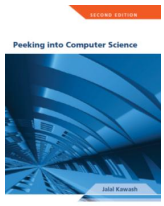
3 Programming



Peeking into Computer Science

- Mandatory: Chapter 5 – Section 5.5
- Jalal's resources:
  - "How to" movies and example programs available at:
    http://pages.cpsc.ucalgary.ca/~kawash/peeking/alice-how-to.html
- JT's resources:
  - www.cpsc.ucalgary.ca/~tamj/203/extras/alice

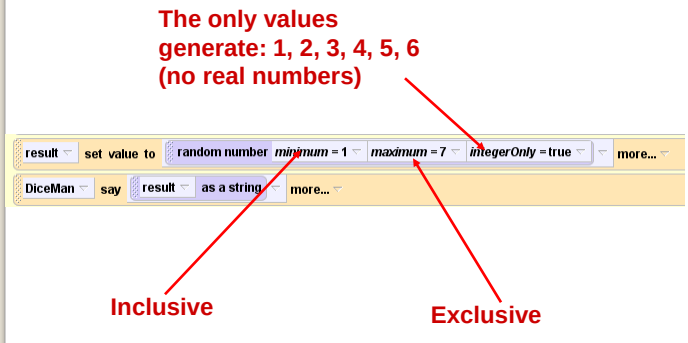
Reading Assignment

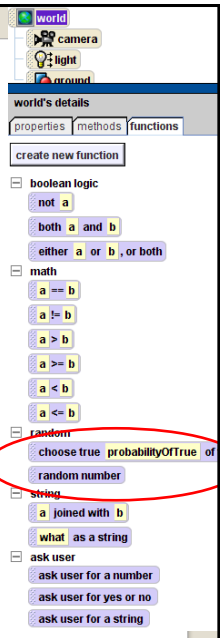
- To simulate the possibility of different events occurring as a program is a run a random number function can be employed.
- Typically the function generates a number within a certain range:
  - 1 – 2 (coin flip)
  - 1 – 6 (normal die roll)
  - 1 – 100 (percentage)
  - Etc.

JT's Extra: Random Numbers

Example 9: random numbers

- It can be invoked by the random function of class 'World'





JT's Extra: Dice Example

If-Else Statements

Alice makes decisions

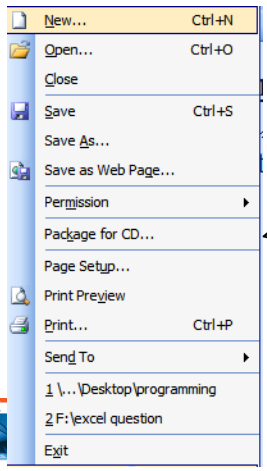
5

At the end of this section, you will be able to:

1. Understand conditional execution
2. Understand and use the Alice if/else statement
3. Use functions as arguments to other methods
4. Use conditional structures in flowcharts

Objectives

- Frequently this is needed when the program must react to user input or the actions of the user.



New: series of instructions

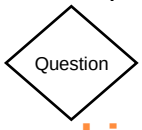
Open: series of instructions

Save: series of instructions

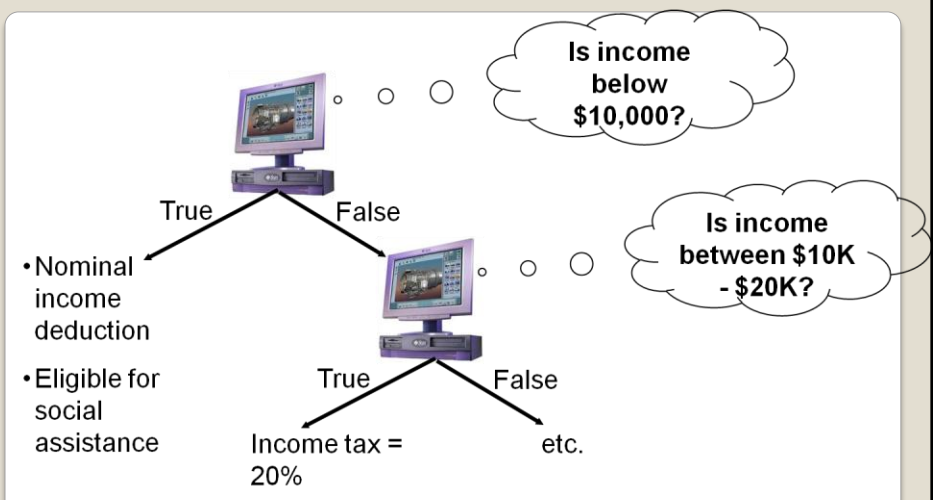
Etc.

