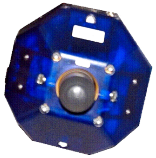
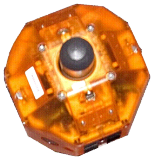
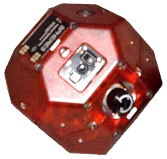
ZERO ROBOTICS







ISS PROGRAMING CHALLENGE

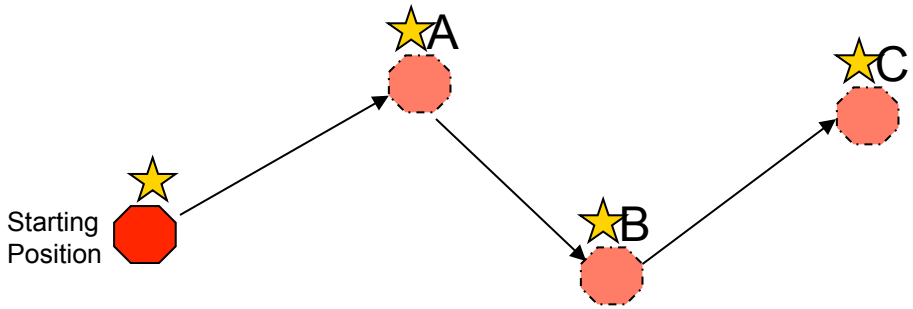
# The Conditionals:

# The Basics of “If-Then”

# Goals


- In this tutorial you will:
  - Learn to use "If-Then" statements in programming
  - Use the logic operator: ">"
  - Learn about counters
  - Learn about flow charts

  - Program a SPHERES satellite to follow a path to multiple locations!



# Create A New Project and Declare Variables


- Open the ZR IDE
- Select “New Project”
  - Project name: **Project 4**
  - Game: FreeMode
  - Text Editor

- Create an array called “positionA”
  - Above void init() { type in “**float positionA[3];**”
  - To set the initial values to 0,1,0 you go under void init() { and type in “**positionA[0] = 0;**
    **positionA[1] = 1;**
    **positionA[2] = 0;**”

```
1  //Declare any variables shared between functions here
2  float positionA[3];
3
4  void init(){
5    //This function is called once when your code is first loaded.
6
7    //IMPORTANT: make sure to set any variables that need an initial value.
8    //Do not assume variables will be set to 0 automatically!
9    positionA[0] = 0;
10   positionA[1] = 1;
11   positionA[2] = 0;
12 }
13
14 void loop(){
15   //This function is called once per second.  Use it to control the satellite.
16 }
17
```

# Create A New Project and Declare Variables (cont.)


- Create an array called “positionB”
  - Above void init() { type in “**float positionB[3];**”
  - To set he initial values to 1,0,0 you go under void init() { and type in “**positionB[0] = 1;**
    **positionB[1] = 0;**
    **positionB[2] = 0;**”

