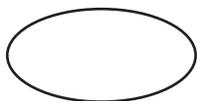


Flowcharts

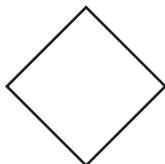
A flowchart visually represents and organizes the flow (using steps) of a program. When programmers write code for a robot, they need to give it instructions that are both sequential and specific. Flowcharts enable programmers to work these steps out before composing code.

There are four basic symbols used for the creation of a flowchart; they are listed below



Start/End Block

The start or end of a program



Decision Block

A point where a decision is made (Yes or No)



Action Block

Where a task is performed

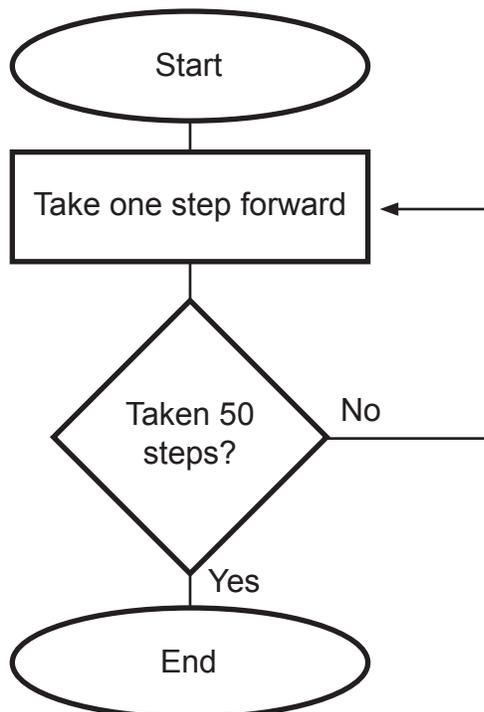


Flow line

Used to connect symbols and display direction of flow

Reading Flowcharts

Move from step to step in the chart by following the lines between them. Perform any task listed when you reach an Action block (rectangle). When you reach a Decision Block (diamond) choose from the different paths shown.

