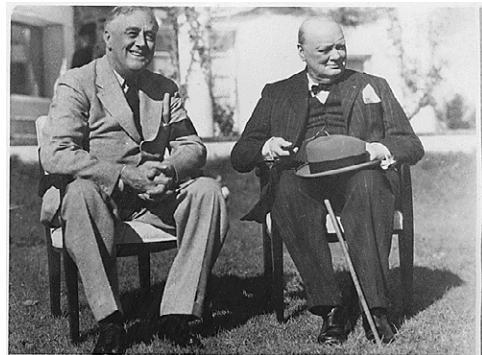


Presidents Quiz

The Presidents Quiz is a trivia game about former leaders of the United States. Though this quiz is about presidents, you can use it as a template to build quizzes on any topic.

In the previous chapters, you've been introduced to some fundamental programming concepts. Now you're ready for something more challenging. You'll find that this chapter requires a conceptual leap in terms of programming skills and abstract thinking. In



particular, you'll use two list variables to store the data—in this case, the quiz questions and answers—and you'll use an index variable to track where the user is in the quiz. When you finish, you'll be armed with the knowledge to create quiz apps and many other apps that require list processing.

This chapter assumes you're familiar with the basics of App Inventor: using the Component Designer to build the user interface, and using the Blocks Editor to specify event handlers and program the component behavior. If you are not familiar with these fundamentals, be sure to review the previous chapters before continuing.

You'll design the quiz so that the user proceeds from question to question by clicking a Next button and receives feedback on whether each answer he inputs is correct or incorrect.

What You'll Learn

This app, shown in Figure 8-1, covers:

- Defining list variables for storing the questions and answers in lists.
- Sequencing through a list using an index; each time the user clicks Next, you'll display the next question.

- Using conditional (if) behaviors: performing certain operations only under specific conditions. You'll use an **if** block to handle the app's behavior when the user reaches the end of the quiz.
- Switching an image to show a different picture for each quiz question.



Figure 8-1. The Presidents Quiz running in the emulator

Getting Started

Connect to the App Inventor website and start a new project. Name it "PresidentsQuiz" and set the screen's title to "Presidents Quiz". Open the Blocks Editor and connect to the phone. Also download the pictures for the quiz from the book's site (<http://examples.oreilly.com/0636920016632/>) onto your computer: *roosChurch.gif*, *nixon.gif*, *carterChina.gif*, and *atomic.gif*. You'll load these images into your project in the next section.

Designing the Components

The Presidents Quiz app has a simple interface for displaying the question and allowing the user to answer. You can build the components from the snapshot of the Component Designer shown in Figure 8-2.

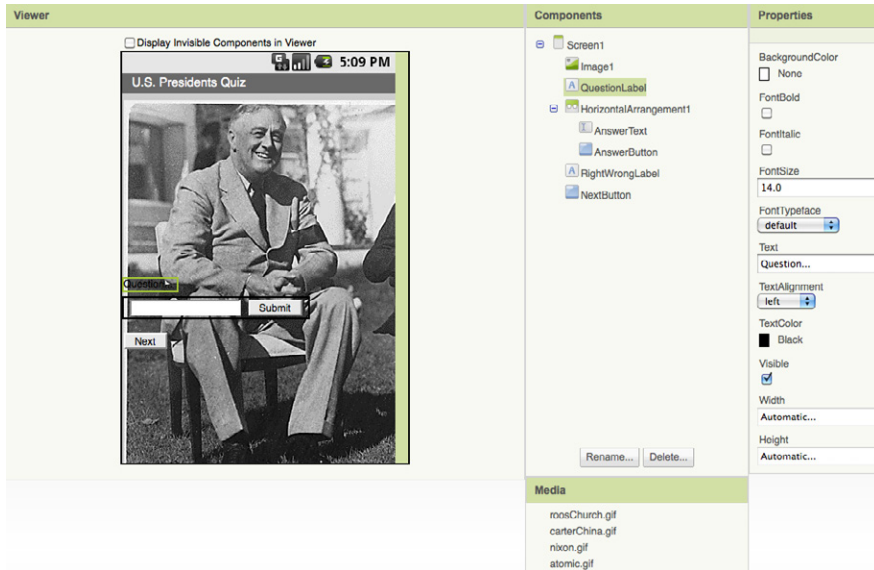


Figure 8-2. The Presidents Quiz in the Designer

To create this interface, first load the images you downloaded into the project. Click Add in the Media area and select one of the downloaded files (e.g., *roosChurch.gif*). Do the same for the other three images. Then add the components listed in Table 8-1.

Table 8-1. Components for the Presidents Quiz app

Component type	Palette group	What you'll name it	Purpose
Image	Basic	Image1	The picture displayed with the question.
Label	Basic	QuestionLabel	Display the current question.
Horizontal Arrangement	Screen Arrange-ment	Horizontal Arrangement1	Organize the AnswerPrompt and Text.
TextBox	Basic	AnswerText	The user will enter his answer here.
Button	Basic	AnswerButton	The user clicks this to submit an answer.
Label	Basic	RightWrongLabel	Display "correct!" or "incorrect!"
Button	Basic	NextButton	The user clicks this to proceed to the next question.