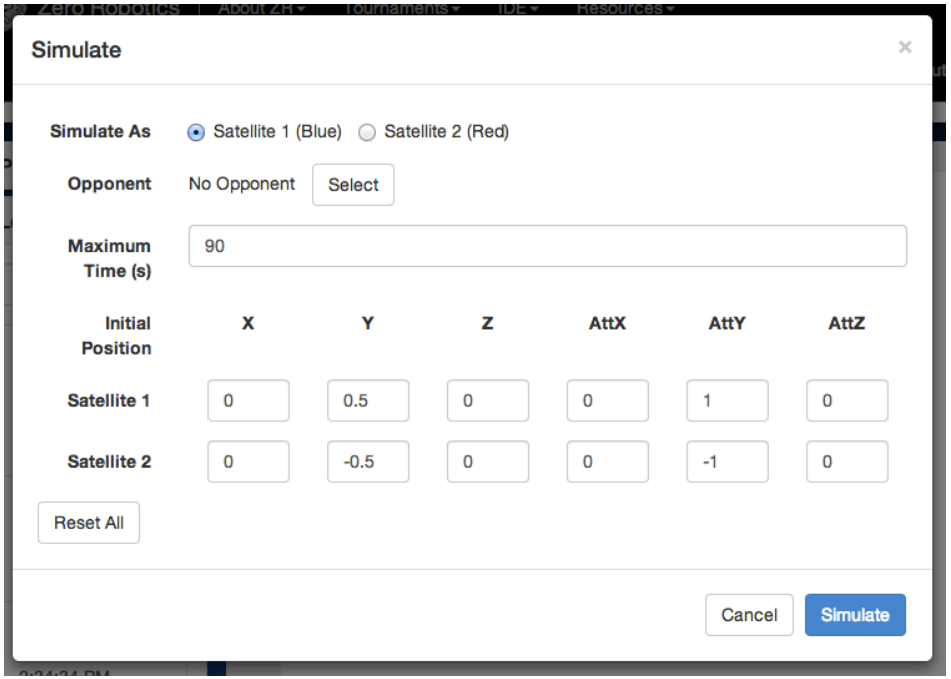
```
1  //Declare any variables shared between functions here
2  float positionA[3];
3  float positionB[3];
4
5  void init(){
6    //This function is called once when your code is first loaded.
7
8    //IMPORTANT: make sure to set any variables that need an initial value.
9    //Do not assume variables will be set to 0 automatically!
10   positionA[0] = 0;
11   positionA[1] = 1;
12   positionA[2] = 0;
13   positionB[0] = 1;
14   positionB[1] = 0;
15   positionB[2] = 0;
16 }
17
18 void loop(){
19   //This function is called once per second.  Use it to control the satellite.
20 }
21
```

# Introduce a SPHERES Control Function

- Create a statement to set the position of the SPHERES satellite
  - Below void loop () { type in "**api.setPositionTarget(positionA);**"

```
18 void loop(){
19   //This function is called once per second.  Use it to control the satellite.
20   api.setPositionTarget(positionA);
21 }
```

- Compile, Simulate
  - In the Simulation Settings window:
  - Leave "Maximum Time" setting = 90
  - Click "Simulate"
- The satellite will move to PositionA



# Test with a 2nd SPHERES Control Function

- Test what happens:
  - Add another position target (positionB).
  - Below api.setPositionTarget(positionA);
    type in "**api.setPositionTarget(positionB);**"

```
18 void loop(){
19   //This function is called once per second.  Use it to control the satellite.
20   api.setPositionTarget(positionA);
21   api.setPositionTarget(positionB);
22 }
```

- Compile, Simulate
- Click on green "Run" button to view simulation
- Question: Did the satellite move first to position A and then to position B?

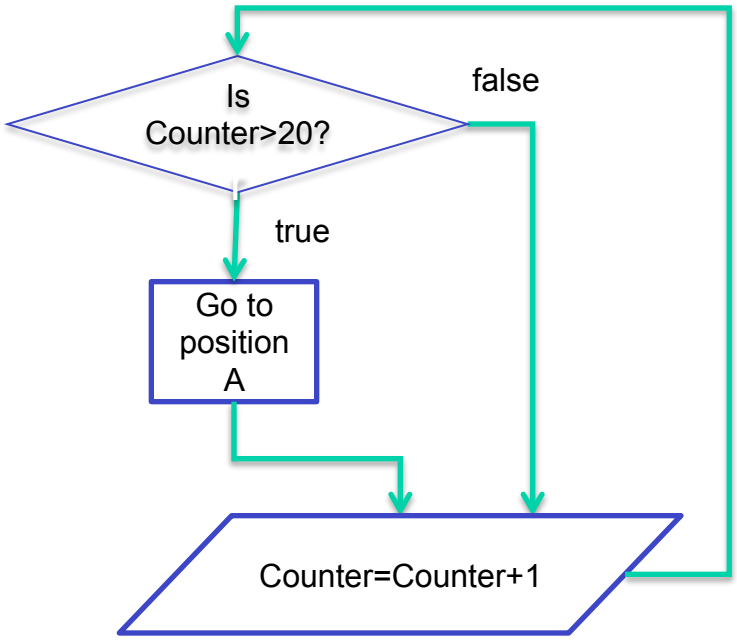
# Test a 2nd SPHERES Control Function, cont.