JT's Extra: Choosing Among Alternative Course Of Action

- It's the mechanism used in many programming languages used to execute different instructions when alternatives are faced.
- At the branch (where the decision must be made) a logical statement determines which alternative occurs.
  - Another way of looking at it: a question is asked which has a true or false answer.
  - The answer to the question determines which branch executes.
- The flowchart symbol used to represent a branch/decision is a diamond.



Branching/Decision Making



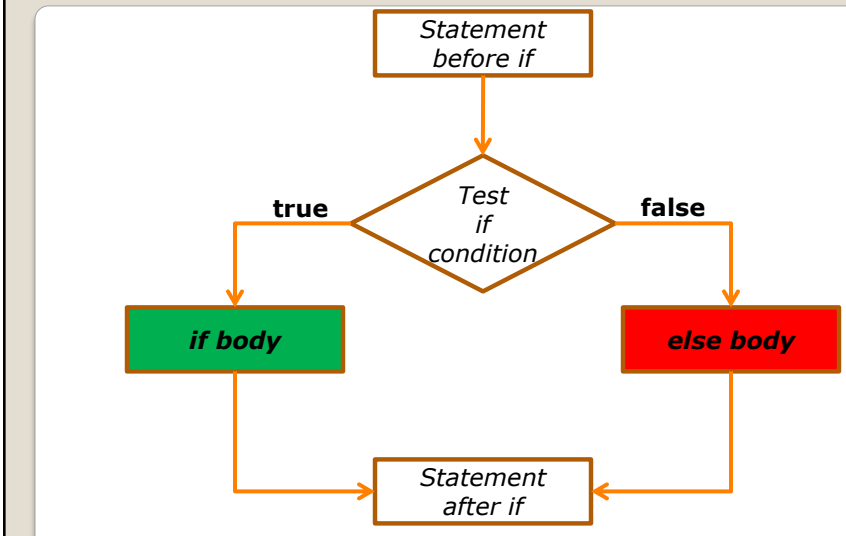
Branching/Decision Making (2)

- Programs need to make decisions
- An ATM program must verify your password to know how to proceed
- This is called *conditional Execution*
- The execution of a group of statements is conditional on a Boolean condition

If *the password is correct then*
  go to the next step
Else
  give an error message

JT (new terminology): body is the part that executes only under a certain condition

