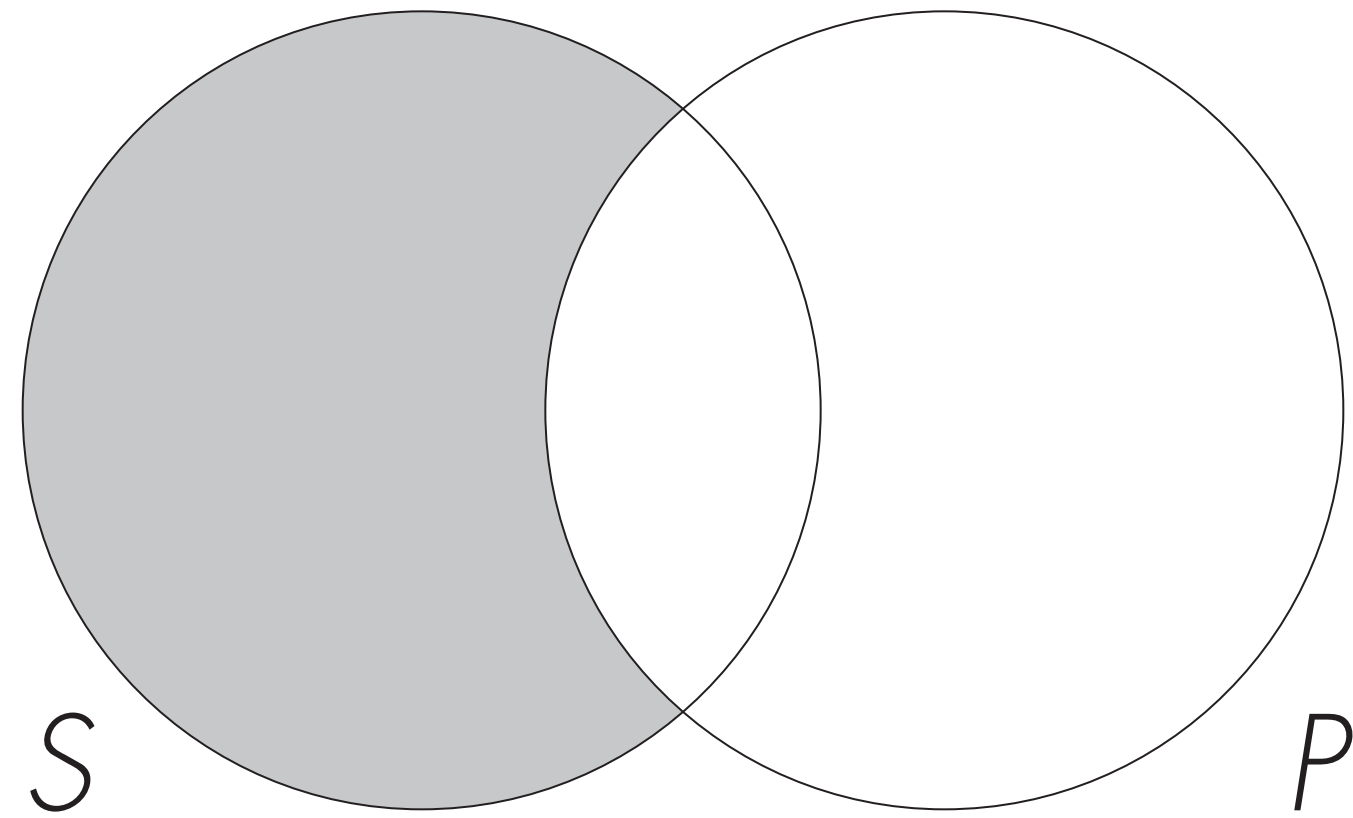# CRITICAL THINKING

Lecture #19

More Advanced Categorical Statements
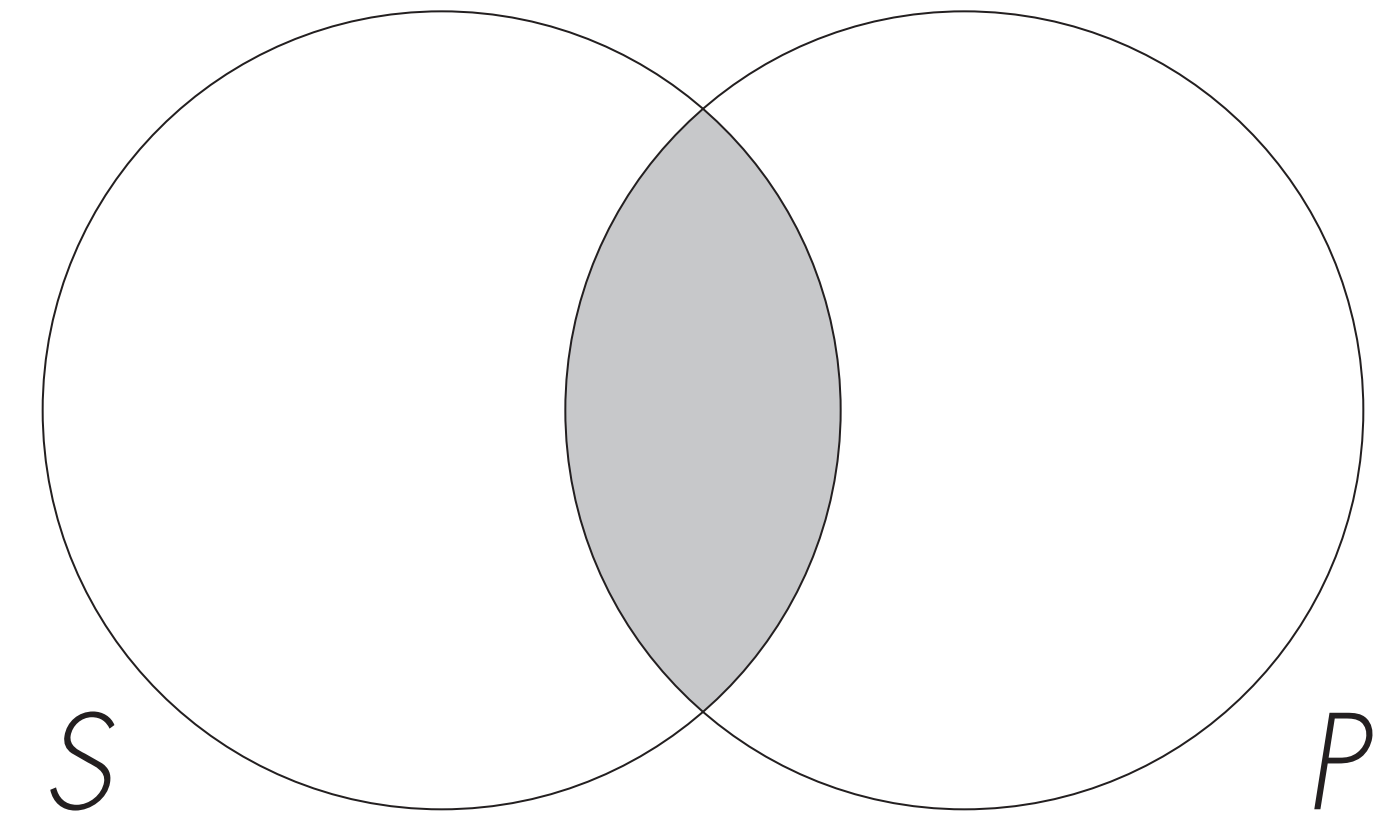
Professor David Emmanuel Gray
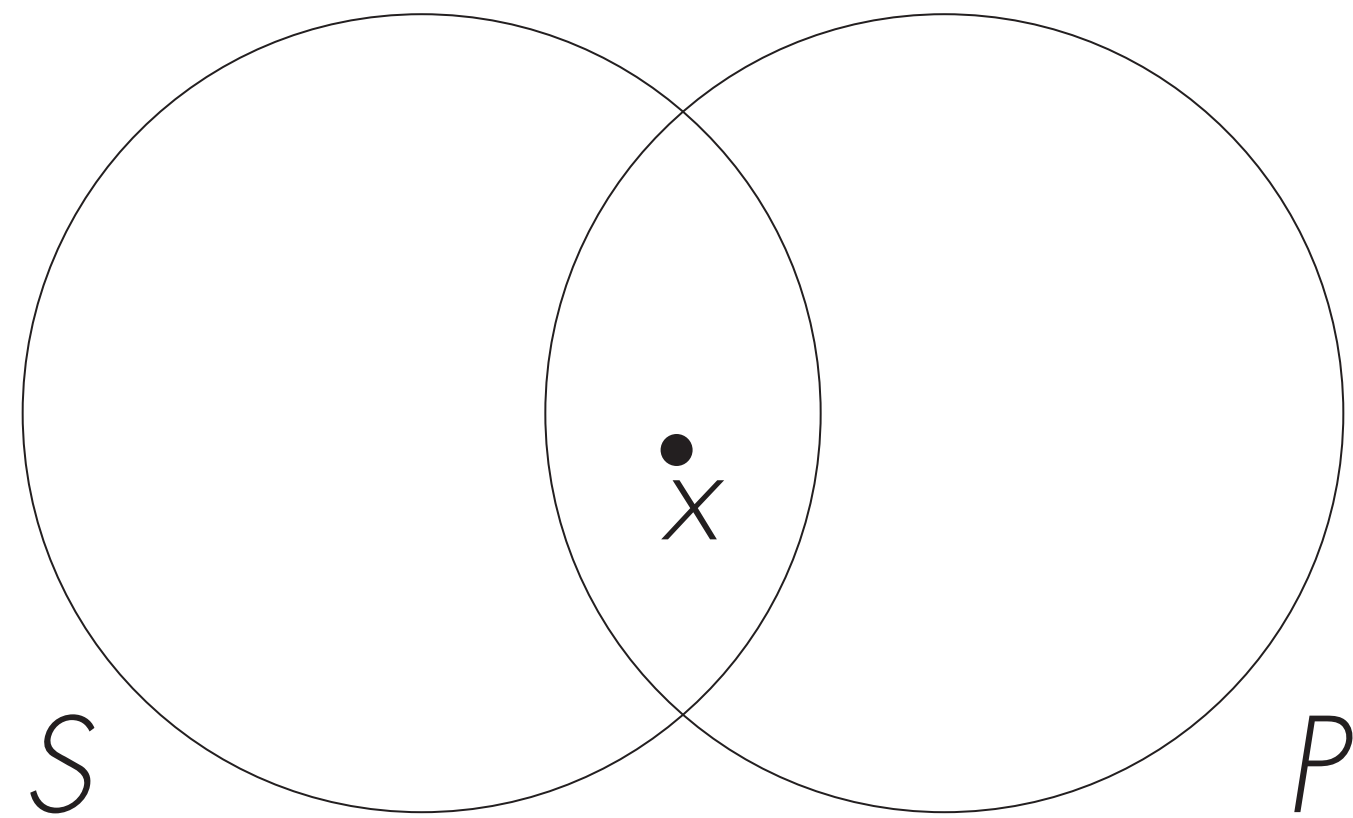
Four Standard Forms of Categorical Statements

