Ray Wenderlich para mim 6 de ago

José, welcome back to the **raywenderlich.com iOS Apprentice Email Course**!

OK, so you have made quite a bit of progress on the game and the to-do list is getting ever shorter :] So what's next on the list now that you can generate a random number and display it on screen?

A quick look at the task list shows that you now have to "compare the value of the slider to that random number and calculate a score based on how far off the player is". Let's get to it!

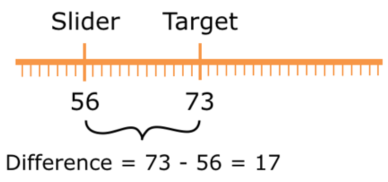
> **Note:** Prefer learning via video? You might like to check out videos #19-21 of the free video version of this course, which correspond to this email.

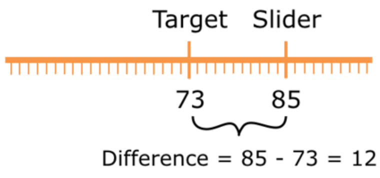
Get the difference

Now that you have both the target value (the random number) and a way to read the slider's position, you can calculate how many points the player scored.

The closer the slider is to the target, the more points for the player.

To calculate the score for each round, you look at how far off the slider's value is from the target:





A simple approach to finding the distance between the target and the slider is to subtract `currentValue` from `targetValue`.

Unfortunately, that gives a negative value if the slider is to the right of the target because now `currentValue` is greater than `targetValue`.

You need some way to turn that negative value into a positive value – or you end up subtracting points from the player's score (unfair!).

Doing the subtraction the other way around – `currentValue` minus `targetValue` – won't always solve things either because then, the difference will be negative if the slider is to the left of the target instead of the right.

Hmm, it looks like we're in trouble here…

And with that, it's time for a challenge!

How would you frame the solution to this problem if I asked you to solve it in natural language? Don't worry about how to express it in computer language for now, just think it through in plain English.

Challenge: If you haven't already, stop reading this email and write down how to solve this problem in plain English. If you'd like to compare what you wrote with ours, stop by the discussion thread on our forums. We'd love to see what you came up with! :]

Algorithms

What you've just done is come up with an **algorithm**, which is a fancy term for a series of steps for solving a computational problem. This is only a very simple algorithm, but it is one nonetheless.

There are many famous algorithms, such as **quicksort** for sorting a list of items and **binary search** for quickly searching through such a sorted list. Other people have already invented many algorithms that you can use in your own programs - that'll save you a lot of thinking!

However, in the programs that you write, you'll probably have to come up with a few algorithms of your own at some time or other. Some are simple such as the one above; others can be pretty hard and might cause you to throw up your hands in despair. But that's part of the fun of programming :]

The academic field of Computer Science concerns itself largely with studying algorithms and finding better ones.

You can describe any algorithm in plain English. It's just a series of steps that you perform to calculate something. Often, you can perform that calculation in your head or on paper, the way you did above. But for more complicated algorithms doing that might take you forever, so at some point you'll have to convert the algorithm to computer code.

The point I'm trying to make is this: if you ever get stuck and you don't know how to make your program calculate something, take a piece of paper and try to write out the steps in English. Set aside the computer for a moment and think the steps through. How you would perform this calculation by hand?

Once you know how to do that, converting the algorithm to code should be a piece of cake.

The difference algorithm

It is possible you came up with a different way to solve this little problem, and I'll show you two alternatives later, but let's convert this one to computer code first:

```swift
var difference: Int
if currentValue > targetValue {
  difference = currentValue - targetValue
} else if targetValue > currentValue {
  difference = targetValue - currentValue
} else {
  difference = 0
}
```

The `if` construct is new. It allows your code to make decisions and it works much like you would expect from English. Generally, it works like this:

```
if something is true {
  then do this
} else if something else is true {
  then do that instead
} else {
  do something when neither of the above are true
}
```

Basically, you put a **logical condition** after the `if` keyword. If that condition turns out to be true, for example `currentValue` is greater than `targetValue`, then the code in the block between the `{ }` brackets is executed.

However, if the condition is not true, then the computer looks at the `else if` condition and evaluates that. There may be more than one `else if`, and it tries them one by one from top to bottom until one proves to be true.

If none of the conditions are found to be valid, then the code in the `else` block is executed.

In the implementation of this little algorithm, you first create a local variable named `difference` to hold the result. This will either be a positive whole number or zero, so an `Int` will do:

```
var difference: Int
```

Then you compare the `currentValue` against the `targetValue`. First, you determine if `currentValue` is greater than `targetValue`:

```
if currentValue > targetValue {
```

The > is the **greater-than** operator. The condition `currentValue > targetValue` is considered true if the value stored in the `currentValue` variable is at least one higher than the value stored in the `targetValue` variable. In that case, the following line of code is executed:

```
  difference = currentValue - targetValue
```

Here you subtract `targetValue` (the smaller one) from `currentValue` (the larger one) and store the difference in the `difference` variable.

Notice how I chose variable names that clearly describe what kind of data the variables contain. Often you will see code such as this:

```
a = b - c
```

It is not immediately clear what this is supposed to mean, other than that some arithmetic is taking place. The variable names “a”, “b” and “c” don’t give any clues as to their intended purpose or what kind of data they might contain.

Back to the `if` statement. If `currentValue` is equal to or less than `targetValue`, the condition is untrue (or **false** in computer-speak) and the program will skip the code block and move on to the next condition:

```
} else if targetValue > currentValue {
```

The same thing happens here as before, except that now the roles of `targetValue` and `currentValue` are reversed. The computer will only execute the following line when `targetValue` is the greater of the two values:

```
  difference = targetValue - currentValue
```

This time you subtract `currentValue` from `targetValue` and store the result in the `difference` variable.

There is only one situation you haven’t handled yet, and that is when `currentValue` and `targetValue` are equal. If this happens, the player has put the slider exactly at the position of the target random number, a perfect score.

In that case the difference is 0:

```
} else {
  difference = 0
}
```

Since at this point you’ve already determined that one value is not greater than the other, nor is it smaller, you can only draw one conclusion: the numbers must be equal.

Display the difference

Let’s put this algorithm into action.

To start, open up the Bull's Eye project where you left it off last time (or download the starter project from the corresponding forum discussion thread).

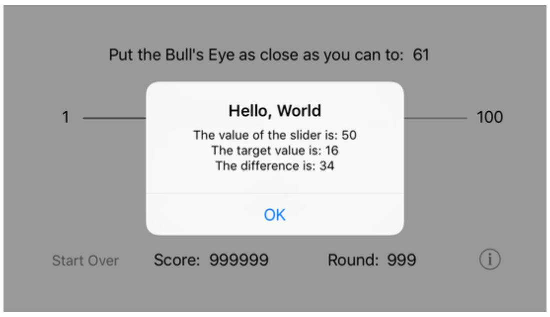
Open up **ViewController.swift**, and add this to the top of `showAlert()`:

```
@IBAction func showAlert() {
  var difference: Int
  if currentValue > targetValue {
    difference = currentValue - targetValue
  } else if targetValue > currentValue {
    difference = targetValue - currentValue
  } else {
    difference = 0
  }

  let message = "The value of the slider is: \(currentValue)" +
                "\nThe target value is: \(targetValue)" +
                "\nThe difference is: \(difference)"
  . . .
}
```

Just so you can see that it works, you add the `difference` value to the alert message as well.

➤ Run it and see for yourself.



The value of the slider is: 50
The target value is: 16
The difference is: 34

Nice! Hopefully you are better at this game than I am. :]

- Ray

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