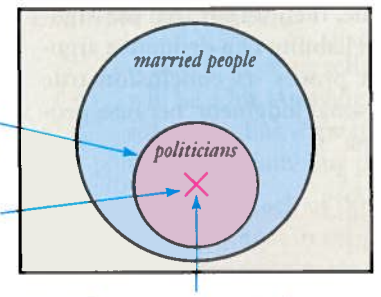


FIGURE 1.26 This Venn diagram shows the two premises of Argument 2. Because the diagram also contains the information in the conclusion, the argument is valid.

members of the set *married people*; that is, it claims that *politicians* is a subset of *married people*. We represent this proposition by drawing the circle for *politicians* inside the circle for *married people* (Figure 1.26). The second premise tells us that Senator Harris is a member of the set *politicians*. We indicate this fact by putting an X, representing the Senator, inside the *politicians* circle. We test validity by checking to see whether the conclusion is contained within the Venn diagram for the premises. In this case, the X is also inside the *married people* circle, meaning that Senator Harris is a married person—just as the conclusion claims. Thus, the Venn diagram shows that the premises lead necessarily to the conclusion, demonstrating that the argument is valid.

**A VENN DIAGRAM TEST OF VALIDITY**

To test the validity of a deductive argument with a Venn diagram:

1. Draw a Venn diagram that represents all the information contained in the premises.
2. Check to see whether the Venn diagram also contains the conclusion. If it does, then the argument is valid. Otherwise, the argument is not valid.

### Example 3 Invalid Argument

Evaluate the validity and soundness of the following argument.

Premise: All fish live in the water.
Premise: Whales are not fish.
Conclusion: Whales do not live in the water.

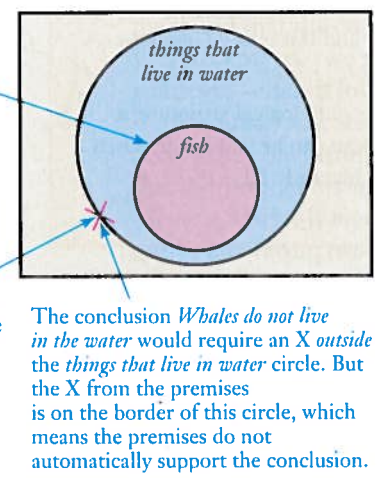


FIGURE 1.27 This Venn diagram shows the two premises of Example 3. The information in the premises does not automatically support the conclusion, so the argument is invalid.

**Solution** Both premises are true, but the conclusion is false. The argument must therefore have a flaw in its logical structure, making it invalid. We can see the flaw by drawing a Venn diagram. The first premise tells us that the set *fish* is a subset of the set *things that live in water*, so we draw the *fish* circle inside the circle for *things that live in water*. The second premise tells us that whales are not fish. We can indicate this fact by putting an X, representing whales, outside the *fish* circle. However, because the second premise does not tell us whether whales live in the water, we do not know whether the X should be inside or outside the *things that live in water* circle. Therefore, to be as general as possible, we place the X on the border of this circle, indicating that it may actually be either inside or outside (Figure 1.27).

We have now captured all the information in the two premises, so we check whether the diagram contains the information in the conclusion. The conclusion states that whales do not live in the water, which means the X representing whales should be outside the circle for *things that live in water*. But it isn't; it is on the border, which means we don't have enough information to know whether it is inside or outside the circle. Therefore, the conclusion does not follow necessarily from the premises, and the argument is invalid. **Now try Exercises 29–32.**



### Example 4 Invalid but True Conclusion

Evaluate the validity and soundness of the following argument.

Premise: All 20th-century U.S. presidents were men.
Premise: John Kennedy was a man.
Conclusion: John Kennedy was a 20th-century U.S. president.

**Solution** We start by drawing a Venn diagram for the first premise, which requires placing the circle for *20th-century presidents* inside the circle for *men*. The second premise tells us to put an X, representing John Kennedy, inside the *men* circle. However, it does *not* tell us whether the X also belongs inside the *20th-century presidents* circle, so we place it on the border of this circle (Figure 1.28). The conclusion states that the X should be inside the *20th-century presidents* circle, but its border location means we lack the information needed to reach this conclusion. The argument is invalid and therefore cannot be sound.

Note that this argument is invalid even though its premises and conclusion are all true. If you are not convinced, try substituting another man, such as Albert Einstein, for John Kennedy. The argument then reads

Premise: All 20th-century U.S. presidents were men.
Premise: Albert Einstein was a man.
Conclusion: Albert Einstein was a 20th-century U.S. president.

The premises are still true, but the conclusion is now false, showing that the argument's structure is invalid. **Now try Exercises 33–36.**

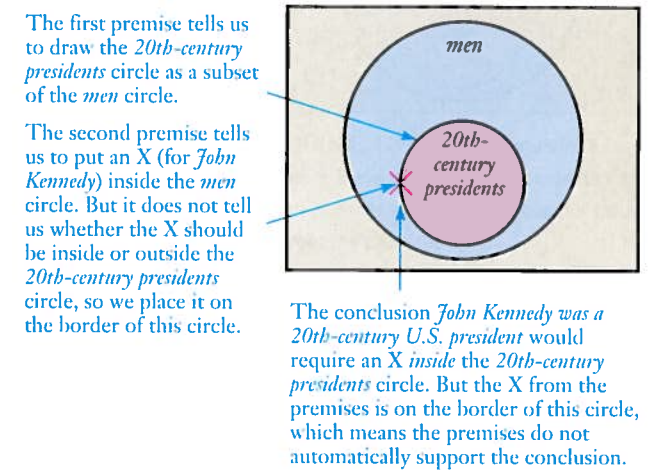


FIGURE 1.28 This Venn diagram shows the two premises of Example 4. The information in the premises does not automatically support the conclusion, so the argument is invalid.

## Conditional Deductive Arguments

Consider the following argument:

Premise: If a person lives in Chicago, then the person likes windy days.
Premise: Carlos lives in Chicago.
Conclusion: Carlos likes windy days.

This type of deductive argument, in which the first premise is a conditional statement *if p, then q*, is among the most common and important types of argument. In this case, $p$ = *a person lives in Chicago* and $q$ = *the person likes windy days*. The second premise asserts that, for the person named Carlos, $p$ is true. The conclusion asserts that $q$ is also true for Carlos. You can probably see that this argument is valid. If it is really true that people who live in Chicago like windy days and that Carlos lives in Chicago, then it must be true that Carlos likes windy days.

Conditional arguments come in four basic forms. Each has a special name, which will make sense if you remember that $p$ is the hypothesis and $q$ is the conclusion in *if p, then q*. For example, the second premise of the above argument about Carlos