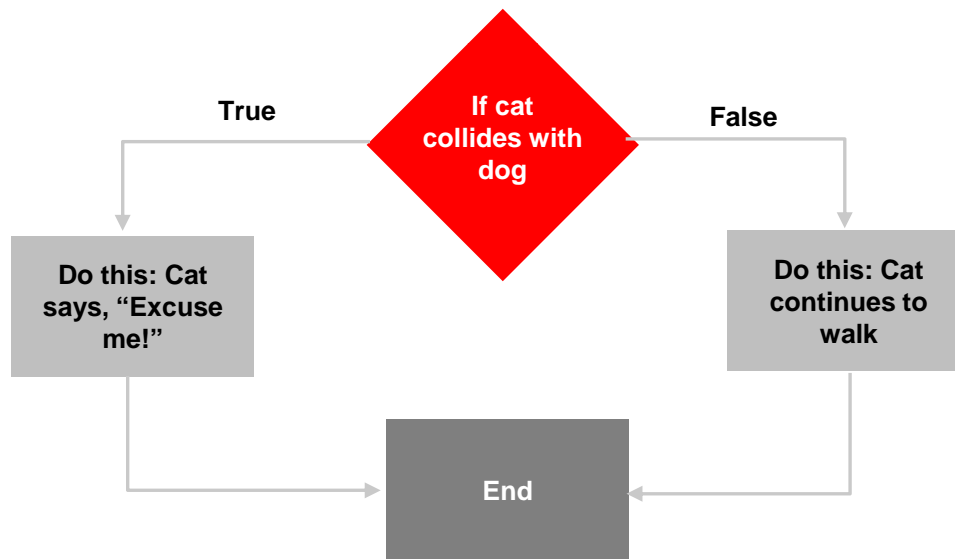
IF Control Structure Process Flow

If it rains today, then I will wear a raincoat. Otherwise, I will wear a sweater.



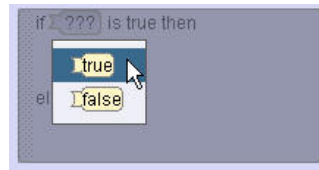
IF Control Structure Process Flow Example

If the cat walks into the dog, then the cat says “Excuse me!” Otherwise, the cat continues walking.



Steps to Program an IF Control Structure

1. Insert the initial motions that happen before the IF control structure is executed.
2. Drag and drop the IF control structure into the Code editor and select the true condition as a placeholder during setup.



3. Replace the true condition with a condition to evaluate, such as a function.
4. Insert the procedures that will execute if the condition is true (IF) and those that will execute if the condition is false (ELSE).
5. Run the animation to test the conditional behavior. Debug as necessary.

IF Control Structure Example

If the cat collides with the dog, then the cat moves backward and says “Excuse me!” Otherwise, the cat continues to move forward.

The `isCollidingWith` function was dragged onto the true condition placeholder. This function tells us if one object is colliding with another.



Conditional Execution

The use of conditional control structures allows two types of loops:

- Conditional loop: Stops when a condition is true.
 - Example: The propeller of a helicopter turns while the helicopter is moving or flying. If the helicopter stops, then the propeller stops turning.
- Infinite loop: Never stops.
 - The hour and minute hands on a clock continue rolling.



WHILE Control Structure

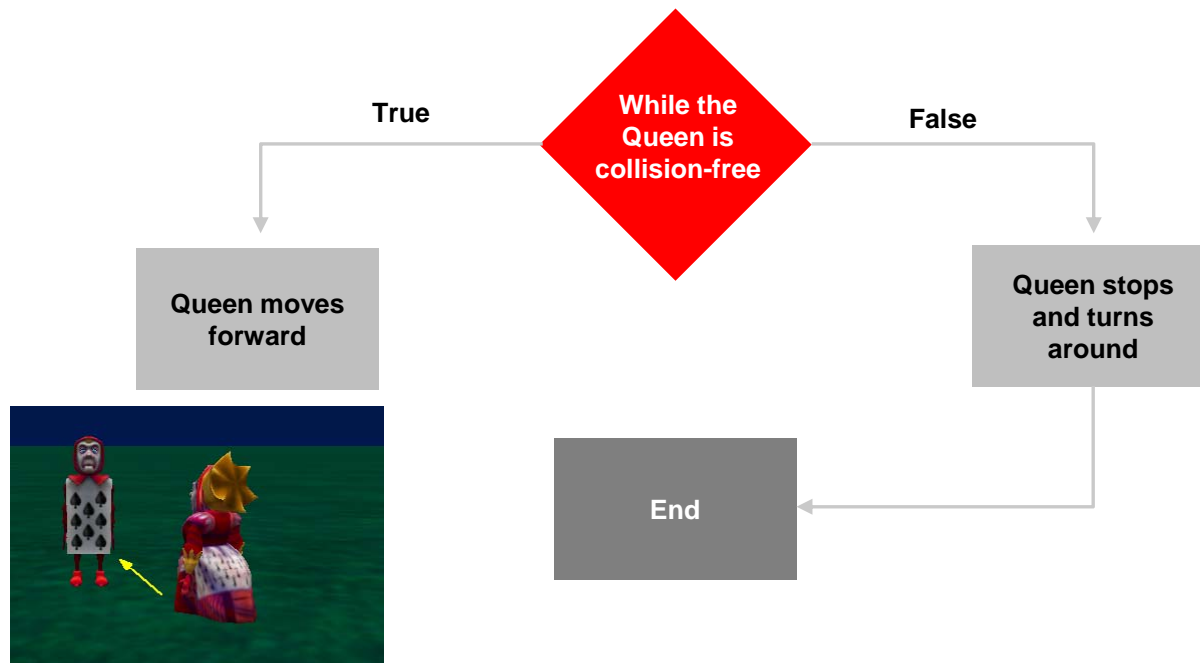
The WHILE control structure performs conditional loops.

- While a condition is true, the programming instructions within the loop are executed.
- Once the condition is no longer true, program execution will skip the WHILE condition and continue with the programming instruction that follows the WHILE loop.

The WHILE control structure will perform instructions while a condition is true; otherwise it will bypass the instructions.

WHILE Control Structure Process Flow

The Queen moves forward, unless she collides with the Playing Card. If the Queen collides with the Playing Card, she stops and turns to face the camera.



Steps to Program a WHILE Control Structure

1. Drag and drop the WHILE control structure into the Code editor and select the true condition as a placeholder.
2. Replace the true condition placeholder with the condition to evaluate.
3. Insert procedures that will be executed while the condition is true.
4. Insert the procedures that are executed after the while loop stops executing.

WHILE Control Structure Example Code

While the Queen is not colliding with the Playing Card, the Queen moves forward repeatedly. If the Queen does collide with the Playing Card, the WHILE loop stops and the program continues with the next instruction: she stops and turns to face the camera.

```
Scene initializeEventListeners myFirstMethod
declare procedure myFirstMethod
do in order
  while NOT (this.queenOfHearts isCollidingWith this.playingCard) is true
  loop
    this.queenOfHearts move FORWARD, 1.0 add detail
  end loop
  this.queenOfHearts turnToFace this.camera add detail
```



Steps to Test a WHILE Control Structure

1. Position objects such that the WHILE condition will evaluate to true.
2. Observe that all programming instructions within the WHILE loop execute.
3. Ensure that the WHILE loop execution stops when the while condition is no longer true.



Summary

In this lesson, you should have learned how to:

- Use the IF control structure to effect execution of instructions
- Use the WHILE control structure to create a conditional loop for repetitive behavior