Conditional Execution



If-Else Flowchart

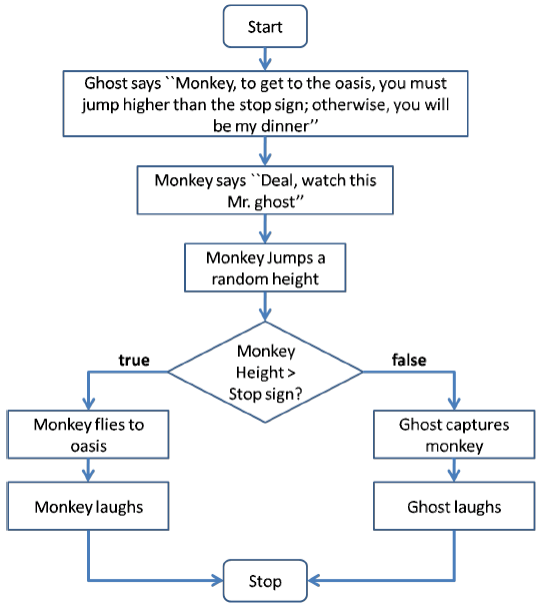
JT: 'if' body

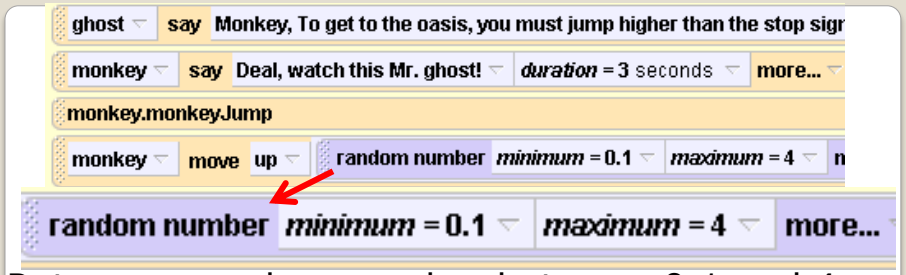
JT: 'else' body

```
If monkey is above stopSign more...
    monkey move to oasis more...
    monkey.screech
    monkey say Ha Ha Ha! duration = 3 seconds more...
Else
    monkey move to ghost.bag more...
    monkey.seizure
    ghost say Ha Ha Ha! duration = 3 seconds more...
```

If-Else Statement in Alice

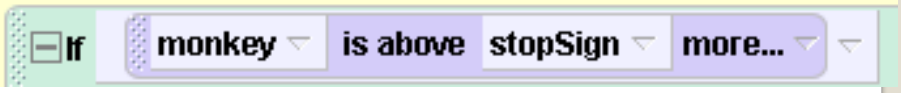
Example Story Line





Returns a random number between 0.1 and 4

value substituted for distance parameter of move



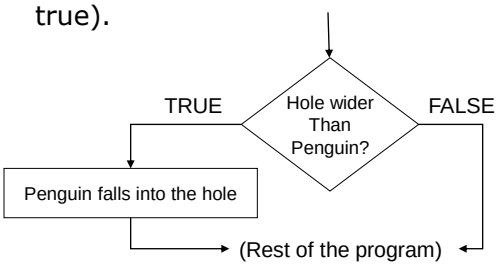
Returns a Boolean value

Use of Functions

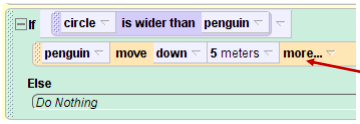
When the if condition is true

When the if condition is false

- If you want the program to react when the logical statement evaluates to true (the answer to the question is true).



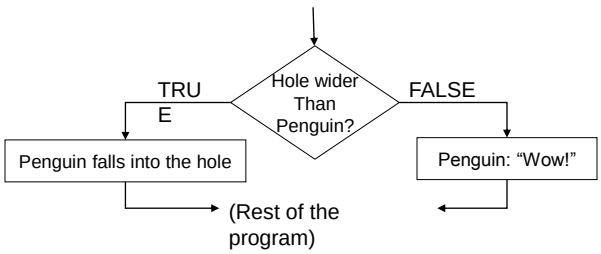
- Just use the 'if' and leave the 'else' portion empty.



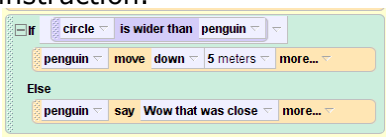
Indented part after the 'if': what executes if the statement is true

JT, One Action: Do Something When True

- You want the program to do something when the logical statement evaluates to true and something different when the statement evaluates to false.

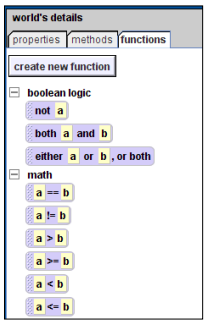


- Add instructions for both the 'if' and the 'else' portion of the instruction.

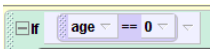
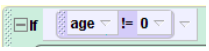
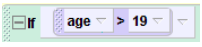
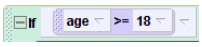
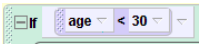
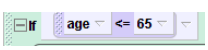


JT: Do Something For Both True/False Cases

- Are used in conjunction with logical statements and relate or compare things.
- The comparison will result in a true or false result.
  - E.g., temperature is above freezing (greater than zero).
- Accessing the logical operators in Alice.
  - Look under the functions of the 'world' object.