A: All *S* is *P*.
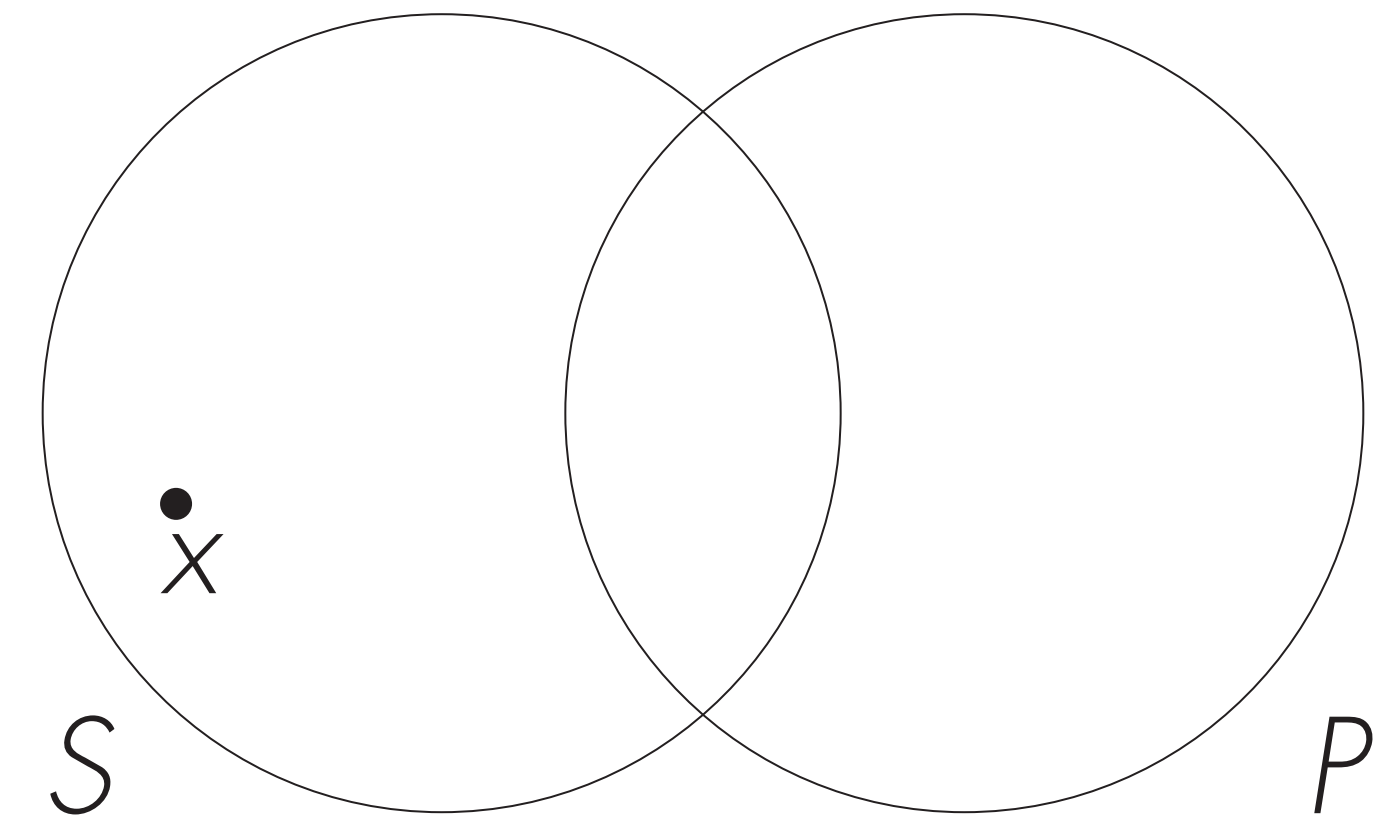(Shade in all of *S* not shared with *P*.)

E: No *S* is *P*.
(Shade in all of *S* shared with *P*.)

I: Some *S* is *P*.
(Dot-*x* in *S* shared with *P*.)

O: Some *S* is not *P*.
(Dot-*x* in *S* not shared with *P*.)

Analyzing Categorical Statements: *Instructions*

Analyzing the logical structure of categorical statements works as follows:

1. Identify the subject term (*S*) and predicate term (*P*),

2. Identifying its logical form (**A**, **E**, **I**, or **O**),

3. Draw the Venn diagram representing it (with the subject term (*S*) on the left and the predicate term (*P*) on the right), being sure to label the parts, and

4. Explain its quality, quantity, and distribution.

Complex Categorical Statements

The categorical statements we often encounter in English often require a little more thought in order to recognize (1) the categories (S and P) involved and (2) which of the four logical forms (**A**, **E**, **I**, or **O**) is being asserted.