Set the properties of the components as follows:

1. Set Image1.Picture to the image file *roosChurch.gif*, the first picture that should appear. Set its Width to "Fill parent" and its Height to 200.
2. Set QuestionLabel.Text to "Question..." (you'll input the first question in the Blocks Editor).
3. Set AnswerText.Hint to "Enter an answer". Set its Text property to blank. Move it into HorizontalArrangement1.

4. Change `AnswerButton.Text` to “Submit” and move it into `HorizontalArrangement1`.
5. Change `NextButton.Text` to “Next”.
6. Change `RightWrongLabel.Text` to blank.

Adding Behaviors to the Components

You’ll need to program the following behaviors:

- When the app starts, the first question appears, including its corresponding image.
- When the user clicks the `NextButton`, the second question appears. When he clicks it again, the third question appears, and so on.
- When the user reaches the last question and clicks the `NextButton`, the first question should appear again.
- When the user answers a question, the app will report whether it is correct or not.

To start, you’ll define two list variables based on the items listed in Table 8-2: `QuestionList` to hold the list of questions, and `AnswerList` to hold the list of corresponding answers. Figure 8-3 shows the two lists you’ll create in the Blocks Editor.

Table 8-2. Variables for holding question and answer lists

Block type	Drawer	Purpose
def variable (“QuestionList”)	Definitions	Store the list of questions (rename it <code>QuestionList</code>).
def variable (“AnswerList”)	Definitions	Store the list of answers (rename it <code>AnswerList</code>).
make a list	Lists	Insert the items of the <code>QuestionList</code> .
text (three of them)	Text	The questions.
make a list	Lists	Insert the items of the <code>AnswerList</code> .
text (three of them)	Text	The answers.

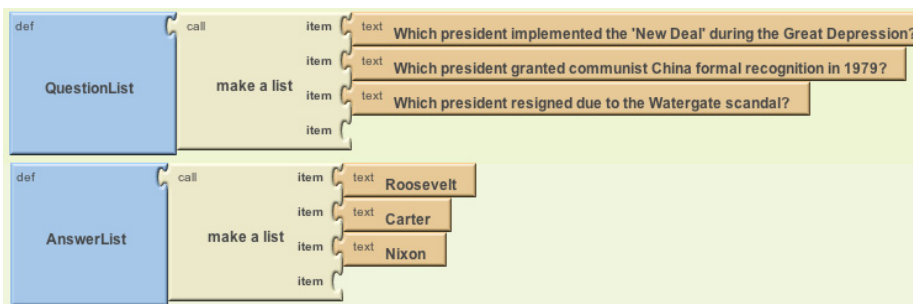


Figure 8-3. The lists for the quiz

Defining the Index Variable

The app needs to keep track of the current question as the user clicks the `NextButton` to proceed through the quiz. You'll define a variable named `currentQuestionIndex` for this, and the variable will serve as the index into both the `QuestionList` and `AnswerList`. Table 8-3 lists the blocks you'll need to do this, and Figure 8-4 shows what that variable will look like.

Table 8-3. Creating the index

Block type	Drawer	Purpose
def variable ("currentQuestionIndex")	Definitions	Hold the index (position) of the current question/answer.
number (1)	Math	Set the initial value of <code>currentQuestionIndex</code> to 1 (the first question).



Figure 8-4. Initiating the index blocks with a value of 1

Displaying the First Question

Now that you've defined the variables you need, you can specify the app's interactive behavior. As with any app, it's important to work incrementally and define one behavior at a time. To start, let's think only about the questions—specifically, displaying the first question in the list when the app launches. We'll come back and deal with the images a bit later.

You want your code blocks to work regardless of the specific questions that are in the list. That way, if you decide to change the questions or create a new quiz by copying and modifying this app, you'll only need to change the actual questions in the list definitions, and you won't need to change any event handlers.

So, for this first behavior, you don't want to refer directly to the first question, "Which president implemented the 'New Deal' during the Great Depression?" Instead, you want to refer, abstractly, to the first *slot* in the `QuestionList` (regardless of the specific question there). That way, the blocks will still work even if you modify the question in that first slot.

You select particular items in a list with the **select list item** block. The block asks you to specify the list and an index (a position in the list). If a list has three items, you can enter 1, 2, or 3 as the index.

For this first behavior, when the app launches, you want to select the first item in `QuestionList` and place it in the `QuestionLabel`. As you'll recall from the "Android, Where's My Car?" app in Chapter 7, if you want something to happen when your app launches, you program that behavior in the **Screen1.Initialize** event handler using the blocks listed in Table 8-4.

Table 8-4. Blocks to load the initial question when the app starts

Block type	Drawer	Purpose
Screen1.Initialize	Screen1	Event handler triggered when the app begins.
set QuestionLabel.Text to	QuestionLabel	Put the first question in QuestionLabel.
select list item	Lists	Select the first question from QuestionList.
Global QuestionList	My Definitions	The list to select questions from.
number (1)	Math	Select the first question by using an index of 1.