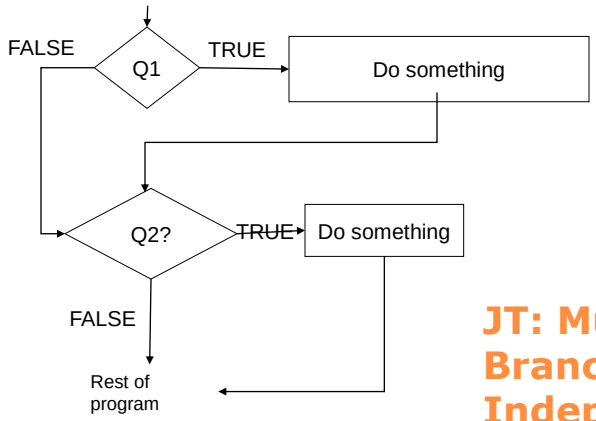


JT: Logical Operators

Desired comparison	Operator (Alice)	Example
Equality	==	
Not equal to (inequality)	!=	
Greater than	>	
Greater than, equal to	>=	
Less than	<	
Less than, equal to	<=	

JT: Types Of Logical Operators

- If a number of questions must by asked by a program and the answer to one question has no impact on the answer to the other questions.
  - That means that all questions will be asked regardless of whether any questions answered true or false.



JT: Multiple Branches: Independent

- If a number of questions must by asked by a program and the answer to one question has no impact on the answer to the other questions.
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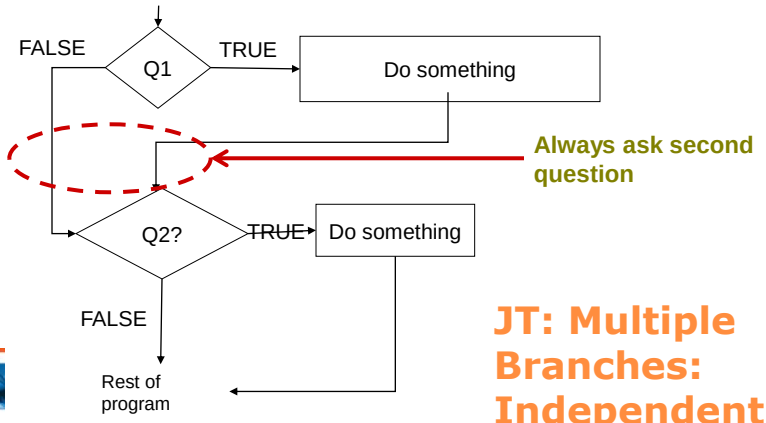

JT: Multiple Branches: Independent

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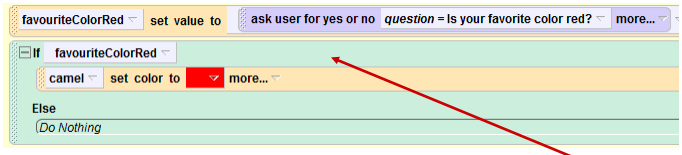
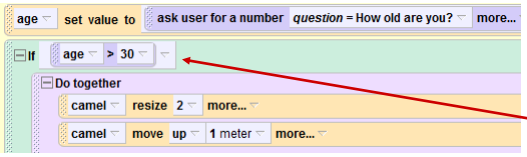
Example 10: multiple successive branches