Categorical Statements: *Identifying the Categories*

When faced with a categorical claim, your first priority is to carefully identify the subject (*S*) and predicate (*P*) terms involved in the statement.

For instance, consider this categorical statement:

No nation can survive without secure borders.

What are the two categories involved here? What is being asserted about them in this statement?

Categorical Statements: *Identifying the Categories*

No nation can survive without secure borders.

Subject (*S*): Nations.
Predicate (*P*): Things that can survive without secure borders.

With these laid out, it should now be easier to see that this is an **E**-type categorical statement:

No nation is a thing that can survive without secure borders.

Logical form: **E** (No *S* is *P*).

Categorical Statements: *Recognizing Quantity and Quality*

Even if you do identify the subject (*S*) and predicate (*P*) terms, it may still be difficult to determine the logical form (**A**, **E**, **I**, or **O**) of the categorical statement.

Recall that the basic elements determining the logical form of a categorical statement are its *quality* and its *quantity*. So ask yourself:

Quantity: Does this refer to *all* things in the subject term (*S*) or just to *some* things in *S*?

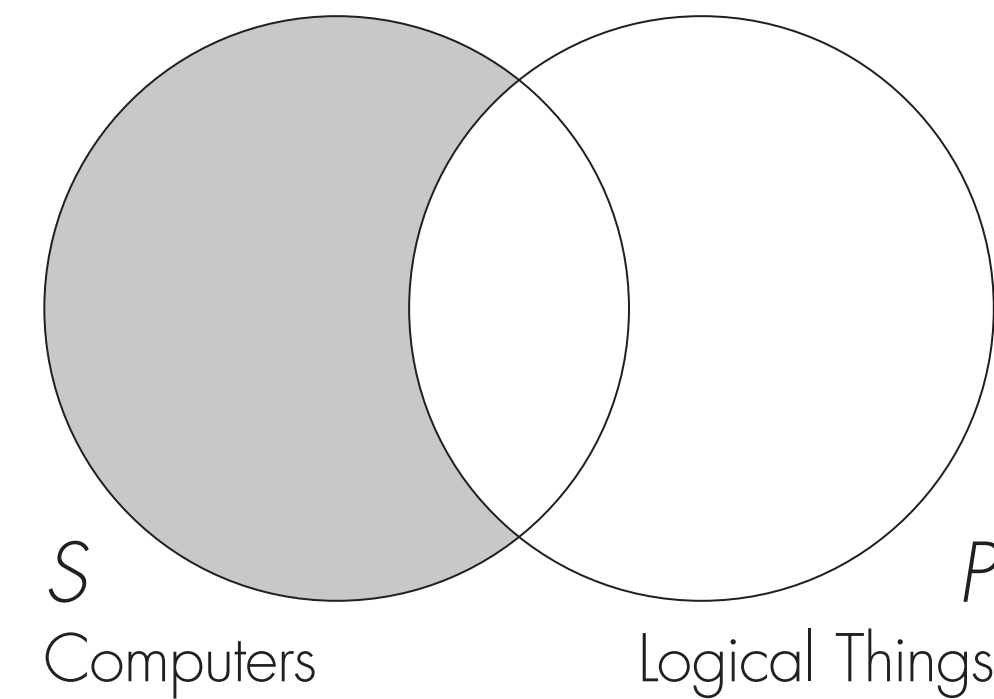**Quality:** Does the statement affirm or deny inclusion of *S* in *P*?

Categorical Statements: *Recognizing Quantity and Quality*

Equivalent Universal Affirmatives (**A** statements):

> Every computer is logical.
>
> Whatever is a computer is logical.
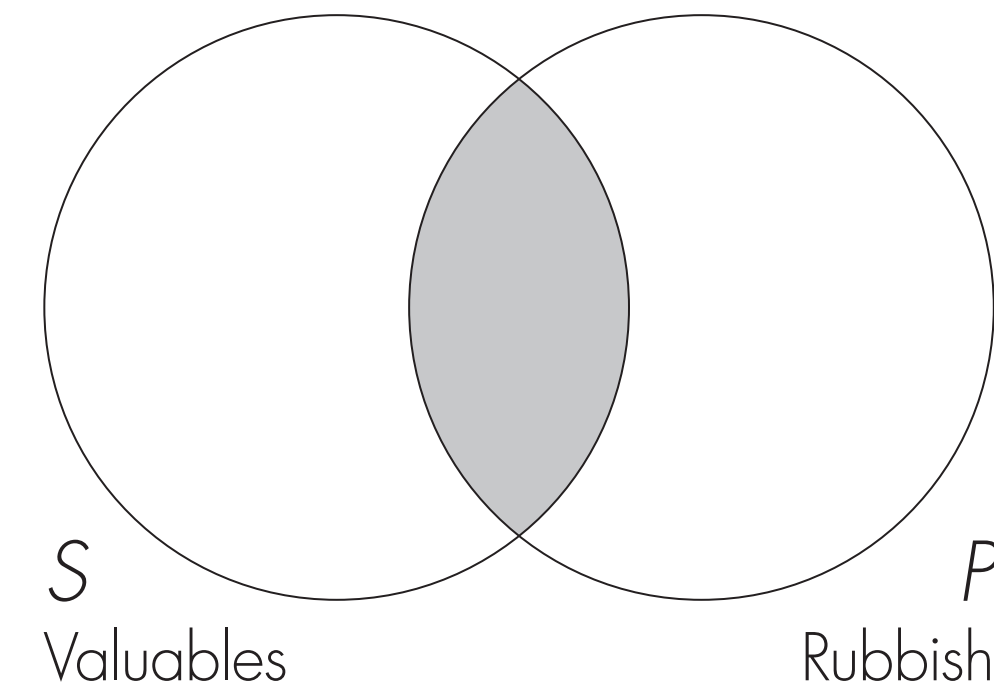>
> Computers are logical.

Equivalent Universal Negatives (**E** statements):

> Nothing valuable is rubbish.
>
> Valuables are not rubbish.
>
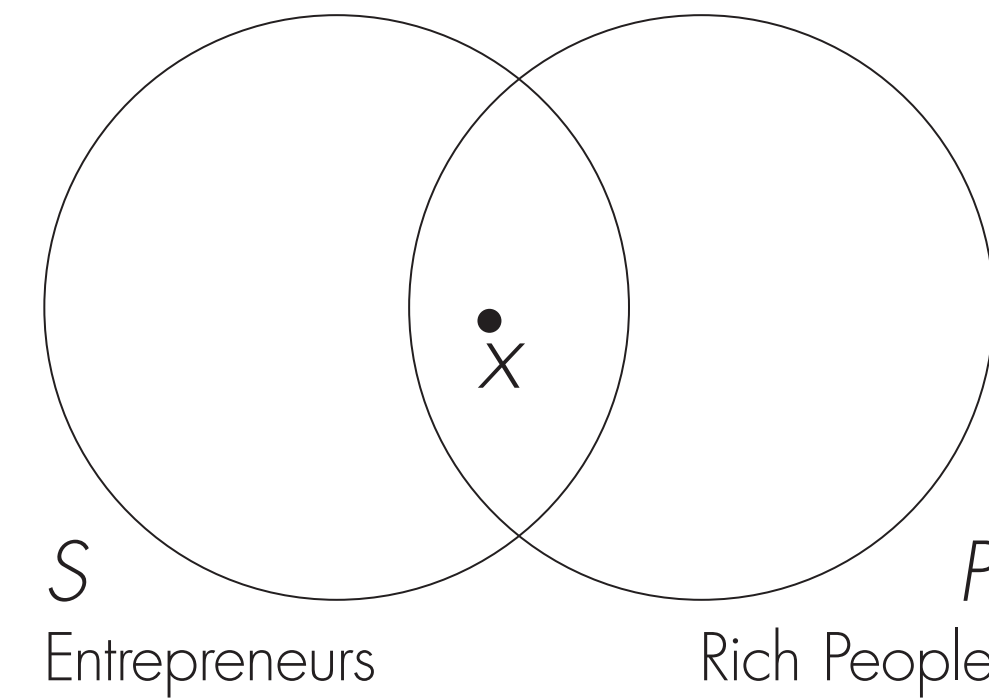> Whatever is valuable is not rubbish.