- Answer: No!
  - It only moved to Position B.
- Why?
  - The SPHERES controller runs all the instructions in the loop once per second
  - When it receives two similar instructions, like "setPositionTarget," it will always follow the last instruction…..
  - Unless…
  - there are conditionals written into the program!

```
18 void loop(){
19   //This function is called once per second.  Use it to control the satellite.
20   api.setPositionTarget(positionA);
21   api.setPositionTarget(positionB);
22 }
```

# What are conditionals?


- Conditionals give instructions about *when* to do something
- An "if-then" statement is an example of a conditional.
  - **If** something is true **then**…..
- For example: Suppose we want the satellite to wait 20 seconds before it moves to position A?
  - This example is described in the flow diagram to the right
  - counter is a variable that starts at 0
  - Add 1 to the counter each second (each time the loop runs) to keep track of the time
  - If counter is greater than 20, then go to position A; otherwise, do nothing and just keep counting



# Programming with conditionals


- Before getting started:
  - Delete the setPositionTarget text we just wrote under void loop () {

```
18 void loop(){
19   //This function is called once per second.  Use it to control the satellite.
20 }
```

- We want to create a conditional "If" statement.
  - Under void loop () { type in "**if () {**" , skip a few lines to leave yourself room for coding and type in "**}**" to close of your if statement.

```
18 void loop(){
19   if(){
20
21   }
22 }
```

# Programming with conditionals, cont

Next, create a new variable that holds only one number, call it "counter".

- Under our other two variables type in " **int counter;**"
- To set the variable to zero we need to type the following "**counter = 0;**" under our other initial values.

```
1  //Declare any variables shared between functions here
2  float positionA[3];
3  float positionB[3];
4  int counter;
5
6  void init(){
7    //This function is called once when your code is first loaded.
8
9    //IMPORTANT: make sure to set any variables that need an initial value.
10   //Do not assume variables will be set to 0 automatically!
11   positionA[0] = 0;
12   positionA[1] = 1;
13   positionA[2] = 0;
14   positionB[0] = 1;
15   positionB[1] = 0;
16   positionB[2] = 0;
17   counter = 0;
18 }
19
```

# Programming with conditionals, cont


- Remember, we want to create the following conditional statement:
  - **If "counter">20,** Then go to positionA
  - So we just type the following "**counter>20**" after the "if" and between the parentheses.
  - And to make it go to positionA we type the following "**api.setPositionTarget(positionA);**" under "if(counter>20) {"
  - The last set it to increment the counter (set: counter = counter+1). To do that we type the following "**counter ++**" before the last "}".

```
20 void loop(){
21   if(counter>20){
22
23   }
24 }
```

```
20 void loop(){
21   if(counter>20){
22     api.setPositionTarget(positionA);
23   }
24 }
```

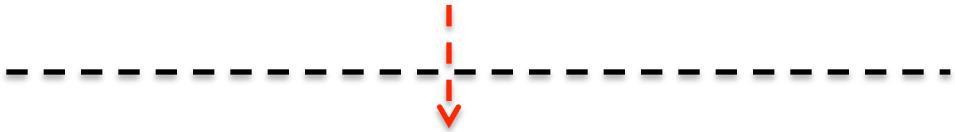
```
20 void loop(){
21   if(counter>20){
22     api.setPositionTarget(positionA);
23   }
24   counter++
25 }
```

# Programming with conditionals, cont


- Your new program will tell the SPHERES satellite to wait until the count of 20 and then move to positionA.

