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Java Fundamentals

2-8

IF and WHILE Control Structures

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```
while NOT (this.queenOfHearts.isCollidingWith this.playingCard2) is true
  this.queenOfHearts.move FORWARD, 1.0 add detail
loop
  this.queenOfHearts.turnToFace this.camera add detail
```



do in order count while for each in if do together each in together variable assign //comment

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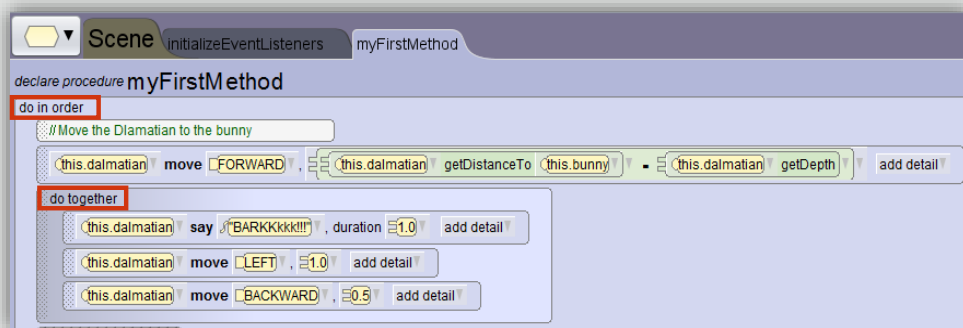
Objectives

- 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



Take a second to think what the difference is between the two control structures.

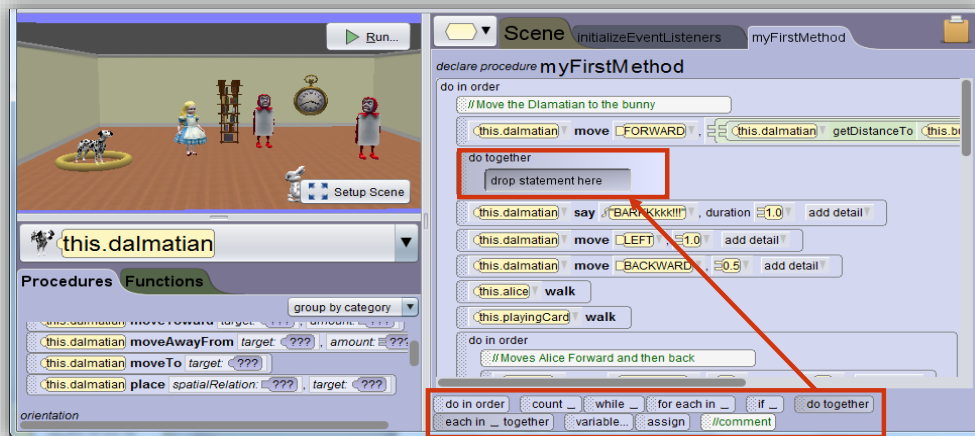
Control Structures Available in Alice 3

- Available pre-defined control structures include:
 - Do in order
 - Count
 - If
 - For each in
 - While
 - Do together
 - Each in together

These are all the control structures available in Alice 3.

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



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IF and WHILE Control Structures

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6

Remember you can drag the control structure into the code editor before or after you have added the code that will be placed inside of it.

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

All of these decisions should already have been decided on when you created your design for the animation. Remember the more time spent on the design the less time it takes to code a valid solution.