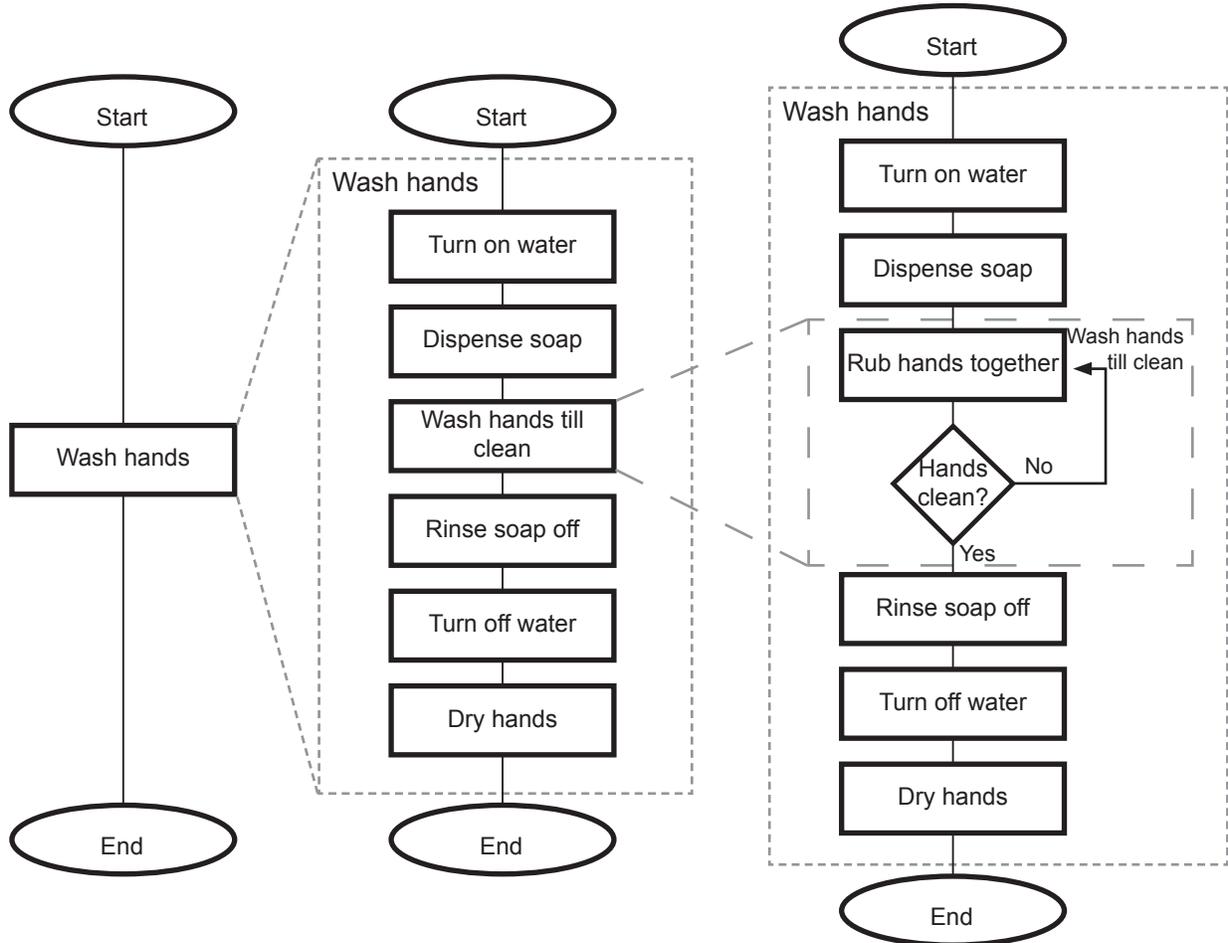


Exercises

1. In the flowchart to the left, what will be the first action that you take? _____
2. If you have not taken 50 steps yet, what will you do next? _____
3. If you have taken 50 steps, what do you do? _____
4. Describe the eventual result of your actions if you follow the flowchart from start to finish.

Writing Flowcharts

How do you take a complex task and create an organized flowchart that describes how to do it? Start with a flowchart that contains only the task. Now break that task down into smaller, more specific steps in another flowchart. Then, review those steps to see if you can break down any of those into simpler parts. Keep on repeating this process until you have written steps that are simple enough for your robot to perform!



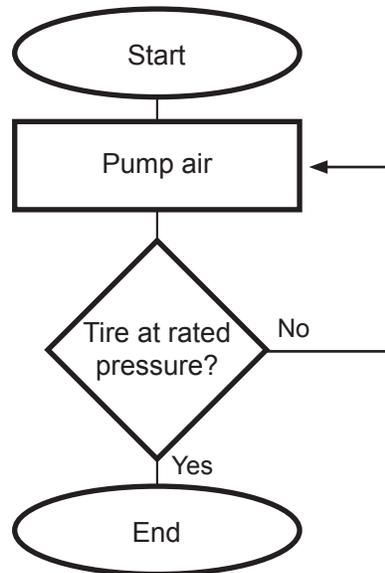
Exercises (cont.)

- On a separate sheet of paper, create a flowchart organizing the "flow" of getting ready to go to school in the morning. Be sure to include the following steps in your chart, but also add other tasks if they are part of your morning routine!

<i>Select something to wear</i>	<i>Look for your shoes</i>	<i>Put your shoes on</i>
<i>Take a shower</i>	<i>Brush your teeth</i>	<i>Hit snooze button</i>
<i>Eat breakfast</i>	<i>Put toast in the toaster</i>	<i>Get dressed</i>
<i>Leave house for school</i>	<i>Check your alarm clock</i>	<i>Comb your hair</i>
<i>Get out of bed</i>	<i>Turn on shower</i>	<i>Check the time</i>

Exercises (cont.)

6. What behavior does the flow chart below describe?



7. Create flowcharts to represent these short tasks:

- If it is raining, bring an umbrella.
- Take twenty paces. Then, turn and shoot.
- Go forward until the Touch Sensor (on Port 1) is pressed in. Then, stop.
- Follow Main Street for two miles. Then, make a left turn onto 4th Street. Go until you reach the bridge, but do not cross the bridge. Instead, make a right turn onto Fair Street. Then, make the first left turn. Follow that road until you reach the monument.
- Turn on the oven. Cook the turkey for four hours or until the meat thermometer reaches 180 degrees.