Categorical Statements: *Recognizing Quantity and Quality*

Equivalent Particular Affirmatives (**I** statements):

    A few entrepreneurs are rich.

    Most entrepreneurs are rich.

    There are entrepreneurs who are rich.
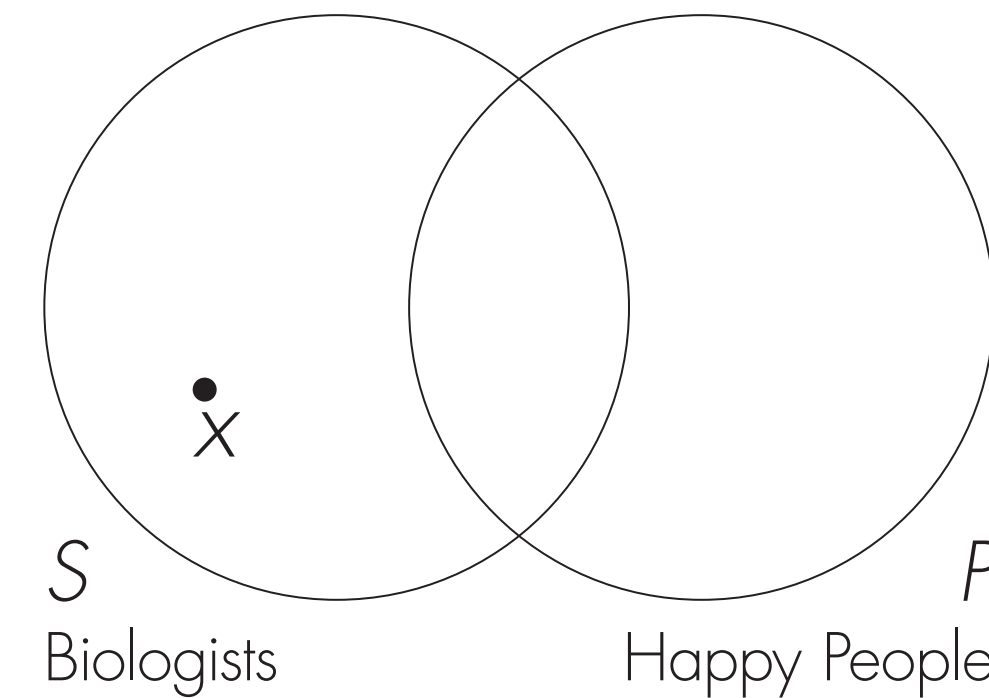
Equivalent Particular Negatives (**O** statements):

    Many biologists are not happy.

    A few biologists are not happy.

    There are biologists who are not happy.

Singular Statements: *Example*

Sometimes a statement might not seem categorical. Consider this:

Sara is a good reader.

This seems to just be about one person and not a category of things at all. In general, a **singular statement** like this makes an assertion about one single, particular thing.
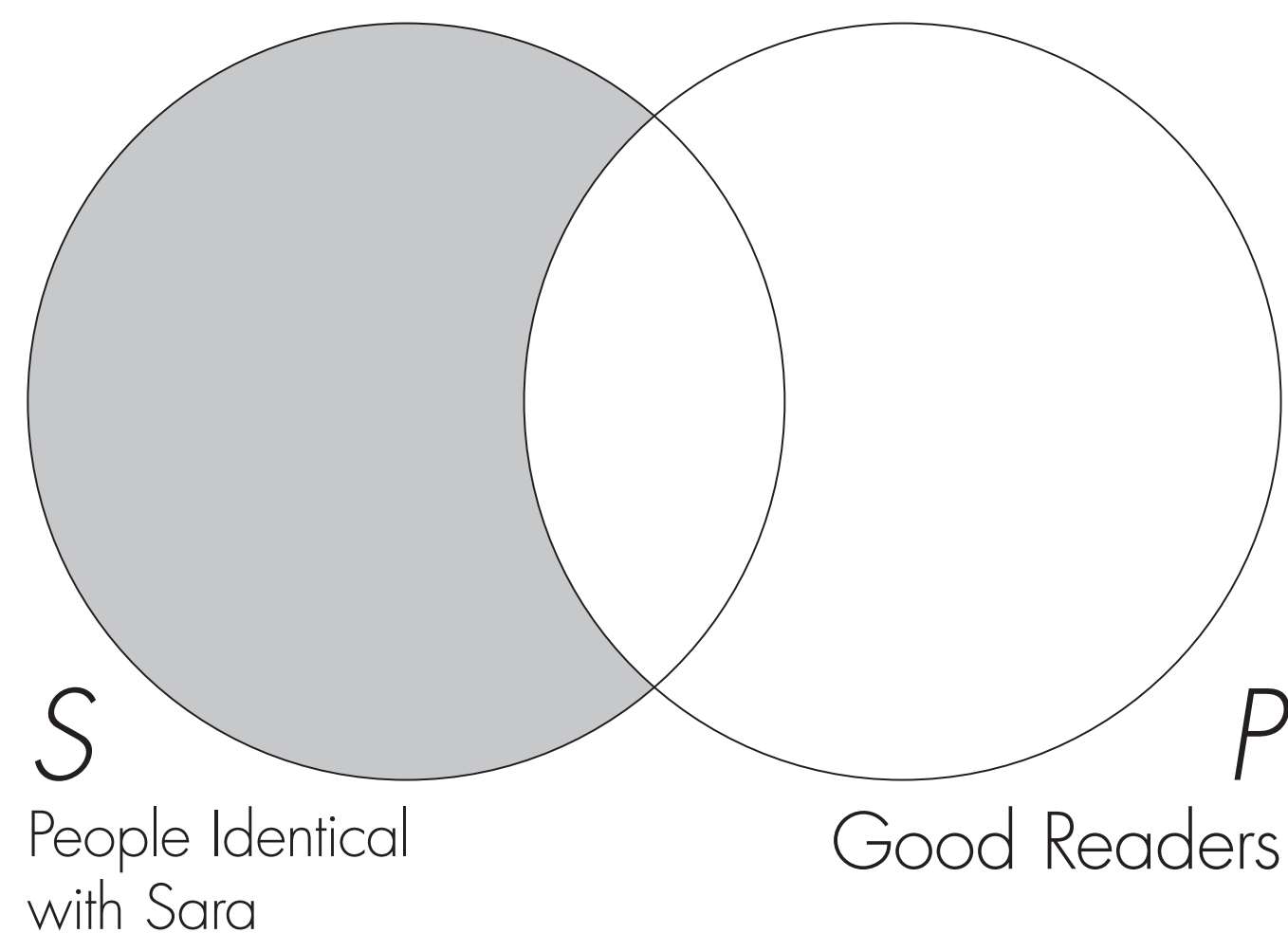
Singular Statements: *Example*

Sara is a good reader.

We can still work with this statement by creating a category to accommodate its singular entity:

All people identical with Sara are good readers.