First Boolean question: Always asked

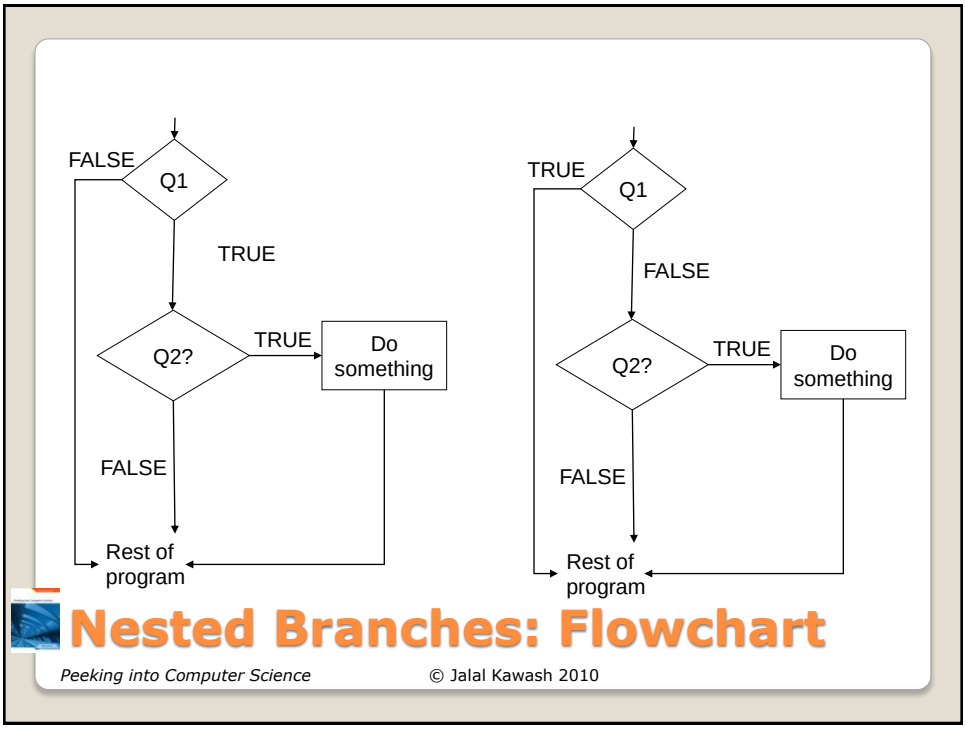


Second Boolean question: Not indented, always asked

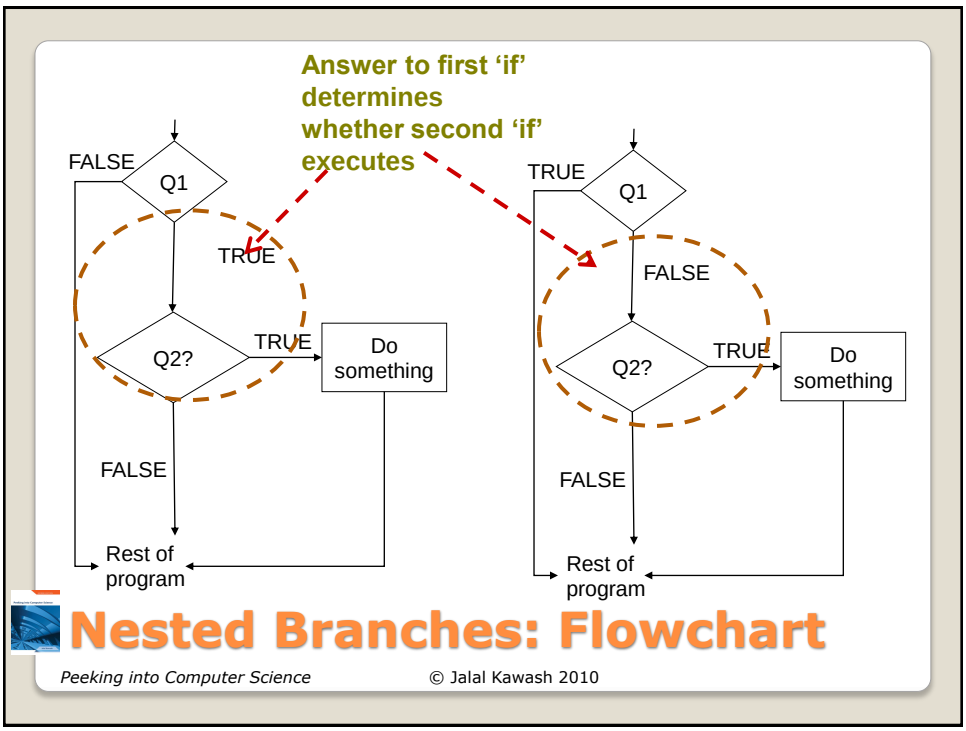
JT's Extra: Multiple Branches

- Sometimes the answer to one question will determine whether or not other questions will be asked.
  - The answer to one question (true or false) has an effect on whether another question is asked.
  - The asking of the second question is dependent on the answer to the first question.
  - (Alternatively: the second question is nested inside the first question).