Nesting Control Structures

- Control structures may be nested, meaning that one structure is contained within another
- For example, if a biped is going to wave their left hand and then their right hand while it is moving forward, nested control structures would be necessary



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IF and WHILE Control Structures

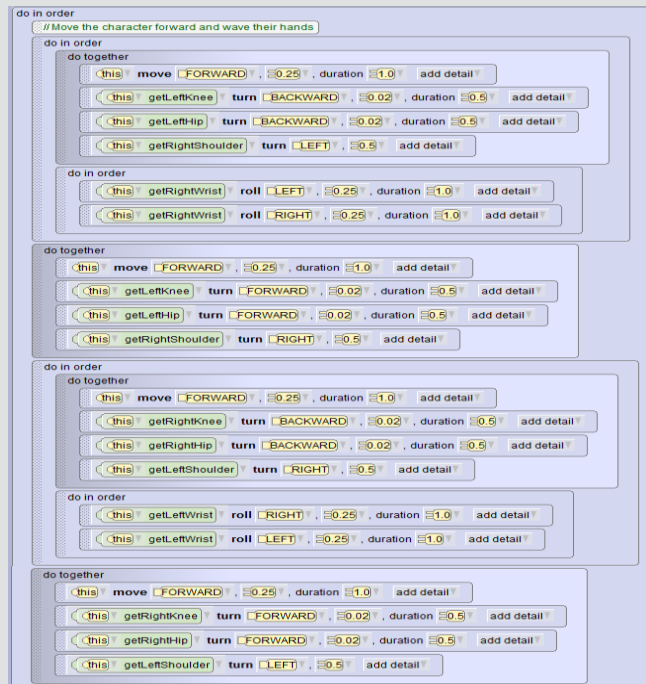
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8

There can be many levels of nesting. It can become quite complex so always use comments to explain each nested block's purpose.

Nesting Control Structures Code Example

- Examine these programming instructions



Take time to look at the code on the slide and understand how it works. There are a few different levels of nesting here. Create a simple animation that you can add the code to and practice adding comments at the nested control structures explaining their purpose.

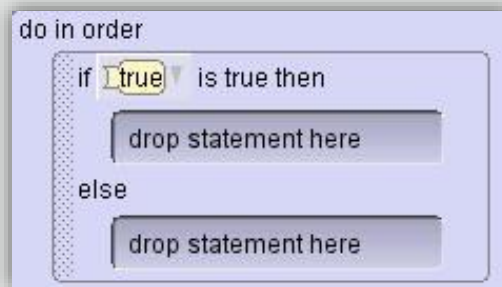
Conditional Execution Using Control Structures

- 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 distance to the rock is less than 1 meter, move forward 1/2 meter
 - If the object opacity is 0, change the opacity to 1

Think of these statements as extracts from a textual storyboard.

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



To change the value of the placeholder click on the true part of the statement and add the condition to be evaluated. An IF statement will execute if the condition returns a true value.

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
 - Exits the loop when the condition becomes false

A while loop allows you to execute a code block multiple times depending on the value of the terminating condition. Make sure the value of the terminating condition changes within the loop or it will never terminate (infinite loop).

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

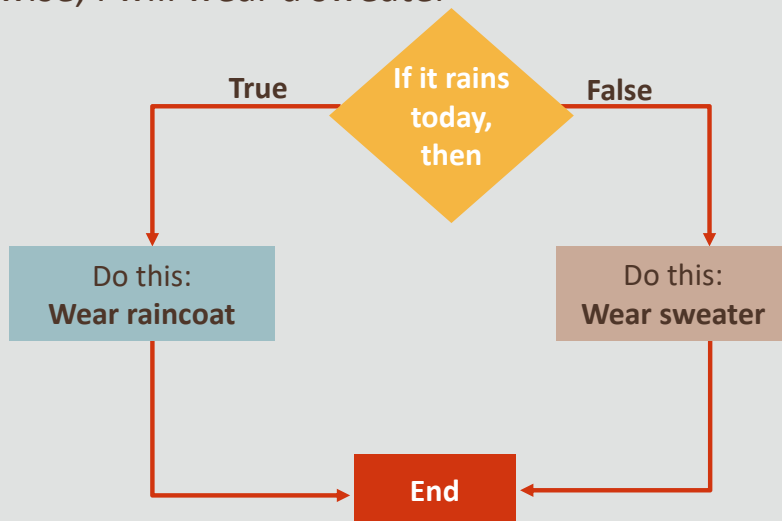
Interpret an IF Control Structure

- 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.