8. Create a flowchart for the process of crossing the street.

Hint: Looking both ways before crossing will not do any good unless you use that information to make decisions.

9. **Bonus:** Create a flowchart that breaks down the process of how to read flowcharts.

NAME		DATE	
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Exercises Answered

1. What will be the first action that you take?

Take one step forward.

2. If you have not taken 50 steps yet, what will you do next?

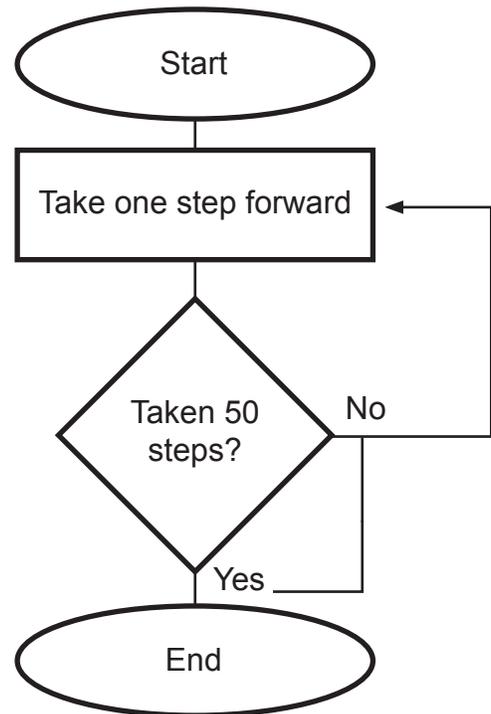
Take another step forward.

3. If you have taken 50 steps, what do you do?

Stop because you have reached the end of the flowchart.

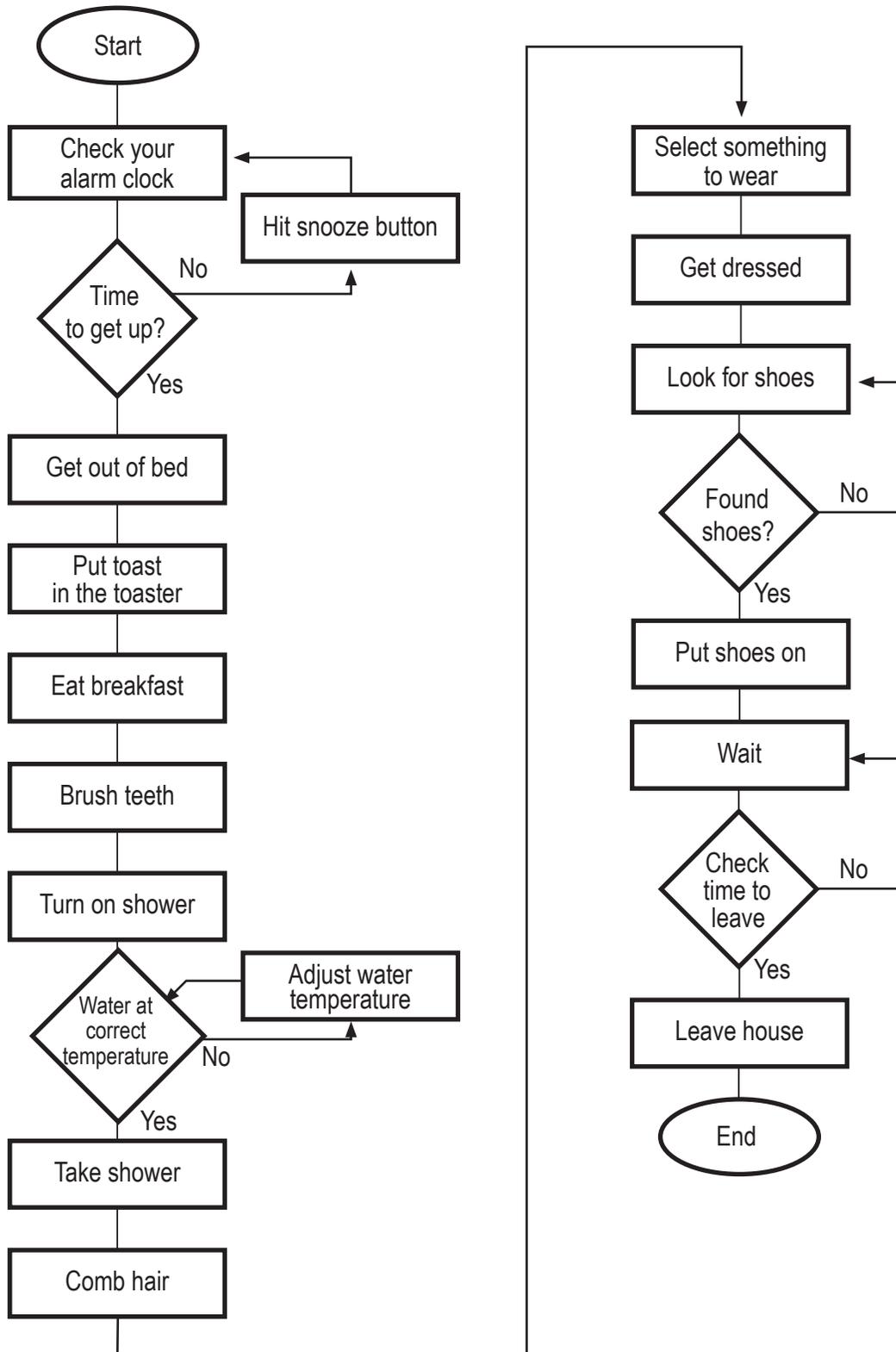
4. Describe the eventual result of your actions if you follow the flowchart from start to finish.