Nested Branches

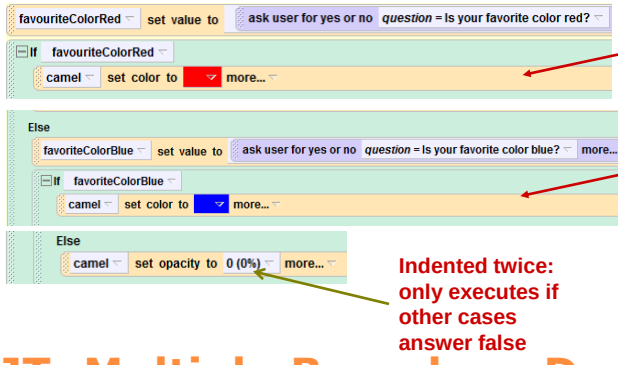


Nested Branches: Flowchart



Nested Branches: Flowchart

- Multiple if/else statements can be used in succession.
- Example program 11: nested_branches



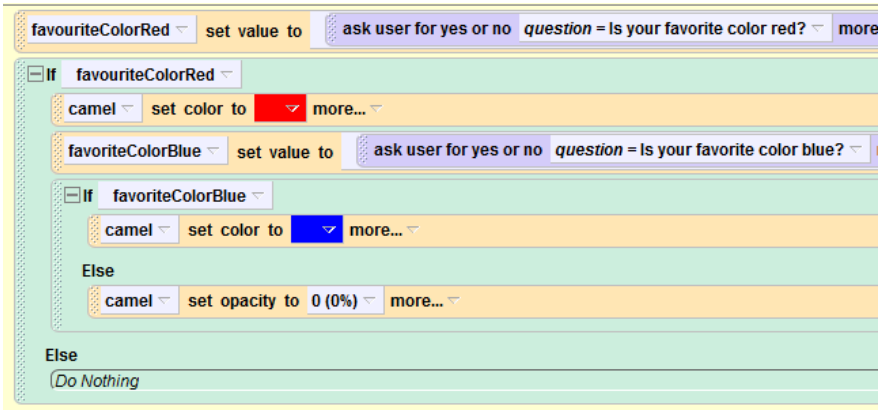
Indented: executes if first 'if' is true

Also indented: execution is dependent on the first 'if'

(Only ask about blue if user does not indicate that red is the favorite)

Indented twice: only executes if other cases answer false

JT: Multiple Branches: Dependent (RHS Case)



JT: Multiple Branches: Dependent (LHS Case: Nonsensical)

Loops

Do it again

29

At the end of this section, you will be able to:

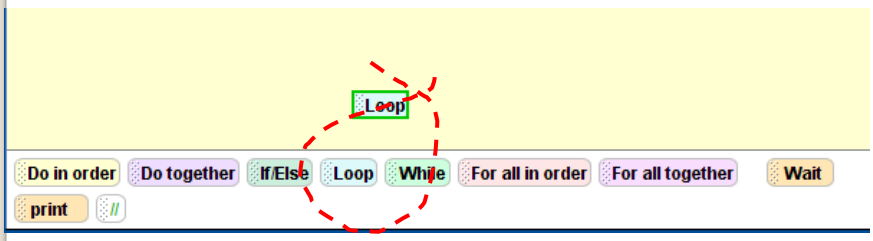
1. Understand repetition structures
2. Use the loop statement
3. Use the while statement
4. Understand when to use a loop or a while
5. Use loop structures in flowcharts