How the blocks work

The **Screen1.Initialize** event is triggered when the app begins. As shown in Figure 8-5, the first item of the variable `QuestionList` is selected and placed into `QuestionLabel.Text`. So, when the app begins, the user will see the first question.

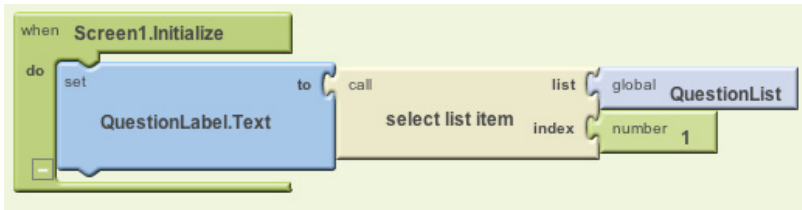


Figure 8-5. Selecting the first question



Test your app. Plug in your phone to the computer or click “New emulator” to open an Android emulator, and then click “Connect to Device.” When your app loads, do you see the first item of `QuestionList`, “Which president implemented the ‘New Deal’ during the Great Depression?”

Iterating Through the Questions

Now program the behavior of the `NextButton`. You’ve already defined the current `QuestionIndex` to remember which question the user is on. When the user clicks the `NextButton`, the app needs to *increment* (add one to) the current `QuestionIndex` (i.e., change it from 1 to 2 or from 2 to 3, and so on). You’ll then use the resulting value of `currentQuestionIndex` to select the new question to display.

As a challenge, see if you can build these blocks on your own. When you’re finished, compare your results against Figure 8-6.

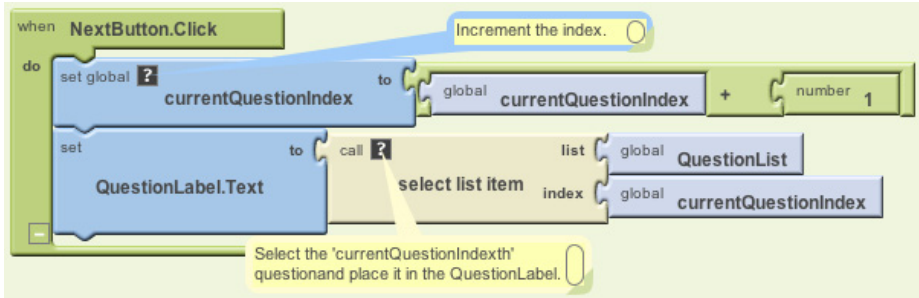


Figure 8-6. Moving to the next question

How the blocks work

The first row of blocks increments the variable `currentQuestionIndex`. If `currentQuestionIndex` has a 1 in it, it is changed to 2. If it has a 2, it is changed to 3, and so on. Once the `currentQuestionIndex` variable has been changed, the app uses it to select the new question to display.

When the user clicks `NextButton` for the first time, the increment blocks will change `currentQuestionIndex` from 1 to 2, so the app will select the second item from `QuestionList`, “Which president granted communist China formal recognition in 1979?” The second time `NextButton` is clicked, `currentQuestionIndex` will be set from 2 to 3, and the app will select the third question in the list, “Which president resigned due to the Watergate scandal?”



Note. Take a minute to compare the blocks of `NextButton.Click` to those in the `Screen.Initialize` event handler. In the `Screen.Initialize` blocks, the app used `select list item` with a concrete number (1) to select the list item. In these blocks, you’re selecting the list item using a variable as the index. The app doesn’t choose the first item in the list, or the second or third; it chooses the `currentQuestionIndex`th item, and thus a different item will be selected each time the `NextButton` is clicked. This is a very common use for an index—incrementing its value to find and display items in a list.

The problem with the app is that it simply increments to the next question each time without any concern for the end of the quiz. When `currentQuestionIndex` is already 3 and the user clicks the `NextButton`, the app changes `currentQuestionIndex` from 3 to 4. It then calls `select list item` to get the `currentQuestionIndex`th item—in this

case, the fourth item. Since there are only three items in the variable `QuestionList`, the Android device doesn't know what to do and forces the app to quit. So how can we let the app know that it has reached the end of the quiz?



Test your app. *Test the behavior of the `NextButton` to see if the app is working correctly. Click the `NextButton` on the phone. Does the phone display the second question, “Which president granted communist China formal recognition in 1979?” It should, and the third question should appear when you click the `NextButton` again. But if you click again, you should see an error: “Attempting to get item 4 of a list of length 3.” The app has a bug! Do you know what the problem is? Try figuring it out before moving on.*

The app needs to ask a question when the `NextButton` is clicked, and execute different blocks depending on the answer. Since you know your app contains three questions, one way to ask the question would be, “Is the variable `currentQuestionIndex` greater than 3?” If the answer is yes, you should set `currentQuestionIndex` back to 1 so the user is taken back to the first question. The blocks you'll need for this are listed in Table 8-5.