You will walk forward for 50 steps.



Exercises (cont.)

5. This is only one possible answer. Your flowchart may vary.

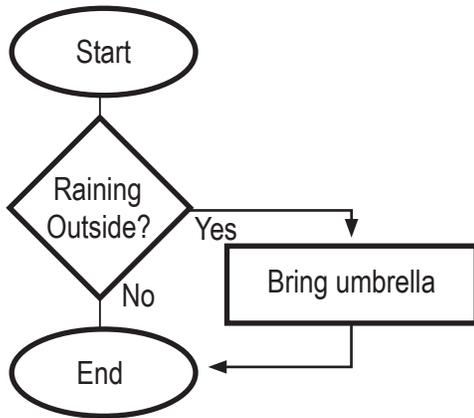


Exercises (cont.)

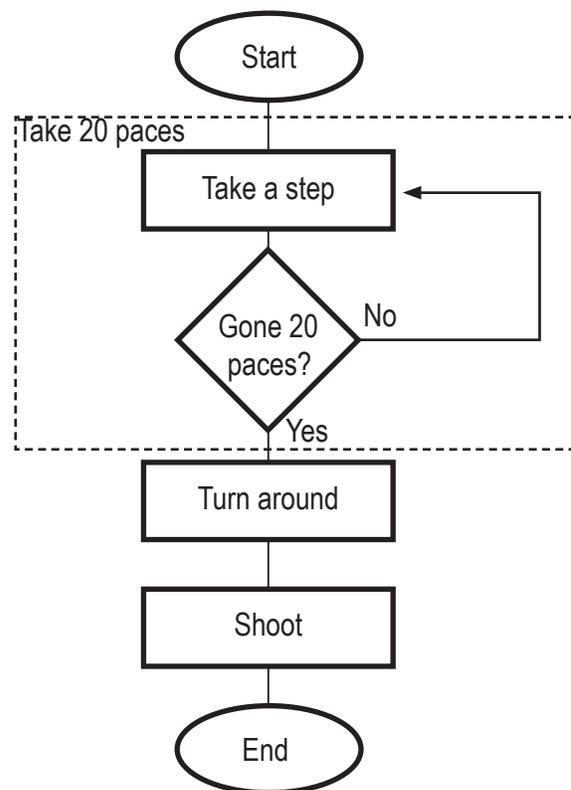
6. What behavior does the flowchart below describe?

The behavior shown in the flowchart is filling a tire with air from a pump.

