Conditionals with Advanced Logic Operators ("and" and "or")

(Project 6)
Goals

In this tutorial you will learn to use the logic operators “and” and “or” in conditionals.
Create a New Project

• Open the ZR IDE
• Select “New Project”
  – Project name: **Project 6**
  – Editor: Graphical Editor
  – Game: FreeMode
• Declare Variables/Arrays on the Init page
  (Go back and look at Project 4 if you need help with how to declare variables)
  – “counter” (integer, initialized to **0**)
  – “positionA” (float, 3, initialized to **1,0,0**)
  – “positionB” (float, 3, initialized to **0,1,0**)
• Back in main, Add a SPHERES Control statement to `setPositionTarget` to `PositionA`
• Next we will add a conditional statement to tell the satellite when to go to `PositionB`. 
The Logic Operator “and”

• Create the following “If-Then” statement in your loop using the logic operator **and**:

  “If counter > 20 **and** counter < 40 then... (go to positionB.)”

• First steps:
  – Drag an “If-Then” block from the Logic accordion
  – Drag an “and” block from the Logic accordion
The Logic Operator “and” (cont.)

- Remember the “If-Then” statement is:
  “If counter > 20 and counter < 40 then... (go to positionB.)”

- Next:
  - Drag an “___==___” block from the Logic accordion into the first empty space in the “and” block
  - Drag another “___==___” block from the Logic accordion into the second empty space in the “and” block
  - Change the first “==” to a “>” in the dropdown menu
  - Change the second “==” to a “<” in the dropdown menu
The Logic Operator “and” (cont.)

- Remember the “If-Then” statement is:
  “If counter > 20 and counter < 40 then... (go to positionB.)”

- Next:
  - Drag two pink Variable blocks from the Variables accordion and place them in the first empty slots of both the “>” and “<” blocks
  - Select “counter” in the dropdown menu for each
  - Add two blue Number blocks from the Math accordion and place them in the remaining empty slots of the “>” and “<” blocks
  - Enter 20 in the first Number block
  - Enter 40 in the second Number block
• Remember the “If-Then” statement is:
  “If counter > 20 and counter < 40 then... (go to positionB.)”

• Drag a SPHERES Control statement into the If-Then block to
  setPositionTarget to positionB

• The last step is to increment the counter
  (set counter = counter + 1)
  – Drag the “--Select--=0” block from the Variables accordion. (Make sure to drop it into the loop after the If-Then block.)
  – Drag the “+” block from the Math accordion
  – Drag the counter block from the Variables accordion
  – Drag the number block from the Math accordion and set to 1
The Logic Operator “and” (cont.)

- What do you expect to happen?
  - Compile, Simulate
  - Maximum Time: 90 seconds
  - View simulation

Blue satellite should move from:
initial position ➔ positionA ➔ positionB ➔ positionA

Compare: Your program - versus - C Code

```
void loop() {
  api.setPositionTarget(positionA);
  if (counter > 20 && counter < 40) {
    api.setPositionTarget(positionB);
  }
  counter = counter + 1;
}
```
Modify program

- Modify the program to change both the attitude and position of the satellite.
- Create the following arrays:
  - `float pointposx[3]`
    - Set initial value to **1,0,0**
  - `float pointnegx[3]`
    - Set initial value to **-1,0,0**
- Add the Spheres Control Function `setAttitudeTarget` into the If-then statement (toggled from `setPositionTarget`):
  - Select: `pointposx`
- Drag the `counter = counter + 1` statement out of the loop, but do not delete.
The Logic Operator “or”

• Add the “If-Then” statement:
  “If counter < 20 or counter > 40 then...
(point in the negative x direction)”

• Hints:
  – Drag the “If-Then” block from the Logic accordion
  – Drag an “and” block from the logic accordion and toggle to “or”
  – Drag “__==__” blocks from the Logic accordion into the empty spaces in the “or” block
  – Change the first “==” to a “< the second “==” to a “>“
  – Add counter blocks and numbers
• Add the Spheres Control Function `setAttitudeTarget` into the new If-then statement
  – Select: `pointnegx`
• Drag `counter = counter + 1` back into the loop after the If-Then statement.
The Logic Operator “or” (cont.)

- What do you expect to happen?
  - Compile, Simulate
  - Maximum Time = 90 seconds
  - View simulation

- Compare: Your program - versus - C Code
  - What is the C code symbol for:
    - `and`
    - `or`

```c
1. void loop() {
   2.   api.setPositionTarget(positionA);
   3.   if (counter > 20 && counter < 40) {
          api.setPositionTarget(positionB);
          api.setAttitudeTarget(pointposx);
       }
   4.   if (counter < 20 || counter > 40) {
          api.setAttitudeTarget(pointnegx);
       }
   5.   counter = counter + 1;
}
```
• Congratulations!

• You have learned two more logic operators: “and” and “or”

• You wrote a program that changes the SPHERES position and attitude