Table 8-5. Blocks for checking the index value for the end of the list

Block type	Drawer	Purpose
if	Control	Figure out if the user is on the last question.
=	Math	Test if <code>currentQuestionIndex</code> is 3.
global <code>currentQuestionIndex</code>	My Definitions	Put this into the left side of = .
number 3	Math	Put this into the right side of = since 3 is the number of items in the list.
set global <code>currentQuestionIndex</code> to	My Definitions	Set to 1 to revert to the first question.
number 1	Math	Set the index to 1.



Test your app. Because variables like `currentQuestionIndex` aren't visible when you run an app, they are often the source of bugs in a program. Fortunately, App Inventor provides a way to “watch” variables during testing. Specifically, you can right-click a **def variable** block and select Watch, and a little box will appear, showing the value of the variable. In this case, right-click the **def currentQuestionIndex** definition to watch it. Then click on the “Connect to Device...” button in the Blocks Editor to restart the app. The **def currentQuestionIndex** block will appear with a watch box displaying the initial value of `currentQuestionIndex` (1), as shown in Figure 8-8.

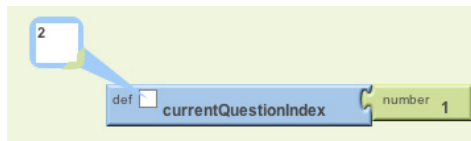


Figure 8-8. Watching a variable while testing your app

Now pick up the phone and click the `NextButton`. The second question, “Which president granted communist China formal recognition in 1979?” should appear in the `QuestionLabel` on the phone, as before. On the App Inventor screen, a 2 should appear in the `currentQuestionIndex` watch box, as shown in Figure 8-9.

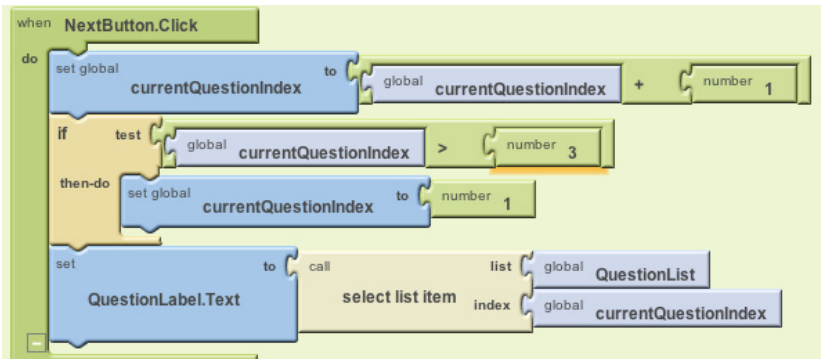


Figure 8-9. Confirming that the index is incrementing

When you click again, the third question should appear on the phone and a 3 should appear in the watch box. Now for the behavior you're really testing: if you click again, you should see 1 in `currentQuestionIndex`, and the first question (“Which president implemented the ‘New Deal’ during the Great Depression?”) should appear on the phone.

When the user clicks the NextButton, the app increments the index as it did before. But then, as shown in Figure 8-7, it checks to see if `currentQuestionIndex` is larger than 3, the number of questions. If it is larger than 3, `currentQuestionIndex` is set back to 1, and the first question is displayed. If it is 3 or less, the blocks within the **if** block are not performed, and the current question is displayed as usual.

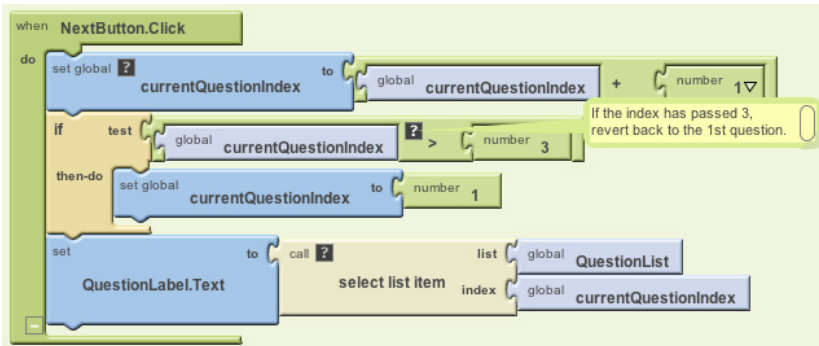


Figure 8-7. Checking if the last (third) question has been reached

Making the Quiz Easy to Modify

If your blocks for the NextButton work, pat yourself on the back—you are on your way to becoming a programmer! But what if you added a new question (and answer) to the quiz? Would your blocks still work?

To explore this, first add a fourth question to `QuestionList` and a fourth answer into `AnswerList`, as shown in Figure 8-10.