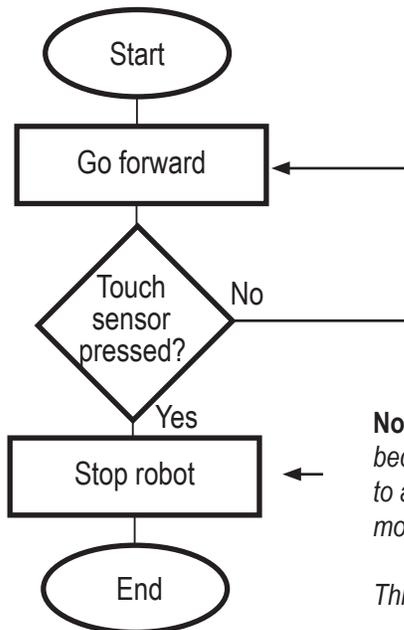
7. a. If it is raining, bring an umbrella.



b. Take twenty paces. Then, turn and shoot.



c. Go forward until the Touch Sensor (on Port 1) is pressed in. Then, stop.

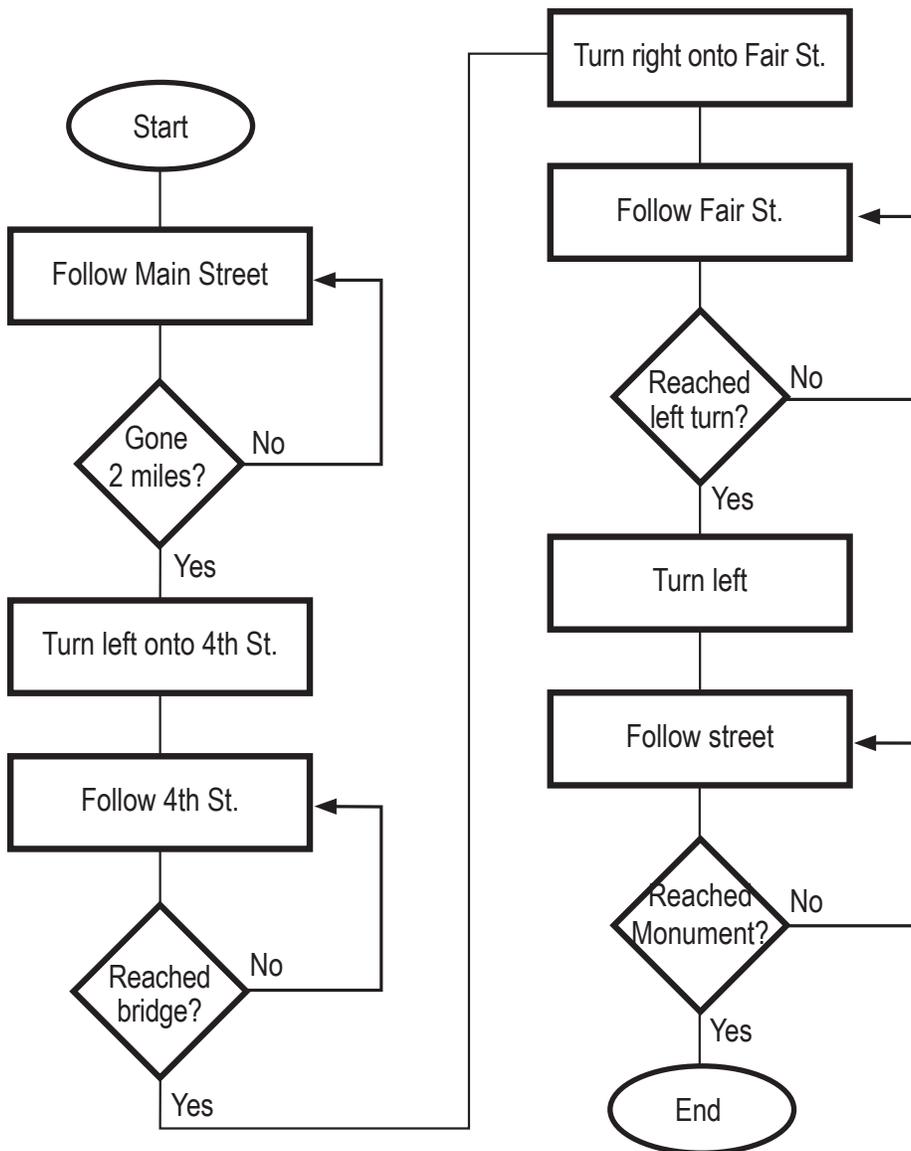


Note: Stopping the robot is not the same as the program stopping because it's reached its end. Stopping the robot means bringing it to a physical halt, whereas ending the program simply means no more commands are issued.