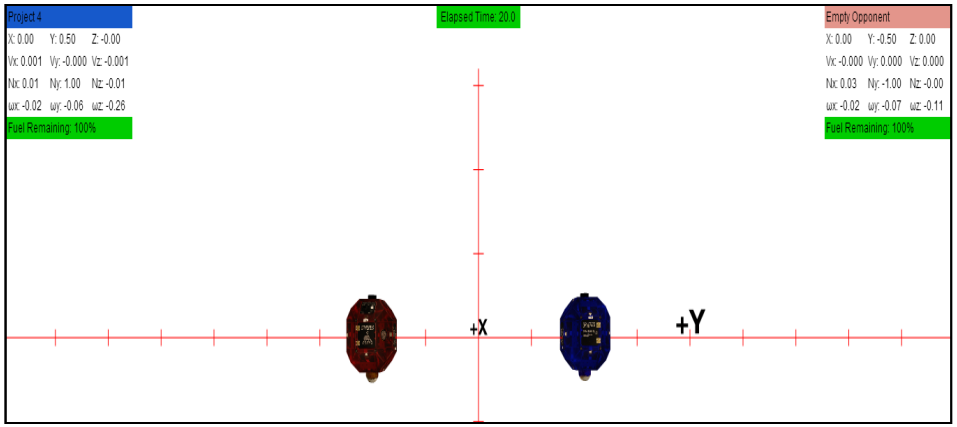
```
20 void loop(){
21   if(counter>20){
22       api.setPositionTarget(positionA);
23   }
24   counter++
25 }
```

- Compile, Simulate
  - Load settings: Tutorial _90



- Run!
- The Blue SPHERE should start to move after: Elapsed Time is > 20

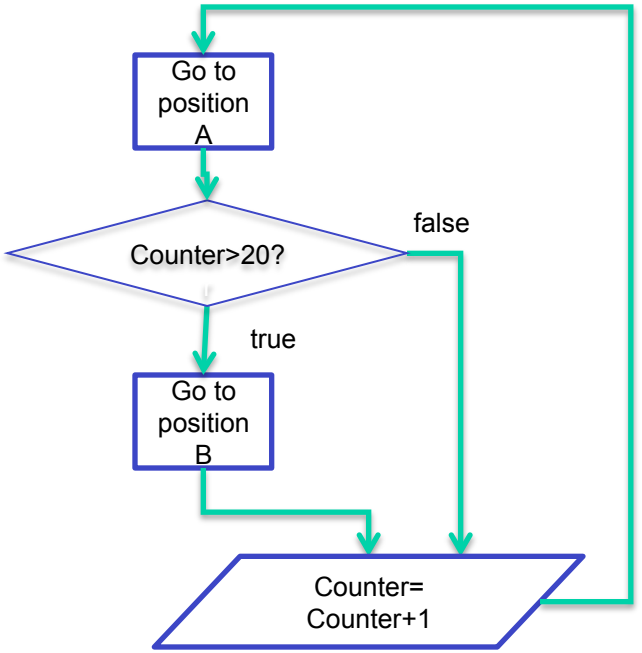
  (Because the counter increases by one every second)



# Move to multiple locations using conditionals


- Next let's make a program that first sends the SPHERES satellite to positionA, and if the counter > 20 then sends the satellite to positionB

- See the flow diagram to the right for this program



# Moving to multiple locations, cont.


- Then under "void loop () {" and above the "if" statement we wrote earlier type the following "**setPositionTarget(positionA);**"
- Then change the target position inside the "if" statement from "setPositionTarget(positionA)" to the following "**setPositionTarget(positionB);**"
- Simulate and Run!
  - The satellite should travel first to position A and then to position B!

```
20 void loop(){
21   api.setPositionTarget(positionA);
22   if(counter>20){
23      api.setPositionTarget(positionB);
24   }
25   counter++
26 }
```

# Moving to multiple locations, cont.


- Try creating the program shown on the right using two "if" statements.

- This program will:
  - First send the SPHERES satellite to position**A**
  - If the counter > 20, send the satellite to position**B**
  - If the counter > 40, send the satellite back to position**A**

```
20 void loop(){
21   api.setPositionTarget(positionA);
22   if(counter>20){
23      api.setPositionTarget(positionB);
24   }
25   if(counter>40){
26     api.setPositionTarget(positionA);
27   }
28   counter++
29 }
```

# Bracket Syntax


- A note on bracket syntax: for conditionals and loops, if the "then" code is only one line, you don't need curly brackets. Keep this in mind when you read code. You can still add brackets out of habit, but you don't need them.
- The two conditionals below are identical.

```
14   if (counter>20)
15     api.setPositionTarget(positionA);
```

```
14   if (counter>20){
15     api.setPositionTarget(positionA);
16   }
```

# Review


- Congratulations!
- You have learned to use if-Then statements to autonomously move a SPHERES satellite to multiple locations!