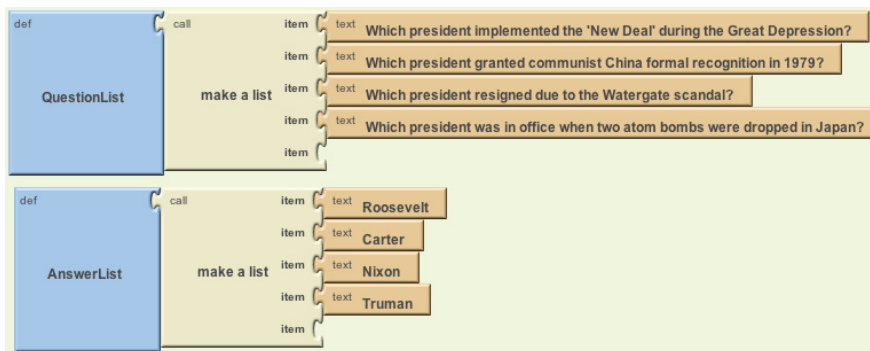


Figure 8-10. Adding an item to both lists



Test your app. Click the `NextButton` several times. You'll notice that the fourth question never appears, no matter how many times you click `Next`.

Do you know what the problem is? Before reading on, see if you can fix the blocks so the fourth question appears.

The problem is that the test to determine whether the user is on the last question is too specific; it asks if the `currentQuestionIndex` variable is 3. You could just change the number 3 to a 4, and the app would work correctly again. The problem with that solution, however, is that each time you modify the questions and answers, you also have to remember to make this change. Such dependencies in a computer program often lead to bugs, especially as an app grows in complexity.

A much better strategy is to design the blocks so that they will work no matter how many questions there are. Such generality makes it easier if you, as a programmer, want to customize your quiz for some other topic. It is also essential if the list you are working with changes dynamically—for example, think of a quiz app that allows the user to add new questions (you'll build this in Chapter 10).

For a program to be more general, it can't refer to concrete numbers like 3, as that only works for quizzes of three questions. So, instead of asking if the value of `currentQuestionIndex` is larger than the specific number 3, ask if it is as large as the *number of items* in `QuestionList`. If the app asks this more general question, it will work even when you add to or remove items from the `QuestionList`. So modify the **NextButton.Click** event handler to replace the previous test that referred directly to 3. You'll need the blocks listed in Table 8-6.

Table 8-6. Blocks to check the length of the list

Block type	Drawer	Purpose
length of list	Lists	Ask how many items are in <code>QuestionList</code> .
global Question List	My Definitions	Put this into the "list" slot of length of list .

How the Blocks Work

The **if** test now compares the `currentQuestionIndex` to the length of the `QuestionList`, as shown in Figure 8-11. So, if `currentQuestionIndex` is 5, and the length of the `QuestionList` is 4, then the `currentQuestionIndex` will be set back to 1. Note that, because the blocks no longer refer to 3 or any specific number, the behavior will work no matter how many items are in the list.

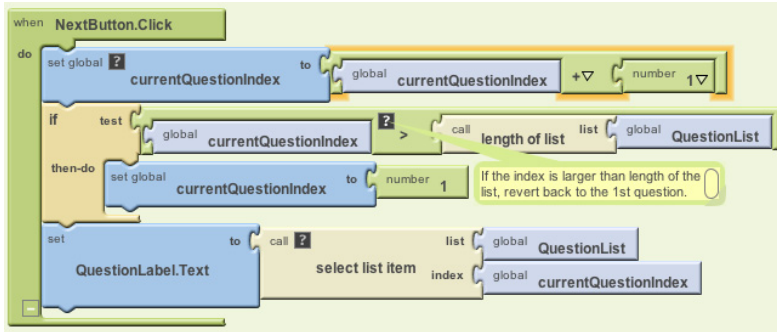


Figure 8-11. Checking for the end of the list in a generic way



Test your app. When you click the `NextButton`, does the app now cycle through the four questions, moving to the first one after the fourth?

Switching the Image for Each Question

Now that you've programmed all the behaviors for moving through the questions (and you've made your code smarter and more flexible by making it more *abstract*), let's get the images working properly, too. Right now, the app shows the same image no matter what question is being asked. You can change this so an image pertaining to each question appears when the user clicks the `NextButton`. Earlier, you added four pictures as media for the project. Now, you'll create a third list, `PictureList`, with the image filenames as its items. You'll also modify the `NextButton.Click` event handler to switch the picture each time, just as you switch the question text each time. (If you're already thinking about using the `currentQuestionIndex` here, you're on the right track!)

First, create a `PictureList` and initialize it with the names of the image files. Be sure that the names are exactly the same as the filenames you loaded into the Media section of the project. Figure 8-12 shows how the blocks for the `PictureList` should look.

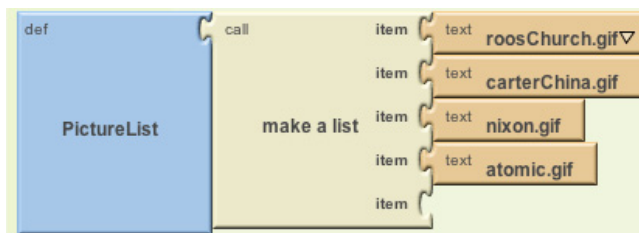


Figure 8-12. The `PictureList` with image filenames as items

Next, modify the **NextButton.Click** event handler so that it changes the picture that appears depending on the question index. The **Image.Picture** property is used to change the picture displayed. To modify **NextButton.Click**, you'll need the blocks listed in Table 8-7.