This is an important distinction to make for later on.

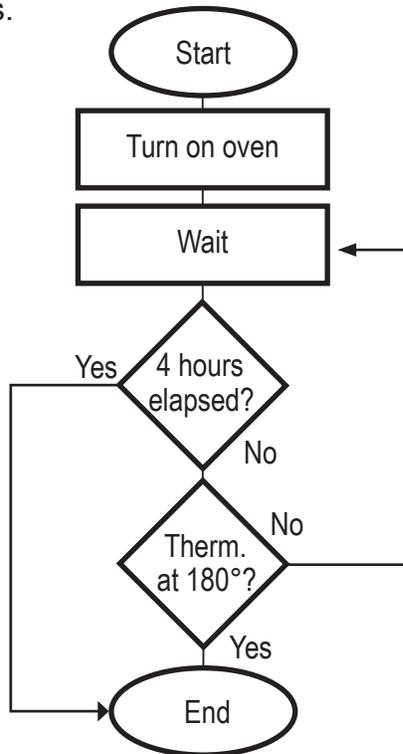
Exercises

7. d. Follow Main Street for two miles, then make a left turn onto 4th Street. Go until you reach the bridge, but do not cross the bridge. Instead, make a right turn onto Fair Street. Then, make the first left turn. Follow that road until you reach the monument.



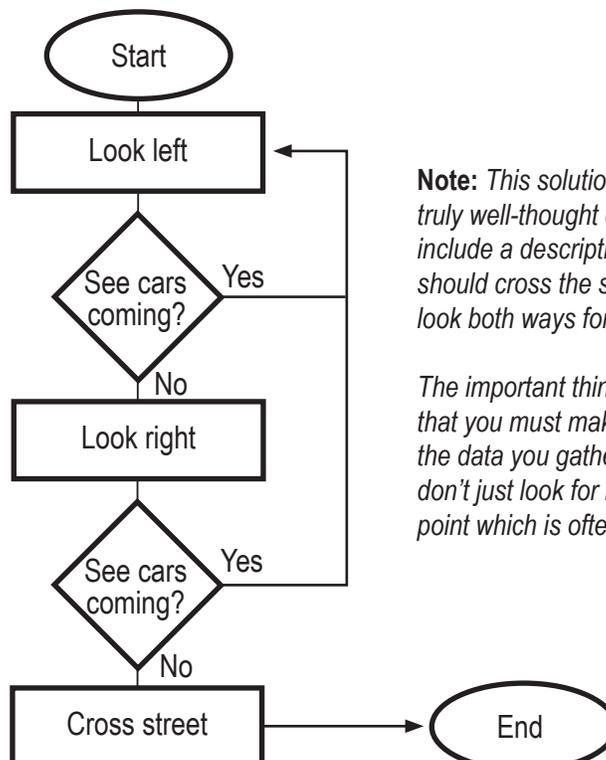
Exercises (cont.)

7. e. Turn on the oven. Cook the turkey for four hours or until the meat thermometer reaches 180 degrees.



Note: This key word in this exercise is the word **OR** between the two conditions. As an additional exercise, consider the ways in which this diagram would change if you replaced the word **OR** with the word **AND**.

8. Create a flowchart for the process of crossing the street.



Note: This solution is good, but a truly well-thought out solution will include a description of how you should cross the street (continuing to look both ways for oncoming traffic).

The important thing here is to note that you must make a decision with the data you gather by looking—you don't just look for looking's sake, a point which is often overlooked.

Exercises (cont.)

9. **Bonus:** Create a flowchart that breaks down the process of how to read flowcharts.