Now this is just a simple **A** statement:

S
People Identical
with Sara

P
Good Readers

Categorical Statements: *Only vs. The Only*

Consider the following two statements:

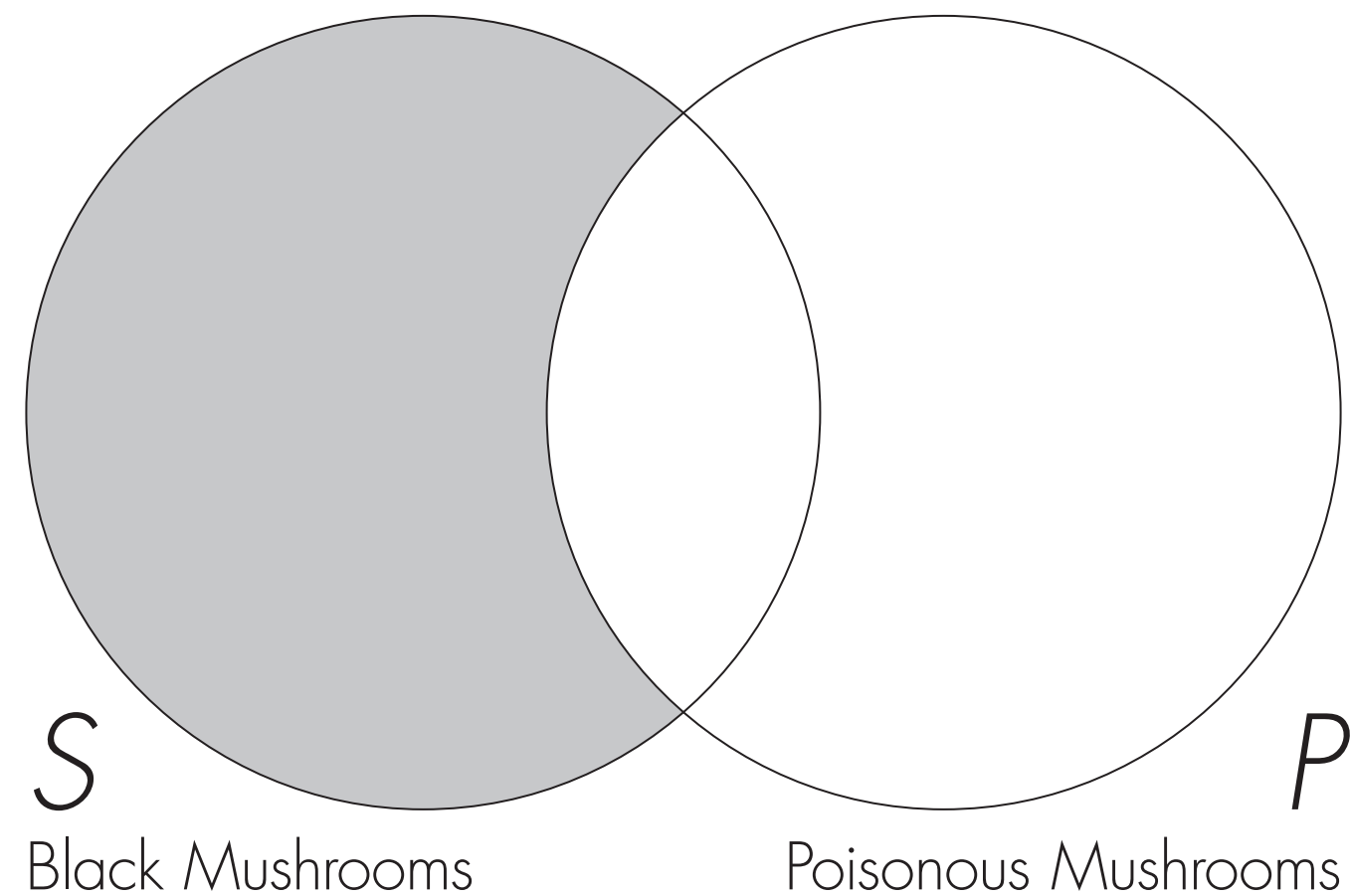Black mushrooms are **only** poisonous mushrooms.

Black mushrooms are **the only** poisonous mushrooms.

Are these just two different ways of saying the exact same thing?

(Imagine you have a black mushroom. If Pumpkin is right, do you immediately know whether this mushroom is poisonous? Is this the same answer if Snowflake is right?)
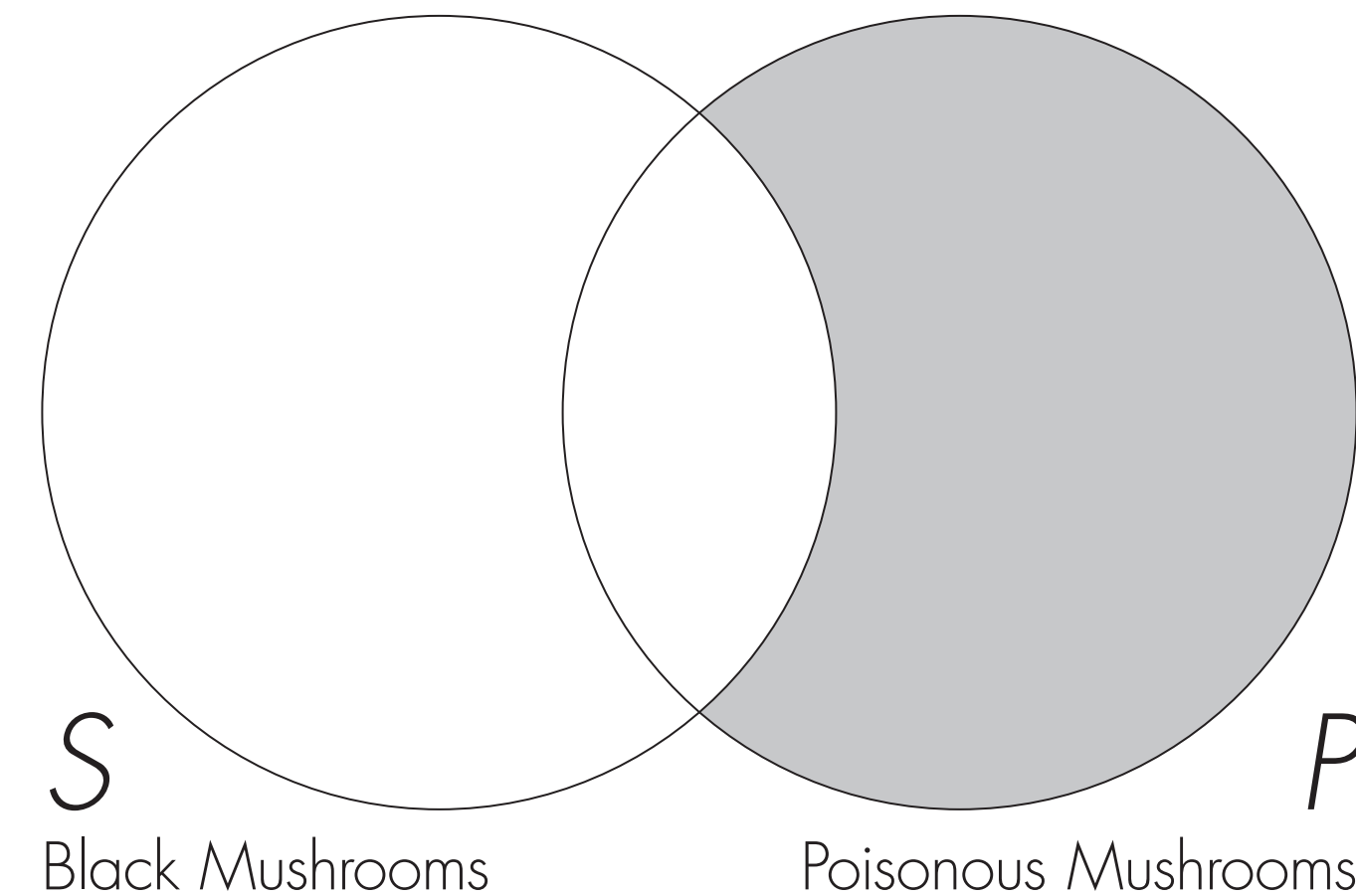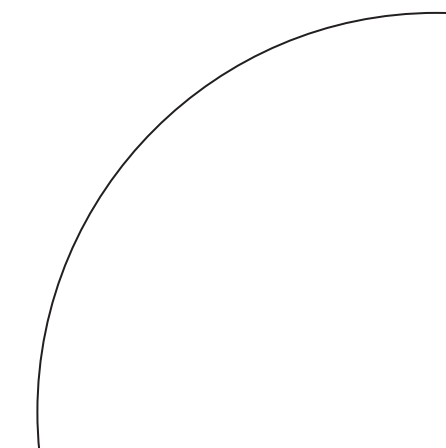
Categorical Statements: *Only vs. The Only*

Black mushrooms are **only** poisonous mushrooms.