Table 8-7. Blocks to add the image that accompanies the question

Block type	Drawer	Purpose
set Image1.Picture to	Image1	Set this to change the picture.
select list item	Lists	Select the picture corresponding to the current question.
global PictureList	My Definitions	Select a filename from this list.
global current QuestionIndex	My Definitions	Select the <i>currentQuestionIndex</i> th item.

How the Blocks Work

The *currentQuestionIndex* serves as the index for both the *QuestionList* and the *PictureList*. As long as you've set up your lists properly such that the first question corresponds to the first picture, the second to the second, and so on, the single index can serve both lists, as shown in Figure 8-13. For instance, the first picture, *roosChurch.gif*, is a picture of President Franklin Delano Roosevelt (sitting with British Prime Minister Winston Churchill), and "Roosevelt" is the answer to the first question.

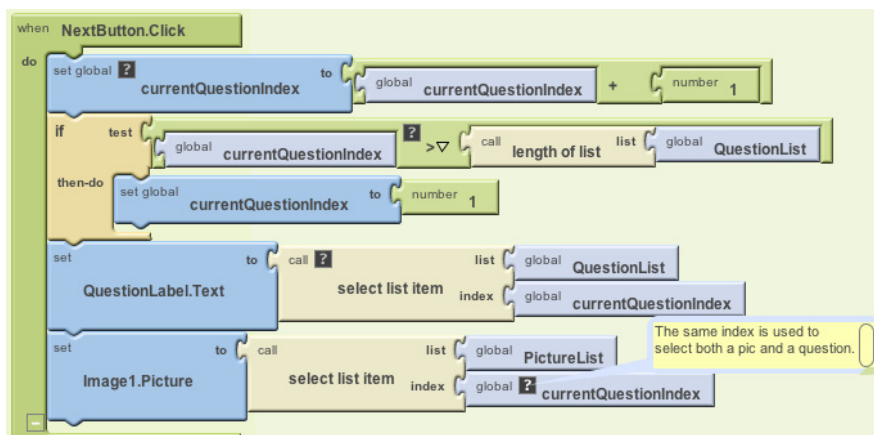


Figure 8-13. Selecting the *currentQuestionIndex*th picture each time



Test your app. Click next a few times. Now does a different image appear each time you click the NextButton?

Checking the User's Answers

Thus far, we've created an app that simply cycles through questions and answers (paired with an image of the answer). It's a great example of apps that use lists, but to be a true quiz app, it needs to give users feedback on whether they're right or wrong. So now let's add blocks that report whether the user has answered a question correctly or not. Our interface is set up so the user enters her answer in `AnswerText` and then clicks the `AnswerButton`. The app must compare the user's entry with the answer to the current question, using an **ifelse** block to check. The `RightWrongLabel` should then be modified to report whether or not the answer is correct. There are quite a few blocks needed to program this behavior, all of which are listed in Table 8-8.

Table 8-8. Blocks for indicating whether an answer is correct or not

Block type	Drawer	Purpose
AnswerButton.Click	AnswerButton	Triggered when the user clicks the AnswerButton.
ifelse	Control	If the answer is correct, do one thing; otherwise, do another.
text=	text	Ask if the answer is correct.
AnswerText.Text	AnswerText	Contains the user's answer.
select list item	Lists	Select the current answer from AnswerList.
global AnswerList	My Definitions	The list to select from.
global currentQuestion Index	My Definitions	The question (and answer) number the user is on.
set RightWrongLabel .Text to	RightWrongLabel	Report the answer here.
text ("correct!")	Text	Display this if the answer is right.
set RightWrongLabel .Text to	RightWrongLabel	Report the answer here.
text ("incorrect!")	Text	Display this if the answer is wrong.

How the Blocks Work

As shown in Figure 8-14, the **ifelse** test asks whether the answer the user entered (**AnswerText.Text**) is equal to the `currentQuestionIndex`th item in the `AnswerList`. If `currentQuestionIndex` is 1, the app will compare the user's answer with the first item in `AnswerList`, "Roosevelt." If `currentQuestionIndex` is 2, the app will compare the user's answer with the second answer in the list, "Carter," and so on. If the test result is positive, the "then-do" blocks are executed and the `RightWrongLabel` is set to "correct!" If the test is false, the "else-do" blocks are executed and the `RightWrongLabel` is set to "incorrect!"