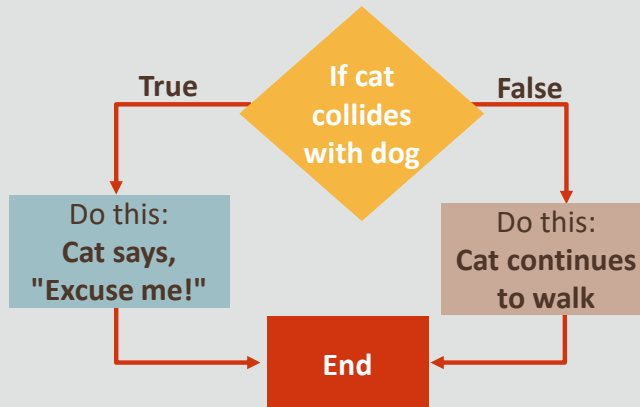
IF Control Structure Process Flow

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



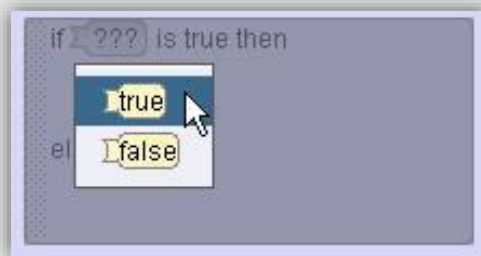
IF Control Structure Process Flow Example

- 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

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



You can also use the false value if you want to create a complex condition to execute an IF statement. These can be difficult to read and understand though.

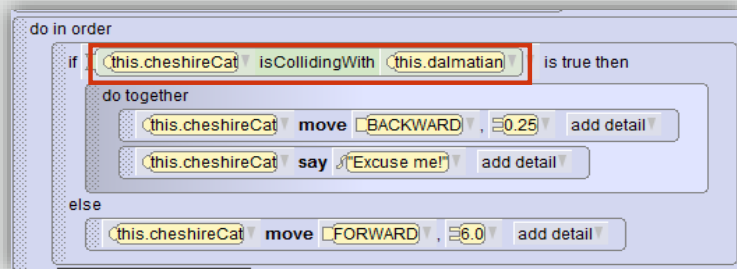
Steps to Program an IF Control Structure

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

It is not necessary to have code in the ELSE part. An IF statement will work with code only in the IF section.

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



Have another look at the Process Flow Diagram and see how it matches the code you have created.

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



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IF and WHILE Control Structures

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21

An intentional infinite loop can be used to make your scenery objects constantly move in the background. An unintentional infinite loop can cause havoc in your animation and will require you to close the animation down to exit it.

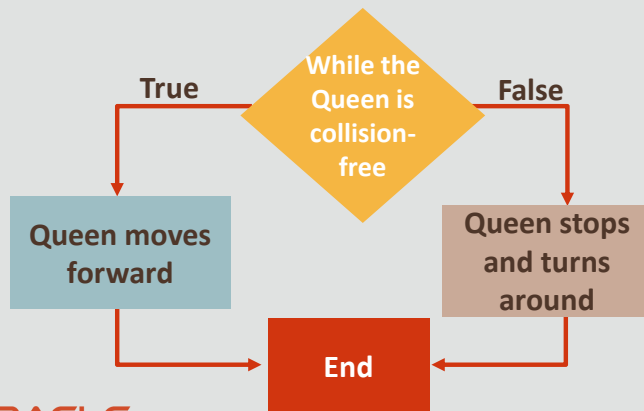
WHILE Control Structure

- 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

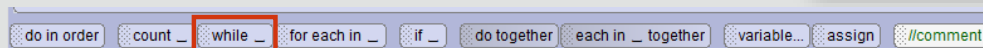
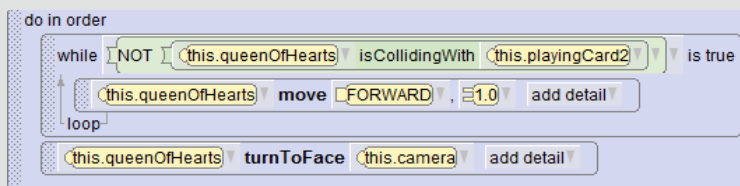


Steps to Program a WHILE Control Structure

- Drag and drop the WHILE control structure into the Code editor and select the true condition as a placeholder
- Replace the true condition placeholder with the condition to evaluate
- Insert procedures that will be executed while the condition is true
- 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



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25

Again look at the design diagram to see how it translates to the written code. A well designed program should take very little time to code.

Steps to Test a WHILE Control Structure

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



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26

If the condition does not evaluate to true in a while loop then the code within it will never execute. Always bear this in mind when using a while loop.

Terminology

- Key terms used in this lesson included:
 - IF control structure
 - Process flow
 - WHILE control structure

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



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