Objectives

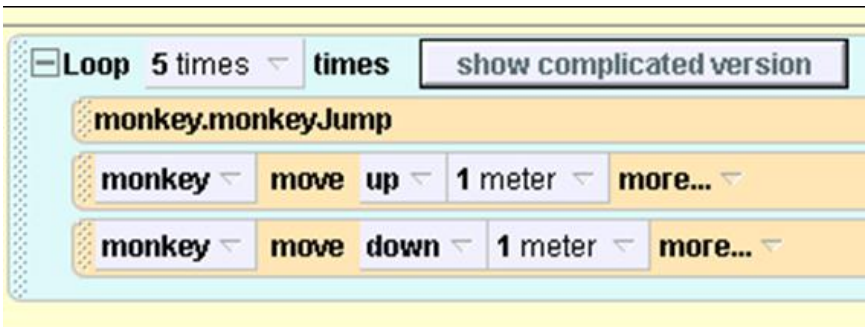
- A *loop* statement allows a group of statements to be repeated for a number of times

loop for 5 times
monkey.monkeyJump
monkey.move(up,1 meter)
monkey.move(down,1 meter)

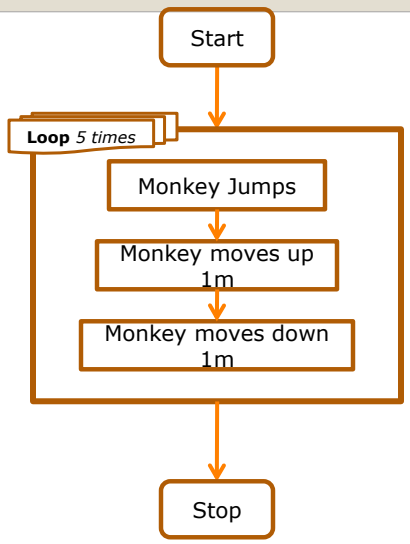
Loop Statement



JT's Extra: Adding A Loop In Alice



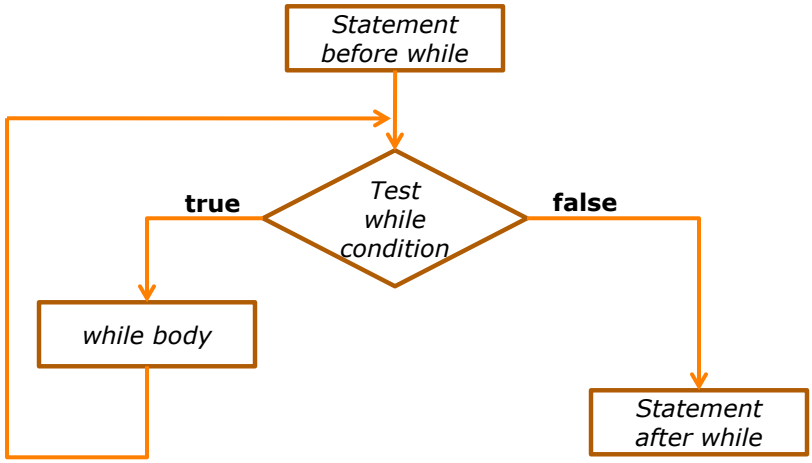
Loop Statement in Alice



Loop in Flowcharts

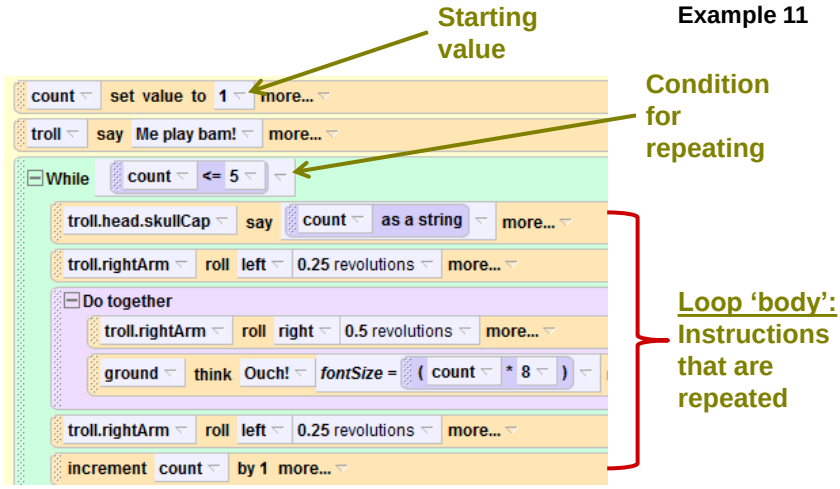
- Loops are used to repeat a part of the program (or potentially the entire program itself).
- They are similar to branches where a logical statement is employed.
- In the case of a loop if the logical statement evaluates to true then a part of the program will repeat (loop).
- The repetition will continue until the logical statement evaluates to false.