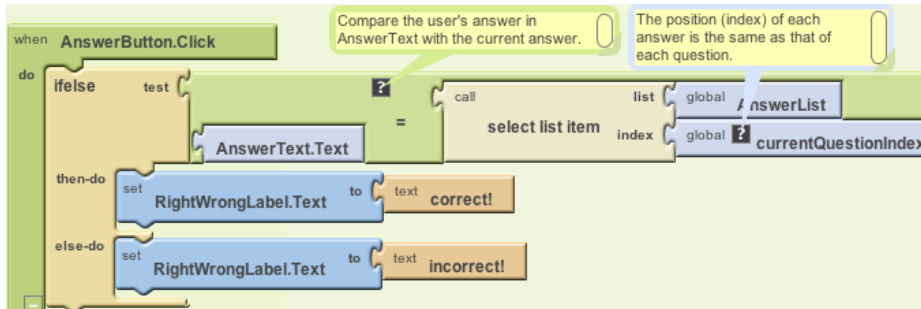


Figure 8-14. Checking the answer



Test your app. Try answering one of the questions. It should report whether or not you answered the question exactly as specified in the AnswerList. Test with both a correct and incorrect answer. You'll likely notice that for an answer to be marked as correct, it has to be an exact match (meaning case-specific and including any punctuation or spaces) to what you entered in the AnswerList. Be sure to also test that things work on successive questions.

The app should work, but you might notice that when you click the NextButton, the “correct!” or “incorrect!” text and the previous answer are still there, as shown in Figure 8-15, even though you’re looking at the next question. It’s fairly innocuous, but your app users will definitely notice such user interface issues.

To blank out the RightWrongLabel and the AnswerText, you’ll put the blocks listed in Table 8-9 within the **NextButton.Click** event handler.

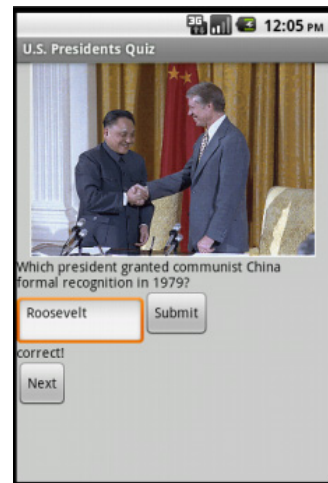


Figure 8-15. The first answer and “correct!” still appear when user moves to the next question.

Table 8-9. Blocks to clear the RightWrongLabel

Block type	Drawer	Purpose
set RightWrongLabel.Text to	RightWrongLabel	This is the label to blank out.
text ("")	Text	When the user clicks NextButton, erase the previous answer's feedback.
set AnswerText.Text to	AnswerText	The user's answer from the previous question.
text ("")	Text	When the user clicks the NextButton, erase the previous answer.

How the Blocks Work

As shown in Figure 8-16, when the user clicks the NextButton, he is moving on to the next question, so the top two rows of the event handler blank out the RightWrongLabel and the AnswerText.

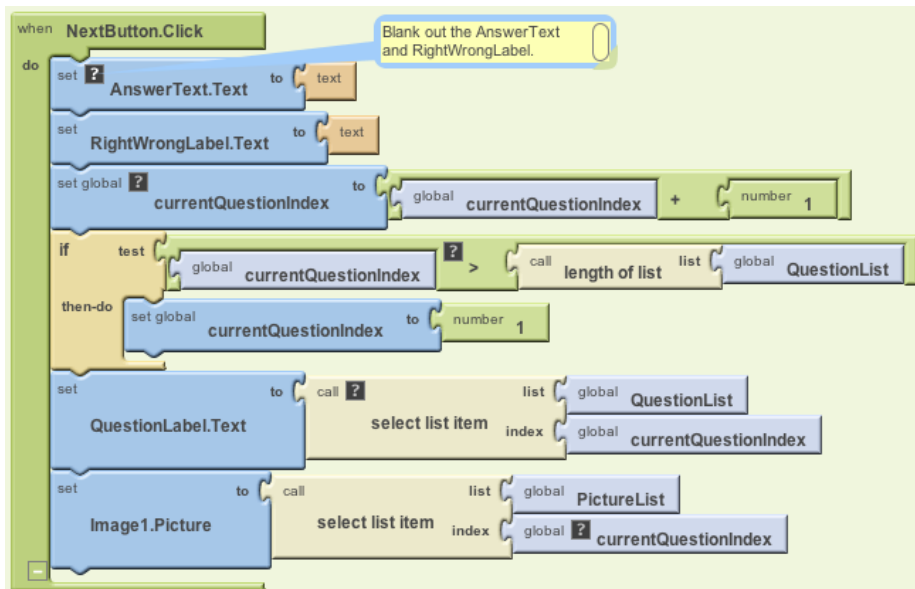


Figure 8-16. Blanking out the answer and correct/incorrect label for the next question



Test your app. Answer a question and click "Submit", then click the NextButton. Did your previous answer and its feedback disappear?

The Complete App: The Presidents Quiz

Figure 8-17 shows the final block configuration for the Presidents Quiz.

