Balancing the scales: Inequalities

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Overview

• This tutorial will show you how to create a game where the player has to compare numbers using the >, <, and = signs.

• Numbers are placed on a scale, and the player clicks on the correct sign to indicate which side is greater.

• This game can be used in a middle school math class to practice inequalities, decimals, addition, multiplication, division, and fractions.
Set Up

• Create a new Alice world with any template.
• Save the world somewhere you can find it.
• Click "Add Objects".
• Click People in the Local Gallery.
• Add Teacher to your scene.
• Then go to the Musical Instruments folder in the Local Gallery and add a TimbalesCowBell.
• Right click TimbalesCowBell in the object tree, click rename, and type “scale”.
• We need to put the teacher’s arms down.
• Click on the + sign next to teacher in the object tree and click on the + sign next to upperBody.
• Right click on the teacher’s leftArm, and then click methods >> teacher.upperBody.leftArm roll >> left >> ¼ revolution.
• Right click on the teacher’s rightArm, and then click methods >> teacher.upperBody.rightArm roll >> right >> ¼ revolution.
Fixing the scale

• The left and right parts of our scale don’t look like an actual scale. Let’s fix this.

• Click on scale in the object tree.
• Click on the + sign next to scale.
• Click on leftTimbale and click on its properties tab.
• Set isShowing to false.
• Do the same for the rightTimbale.
• Click on the Shapes category in the Local Gallery and add 2 Bump objects.
• On the right side of your screen with the row of buttons with faces on them, click on the Turn Objects Forwards and Backwards to turn the Bump objects so that the dome parts are pointing downward.

• Move and resize the teacher, scale and two bump objects so they look like they do in the picture.

• Rename the bump objects so they say leftSide and rightSide.
Adding >, =, < signs

• Go back to the Local Gallery and scroll to the end to find the Create 3D Text category.

• Add 3 3D text objects to say “>”, “=“, and “<“.

• Rename the objects in the object tree to say greaterThan, lessThan, and equals.

• Use the Turn Objects Left and Right, Move Objects Up and Down, and Move Objects Freely buttons so that the >, =, and < signs are in the top right corner.
Adding placeholders

• Go back to the Local Gallery and click on the Shapes category.

• Add a Square and use the Turn Objects Left and Right button so that it is facing forward.

• Right click on the Square and click methods >> move to greaterThan so that it moves to the “>” sign.

• Resize the Square so that it is about the same size as the > sign.

• Rename the square “greaterPosition.”
• Do the same for the = and < signs.
• Also add a **Square** of the same size to the top of the scale and rename it `equationPosition`.
• We want these placeholders to be invisible.
• Click on the **greaterPosition** and click the properties tab in the `greaterPosition’s details` section.
• Change `isShowing` to false.
• Do the same for the other 3 squares, and rename accordingly.
Adding objects to the scale

- Add two 3D text objects into the world that say “1234” (we will change these numbers later).
- Move and resize one of the text objects to fit on the leftSide of the scale and one to the rightSide.
- Rename them leftObject and rightObject.
- Under their properties tabs, change the colors to your two favorite colors.
- Change isShowing to false for leftObject and rightObject.
Adding vehicles

• We want the left object to move with leftSide and for the right object to move with rightSide.
• Go to leftObject’s properties tab and change the vehicle to leftSide.
• Do the same for rightObject on rightSide.
Adding the score

• This is the last object we’ll add for now.
• From your Local Gallery, add a 3D Text object that says “Score: 0”.
• In the object tree, rename the new object “score”.
• Move score to the bottom right corner below the scale.
Keeping score

- We want to keep track of the score.
- Click on world in the object tree.
- Below the object tree, you’ll find the world’s details section.
- Click on the properties tab.
- Select create new variable at the top.
• Beside Name, type in “scoreTracker”.
• Under Type, select Number.
• We want the score to start at 0.
• Click on the 1 next to Value and then click other…
• Type in 0.
• Click OK.
• You should now see your new scoreTracker variable listed in the world’s properties tab.
Teacher gives instructions

• Click on the teacher’s methods tab.
• Drag teacher say into world.myFirstMethod.
• Click other...

• Type “Here’s how the game is played.”
• Right click on the line you just made and click make copy.
• Make 3 more copies.
• Change the second line to say Click the > or greater than sign if the number on the left side of the scale is greater than the number on the right side.

• Change the third line to say Click the = or equals sign if the two sides are equal.

• Change the fourth line to say Click the < or the less than sign if the number on the right is greater.

• Change the fifth line to say You earn a point if you choose the correct answer.
Setting the duration

- Play your world.
- You’ll notice that the teacher’s directions show up too quickly to read them.
- Click on more in the first teacher say line.
- Click on duration.
- You’ll notice that the default duration is 1 second.
- Click on other... and type in 3.
- Do the same for the other 4 teacher say lines.
Adding world variables

- Click on **world** in the object tree, and then go to the properties tab in its details panel.
- We want to record if the user clicks on the >, = or < objects.
- Click on create new variable.
- Type in **hasClicked** for the name and select **boolean** for the type.
- Change the value to **false**.
- Create another variable called **playerAnswer** of type **object** and leave the value as **<None>**.
Creating events

• Find the Events section in the top right corner box in Alice.