JT's Extra: Boolean-Controlled Loops

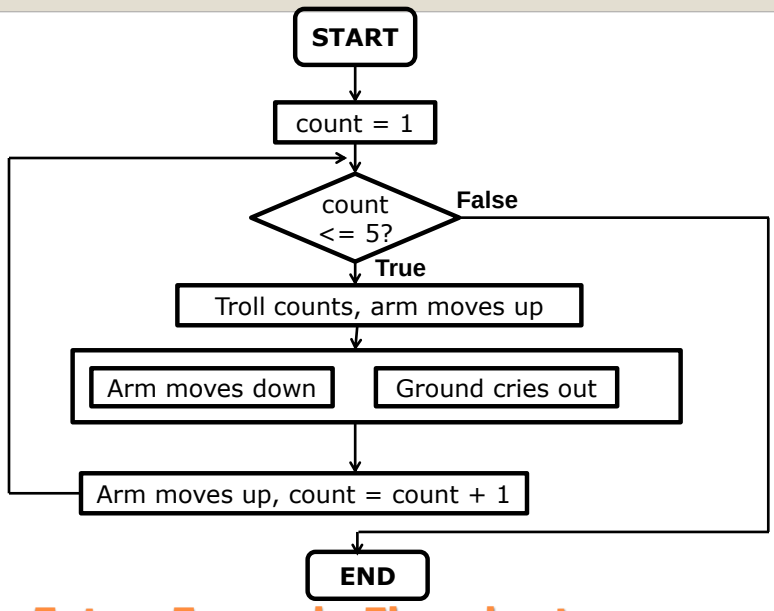


While Statement

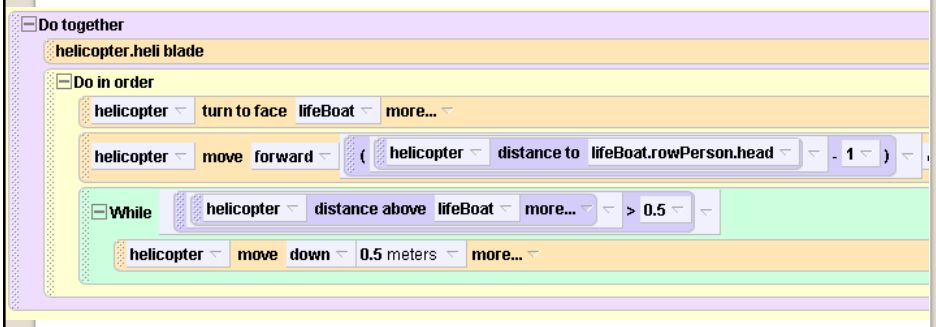
Example 11



JT's Extra: Counting With While

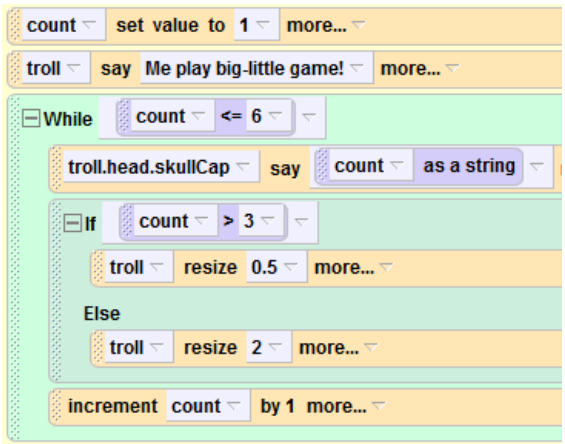


JT's Extra: Example Flowchart



While Example

Example 12



If-Else branch is part of the body of the loop

JT's Extra: Combining Loops And Branches

While Example