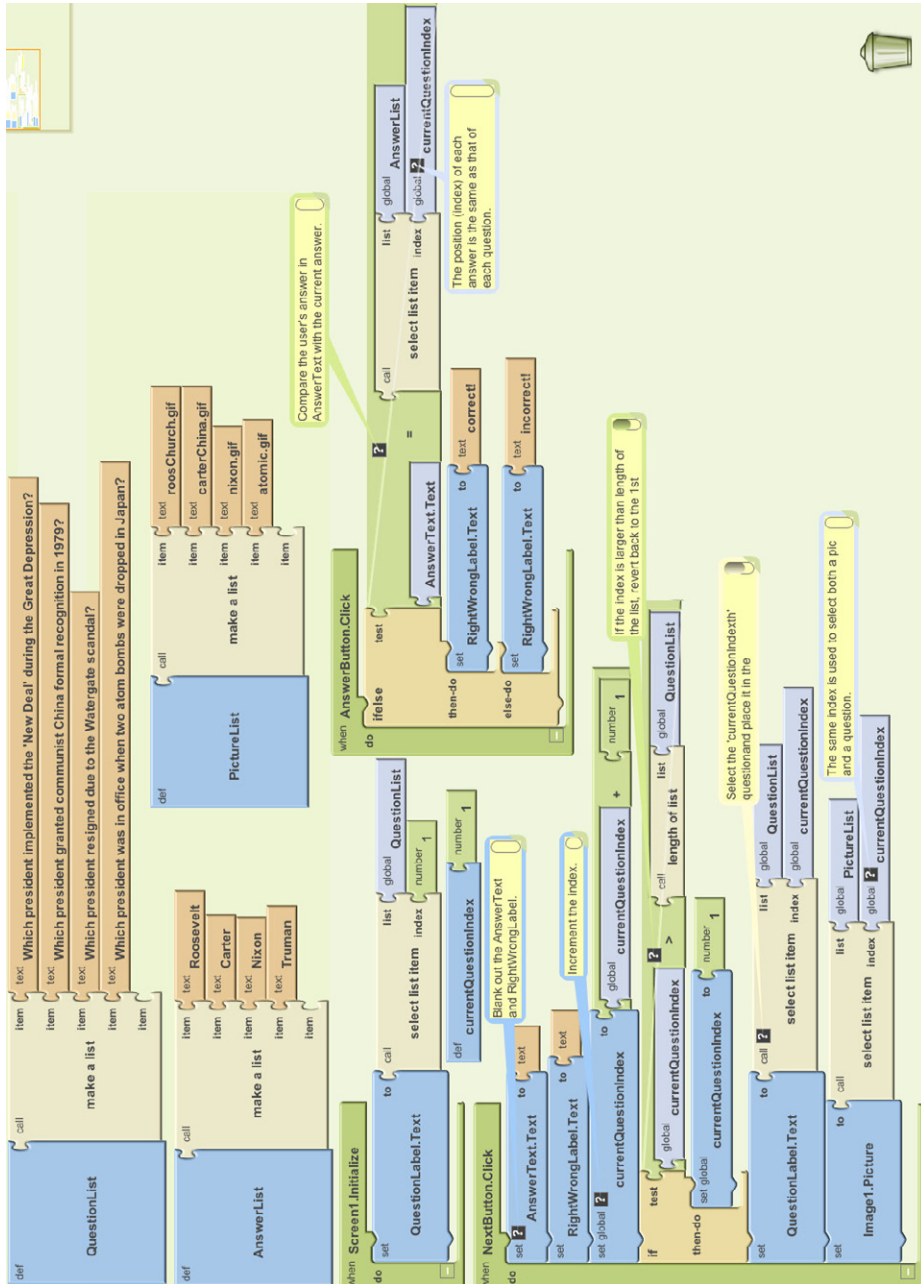


Figure 8-17. The blocks for the Presidents Quiz

Variations

Once you get this quiz working, you might want to explore some variations. For example:

- Instead of just showing images for each question, try playing a sound clip or a short video. With sound, you can turn your quiz into a Name That Tune app.
- The quiz is very rigid in terms of what it accepts as a valid answer. There are a number of ways to modify this. One is to use the `text.contains` block to see if the user's answer is contained in the actual answer. Another option is to provide multiple answers for each question, and check by iterating (`foreach`) through them to see if any match. You could also figure out how to deal with any extra spaces your user entered in the answer or allow upper- or lowercase characters (i.e., make the answers case-insensitive).
- Transform the quiz so that it is multiple choice. You'll need an additional list to hold the answer choices for each question. The possible answers will be a list of lists, with each sublist holding the answer choices for a particular question. Use the `ListPicker` component to allow the user to choose an answer. You can read more about lists in Chapter 19.

Summary

Here are some of the ideas we've covered in this tutorial:

- Separate an app into its data (often stored in a list) and its event handlers. Use an `ifelse` block to check conditions. For more information on conditionals, see Chapter 18.
- The blocks in event handlers should refer only *abstractly* to list items and list size so that the app will work even if the data in the list is changed.
- Index variables track the current position of an item within a list. When you increment them, be careful about using an `if` block to handle the app's behavior when the user reaches the end of the list.