S
Black Mushrooms

P
Poisonous Mushrooms

All black mushrooms are poisonous mushrooms.
(**A** Statement: All *S* are *P*.)

In this case, black mushrooms can "only" be one thing: poisonous. So the area of black mushrooms outside of poisonous mushrooms is empty.

Black mushrooms are **the only** poisonous mushrooms.

S
Black Mushrooms

P
Poisonous Mushrooms

All poisonous mushrooms are black mushrooms.
(**A** Statement: All *P* are *S*.)

Meanwhile, over here, "the only" poisonous mushrooms that you will find are black. So the area of poisonous mushrooms outside of black mushrooms is empty.

So it turns out that these are two very different claims!

Categorical Statements: *Complements*

For any category, we may consider its complement. The **complement** of a category contains everything that is *not* in that category. The complement of category *X* is denoted as non-*X*. In English, for example, the complement of the category of "hero" is "non-hero".

Of particular importance, the compliment of the subject term *S* is denoted as non-*S* and the complement of the predicate term *P* is denoted as non-*P*.

Note: "Winner" and "loser" may be contraries (you cannot be both), but they are *not* complements. That is, "non-winner" is not the same as "loser". E.g., Professor Gray is a non-winner of the 2016 World Cup, but is he is obviously *not* a loser (he cannot even play football). In short, *we use the prefix "non-" to indicate complements, instead of using a contrary word.*

Reasoning with Complements: *Example*

The use of complements allows us to consider even more sophisticated categorical statements.

For instance, consider this categorical statement:

Some students are non-IS-majors.

What are the subject (S) and predicate (P) terms of this statement?

Reasoning with Complements: *Example*

Some students are non-IS-majors.

Subject term (*S*): Students.

Predicate term (*P*): IS majors.

When using complements, the focus should always remain on the main categories involved. In this case the categories are students and IS majors. Yes, *grammatically* the predicate of the above statement is indeed non-IS-majors, but *logically* the predicate term (*P*) is IS majors. Non-IS-majors is logically represented as the complement of the predicate term (i.e., as non-*P*).

Now how do we diagram this statement?

Reasoning with Complements: *Example*

Some students are non-IS-majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*".

Recall that for "normal" **I** statements like "Some *S* is *P*", we create the Venn diagram by putting a dot-*x* in the zone that *S* and *P* share.
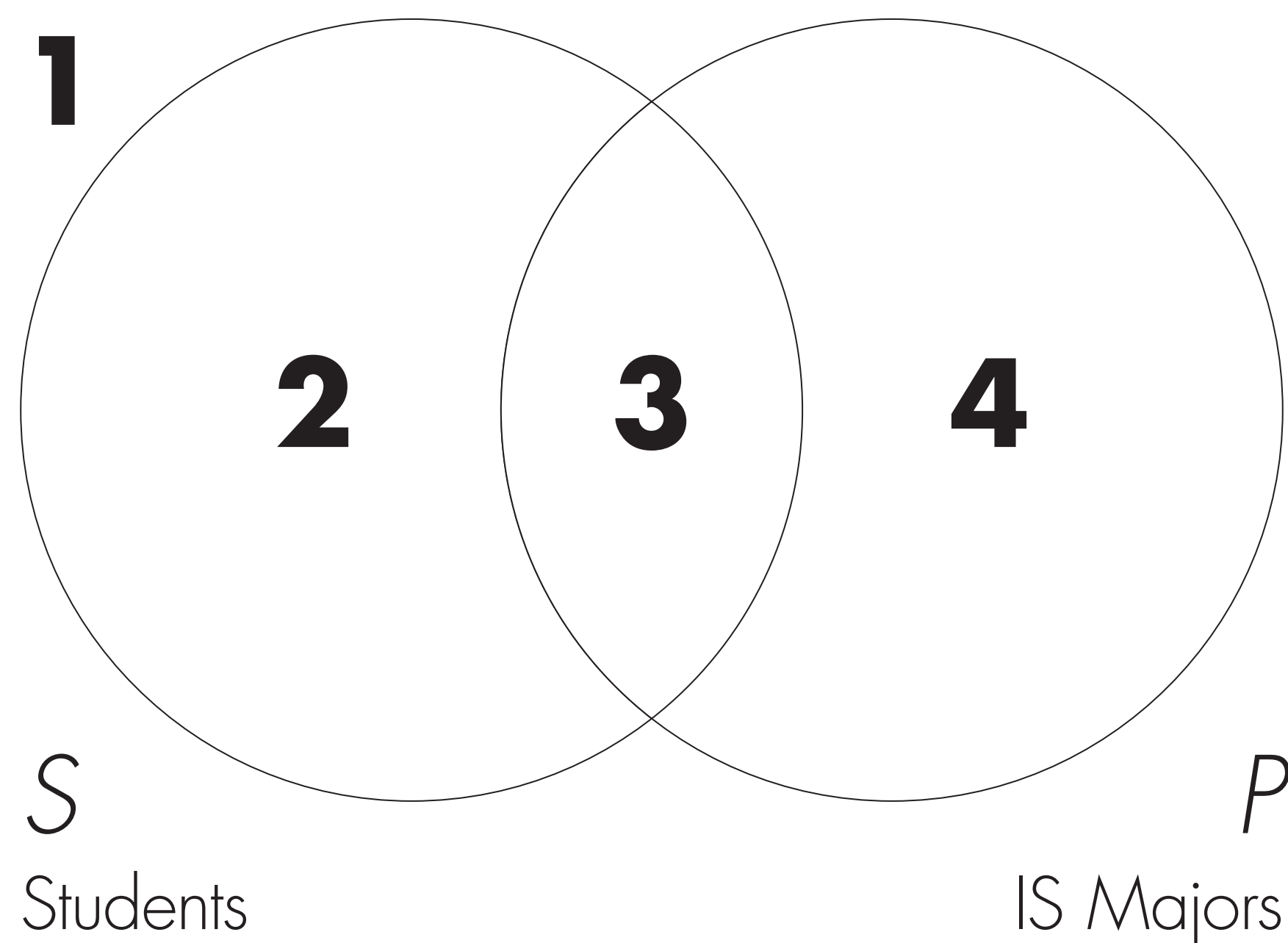
However, this statement is different: it has non-*P* instead of *P*!

That is okay. We just follow the same pattern for I statements by putting a dot-*x* in the zone that *S* and non-*P* share.

Reasoning with Complements: *Example*

Some students are non-IS-majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.

1

2   **3**   **4**

S
Students

P
IS Majors

Reasoning with Complements: *Example*

Some students are non-IS-majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.

S consists of
zones 2 and 3.