• Click create new event and select When the mouse is clicked on something.

• Change anything to greaterThan.

• Drag a pink Do Together from the bottom of the screen into the nothing.
• Drag `playerAnswer` from the world’s properties panel into the Do together.
• Select `set value`, and then select `greaterThan`.
• Next drag `hasClicked` from the properties panel into the Do together.
• Select `set value`, and then select `true`.
• We will now be able to tell if the > sign has been clicked.
Creating similar events

- Drag the entire blue “When mouse is clicked on greaterThan” box to the clipboard in the top right corner to make a copy.
- Now drag the clipboard to the line under the blue box. You should see 2 blue boxes now.
- Drag the clipboard to the line under the second blue box to get a 3rd box.
• In the second When mouse is clicked on box, change the two instances of `greaterThan` to equals.

• In the third box, change the two instances of `greaterThan` to `lessThan`.
Creating a checkAnswer method

• Click on world in the object tree and go to the methods panel.
• Click create new method and call it checkAnswer.
• This method will respond to the player’s answer.
Adding parameters

• It should take in 3 parameters: the number on the left side of the scale, the number on the right side of the scale, and the correct answer.

• Click on create new parameter at the top of the method.

• Name the parameter `leftObjectText`, click Other for the type, and then make sure that the type is String.

• Create a `rightObjectText` parameter the same way.

• Create a `correctAnswer` parameter of type Object.
Changing the objects on the scale

- Click on `leftObject` in the object tree, and go to its properties.
- Drag text from the properties panel into the method.
- Under `value` click `expressions`, and then `leftObjectText`.
- Click on more at the end of the line and select `duration, other...`, and then type in `0`.
- Do the same for `rightObject` and `rightObjectText`. 
Writing the rest of checkAnswer

• Drag `hasClicked` from the `world’s properties` panel into the method, and select set `value`, then `false`.
• Drag in a `Do together` from the bottom.
• Click on `leftObject` in the `object tree` and go to the `properties` panel.
• Drag `isShowing` into the `Do together` and set the value to `true`.
• Do the same for the `rightObject`. 
• Find the **teacher’s methods** panel and drag **teacher say** into the method.

• Under what, select **other** and type in “**Click on the correct answer.**”

• In the next line, make the teacher say “**Let’s see if you’re correct.**”
• We need to wait until the player clicks on something before we can decide if it’s correct.
• Find the green **While** at the bottom of the screen and drag it in between the two **teacher say** lines, and select **true**.
• Drag **hasClicked** from the world’s **properties** panel onto the **true**.
• Click on **world.hasClicked >> logic >> not hasClicked**.
• Now the world “Does nothing” until **greaterThan**, **equals**, or **lessThan** has been clicked.
Creating a helper method with parameters

• To prevent checkAnswer from getting too cluttered, let’s create a new method to check if the player’s answer is right.

• In the world’s methods panel, click create new method and name it checkAnswerHelper.

• Create a parameter of type object called correctAnswer.
Creating variables

• Since we’re going to be moving the >, =, and < signs around, we want to remember where their starting positions were.

• Create 2 new variables of type object: playerAnswerPosition and correctAnswerPosition.
If/Else Statements

• Drag in an If/else from the bottom and select true.

• Drag playerAnswer from the world’s properties panel into the true and select playerAnswer ==, and then select greaterThan.

• Drag playerAnswerPosition into the first Do nothing and select set value, greaterPosition.
• Drag an **If/Else statement** into the *Do nothing* and select **true**.

• Drag `playerAnswer` from the world’s properties panel into the **true**.

• Select `playerAnswer ==`, then **lessThan**.

• Drag `playerAnswerPosition` into the first *Do nothing* and select **set value >> equalsPosition**.

• Drag `playerAnswerPosition` into the last *Do nothing* and select **set value >> lessThanPosition**.
• Drag the huge **If/Else** statement onto the **clipboard**, and then drag the **clipboard** to the next line to copy/paste.

• By clicking on the **small arrows**, change `world.playerAnswer` to `correctAnswer` and `playerAnswerPosition` to `correctAnswerPosition` everywhere in the second huge **If/Else** statement.
Animating the scale

• Drag in `playerAnswer` from the `world`’s properties panel and select move to, `equationPosition`.

• Drag in an `If/Else` statement and select `true`.

• Drag `correctAnswer` into the `true` and select `correctAnswer ==`, then `greaterThan`.

![Diagram](image.png)
• Drag a **Do together** into the first **Do Nothing**.
• Click on **leftSide** in the **object tree** and find **leftSide move** in its methods panel.
• Drag **leftSide move** into the **Do Nothing** and select **down, ½ meter**.
• Do the same for **rightSide** but move it **up**.
• The reason we are moving these objects in opposite directions than you’d expect is that we turned them upside-down when we added them.
• Drag the **If** statement onto the **clipboard** and then into the *Do Nothing* to make a copy.

• Change **greaterThan** to **lessThan**, and switch the **up** and **down** commands.