1
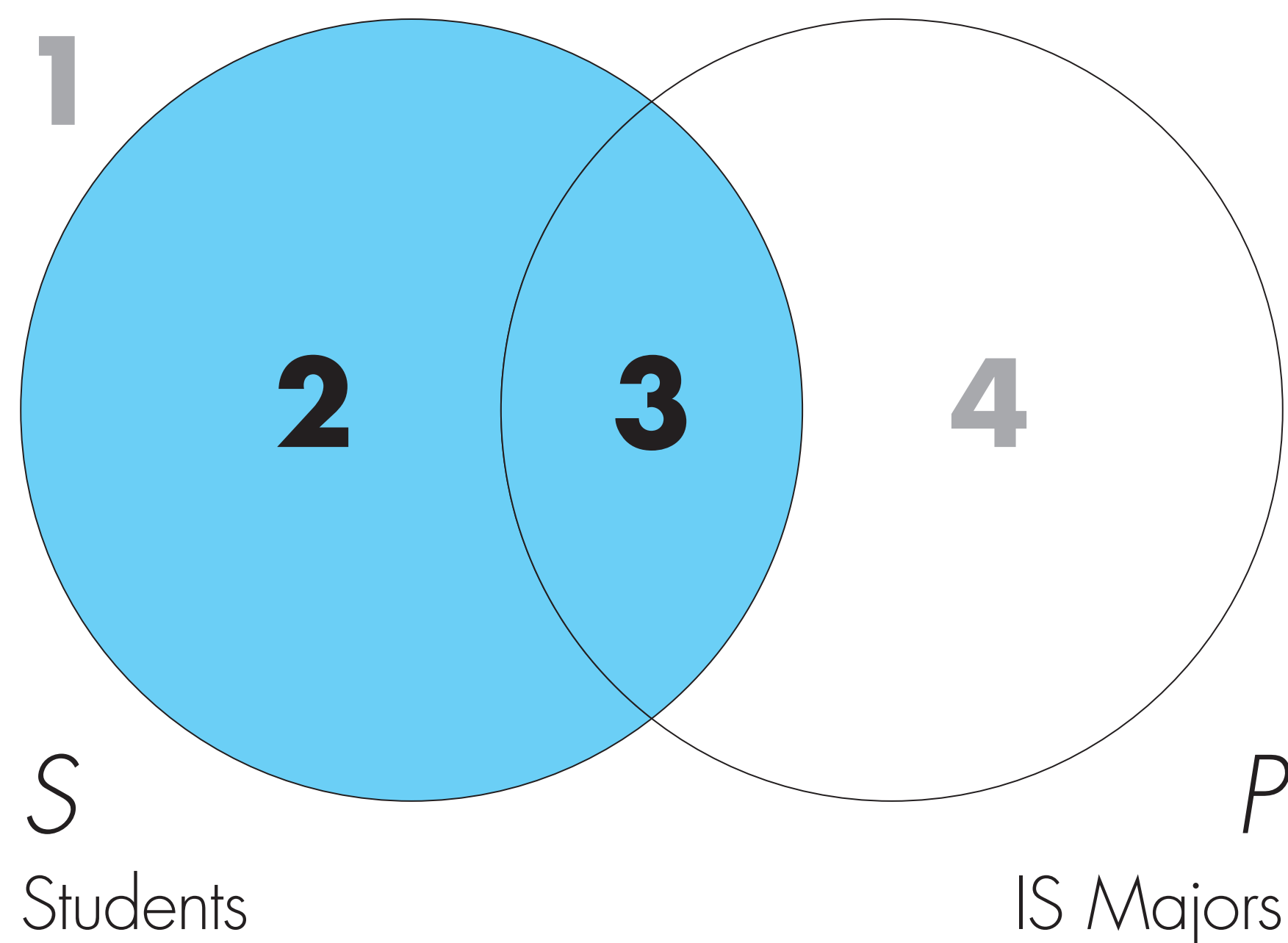
2 **3** **4**

S
Students

P
IS Majors

Reasoning with Complements: *Example*

Some students are non-IS-majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.

S consists of zones 2 and 3.

non-*P* consists of everything *outside* *P*: zones 1 and 2.

1
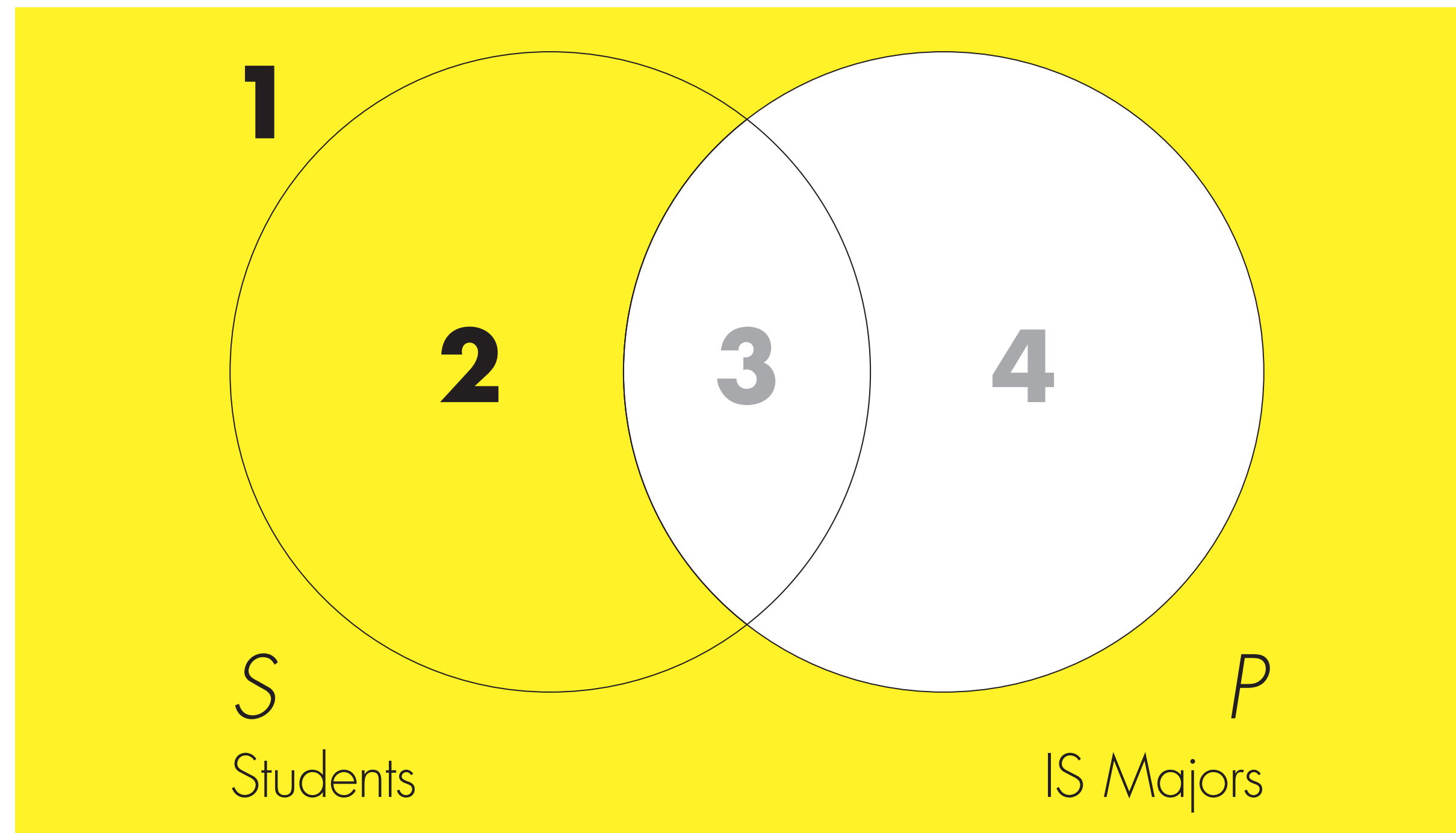
2 **3** **4**

S
Students

P
IS Majors

Reasoning with Complements: *Example*

Some students are non-IS-majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.

S consists of zones 2 and 3.

non-*P* consists of everything *outside* *P*: zones 1 and 2.

S and non-*P* share zone 2!