• We don’t need to move the scale when the two sides are equal because they’re already balanced.
Congratulating if correct

• Drag in an If statement and select true.
• Drag correctAnswer onto the true and select correctAnswer ==, expressions, playerAnswer.
• Drag a Do together into the first Do Nothing.
• Find teacher say in the teacher’s methods panel, drag it in, and type “Good job!”
• Now go to the world’s properties tab, and drag playerAnswer into the Do together.
• Select set color then green.
Incrementing the score

• Find `scoreTracker` in the `world’s properties` panel and drag it after the `Do together`.
• Select `increment world.scoreTracker` by 1.
• Find `text` in the `score’s properties` panel and drag it below the `Do together`.
• Select `other` and type “Score: ”.
• Drag a joined with b in the `world’s functions` panel onto `Score:`. Select default string.
• Drag what as a string from `world’s methods` and onto default string, select expressions, `scoreTracker`. 
Correcting the player if incorrect

• Drag a Do together into the Else’s Do Nothing.
• Drag teacher say into the new Do Nothing, select other, and type “That is incorrect.”
• Find playerAnswer in world’s properties panel and select world.playerAnswer set color to, and select red.
• Below the Do together, drag teacher say.
• Select other and type “Here is the correct answer.”
• Find playerAnswer in the world’s properties panel and select world.playerAnswer move to, then expressions, then playerAnswerPosition.

• Below that drag in the parameter correctAnswer, world.checkAnswerHelper.correctAnswer move to, then equationPosition.

• Then drag in correctAnswer, then select set color to, then green.
Moving the scales back

- Scroll up to find the **If/Else** statement that begins with **If correctAnswer == greaterThan** and moves the scales.
- Drag that whole **If/Else** onto the **clipboard** to make a copy and the drag the **clipboard** to the bottom of the method.
- Switch all of the **ups** and **downs**.
Resetting the answer signs

• At the bottom of the method drag in the parameter `correctAnswer`, select `move to` >> `expressions` >> `correctAnswerPosition`.

• Drag in a `Do together`.

• Find `greaterThan`’s properties tab and drag `color` into the `Do together`, and select `no color`.

• Do the same for `lessThan` and `equals`.
Connecting `checkAnswer` and `checkAnswerHelper`

- Open the `checkAnswer` method and scroll to the bottom.
- Drag in `correctAnswerHelper` from world’s methods panel and select `expressions`, and then `correctAnswer`.
- After the helper checks if the answer is correct, we want the objects on the scale to be invisible again.
- Find the `Do together` from a few lines up, drag it to the clipboard, and then drag it to the bottom of the method.
- Change `true` to `false` in both lines.
Creating examples

• In the world’s method pane, click create new method, and name it examples.
• Drag in checkAnswer from world’s methods, and select default string, default string, and <None> for the parameters right now.
• Change leftObjectText to 15, rightObjectText to 20.
• What is the correct answer? Put in greaterThan, lessThan, or equals into correctAnswer. You decide.
Add these examples the same way:

<table>
<thead>
<tr>
<th>leftObject</th>
<th>rightObject</th>
<th>correctAnswer</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.90</td>
<td>3.9</td>
<td>greaterThan, lessThan, or equals</td>
</tr>
<tr>
<td>10-3</td>
<td>5+4</td>
<td>greaterThan, lessThan, or equals</td>
</tr>
<tr>
<td>8*8</td>
<td>9*7</td>
<td>greaterThan, lessThan, or equals</td>
</tr>
<tr>
<td>4/7</td>
<td>19/35</td>
<td>greaterThan, lessThan, or equals</td>
</tr>
<tr>
<td>4/3</td>
<td>1.4</td>
<td>greaterThan, lessThan, or equals</td>
</tr>
<tr>
<td>4-7</td>
<td>-18/7</td>
<td>greaterThan, lessThan, or equals</td>
</tr>
</tbody>
</table>

Add in your own example! Add in your own example! greaterThan, lessThan, or equals
Finishing the world!

- Open **my first method**, and scroll to the bottom.
- Drag in **examples** from the **world’s methods** panel.
- Drag in an **If/Else** statement and select **true**.
- Find **scoreTracker** from the **world’s properties** and drag it onto the **true**.
- Select **scoreTracker <=**, then **other**, then type **4**.
• Drag in teacher say into the first *Do Nothing* and select default string (we’ll change this later).
• Drag a joined with b from world’s functions onto default string and select default string again.
• Drag another a joined with b onto the second default string.
• Change the first default string to “You got: ”.
• Drag what as a string from world’s functions onto the second default string and select expressions, and then *world.scoreTracker*.
• In the last default string, type “/7 correct. You should work on your math facts.”

• Drag an If/Else statement into the *Do Nothing* and select *true*.

• Drag *scoreTracker* onto the *true*, select *scoreTracker <=* and then *other*, and type in 6.

• Make two copies of the long *teacher say line* and move each into a *Do Nothing*. 
• In the first one, change You should work on your math facts. to Great job!
• In the second one, change it to Perfect!
• If you added in your own examples and there are more than 7, change the “/7” accordingly. Change the 4 to about half of the total number of examples, and the 6 should be the total minus 1.
Finished!!
Play the world!