1

2   **3**   **4**

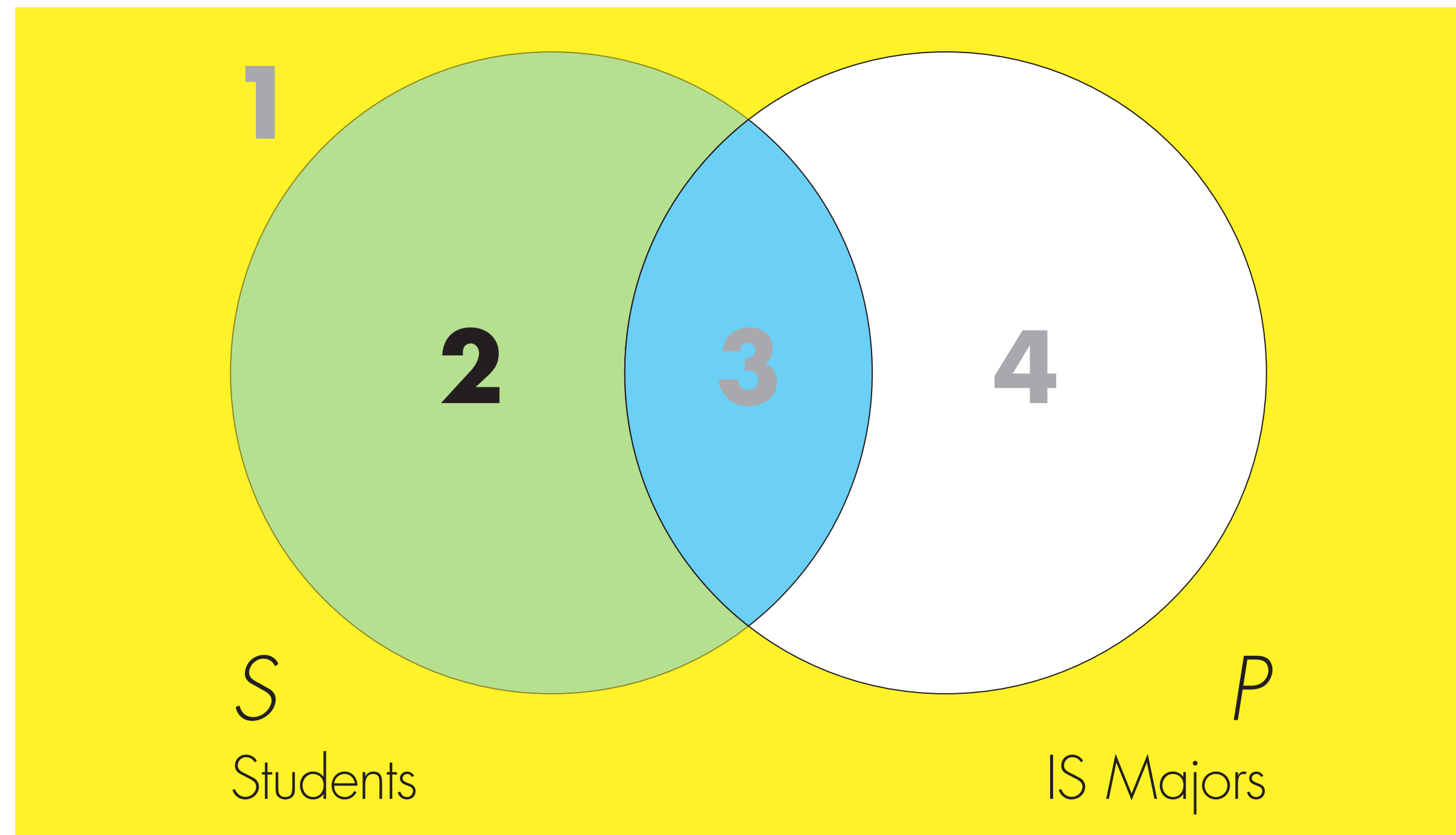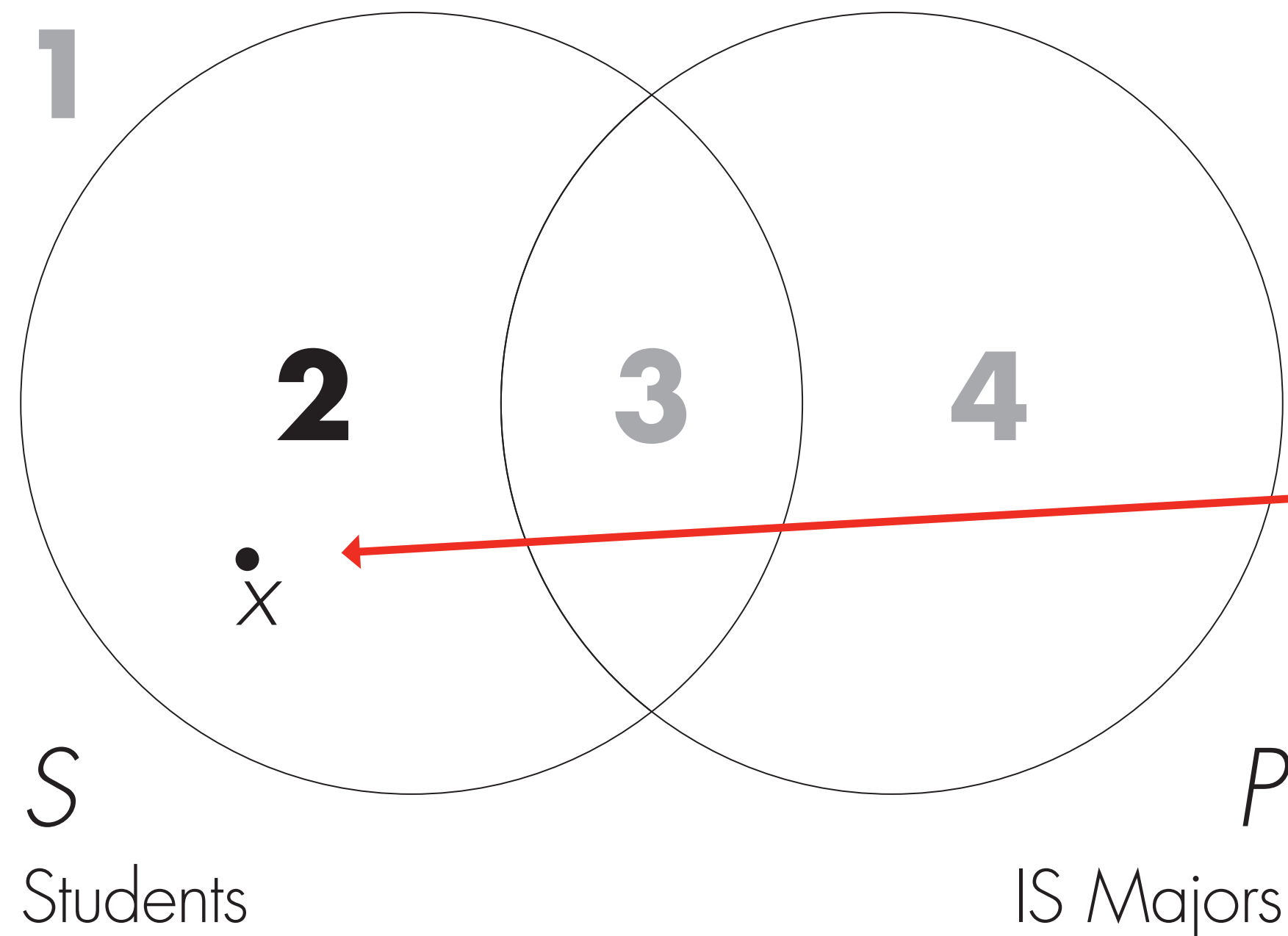*S*
Students

P
IS Majors

Reasoning with Complements: *Example*

Some students are non-IS-majors.

This is an **I**-type categorical statement of the form "Some *S* is non-*P*". So we are putting a dot-*x* in the zone that *S* and non-*P* share.

S consists of zones 2 and 3.

S and non-*P* share zone 2!

non-*P* consists of everything *outside* *P*: zones 1 and 2.

So zone 2 gets the dot-x!

1

2   **3**   **4**

•
x

S
Students

P
IS Majors

Reasoning with Complements: *Example*

Some students are non-IS-majors.
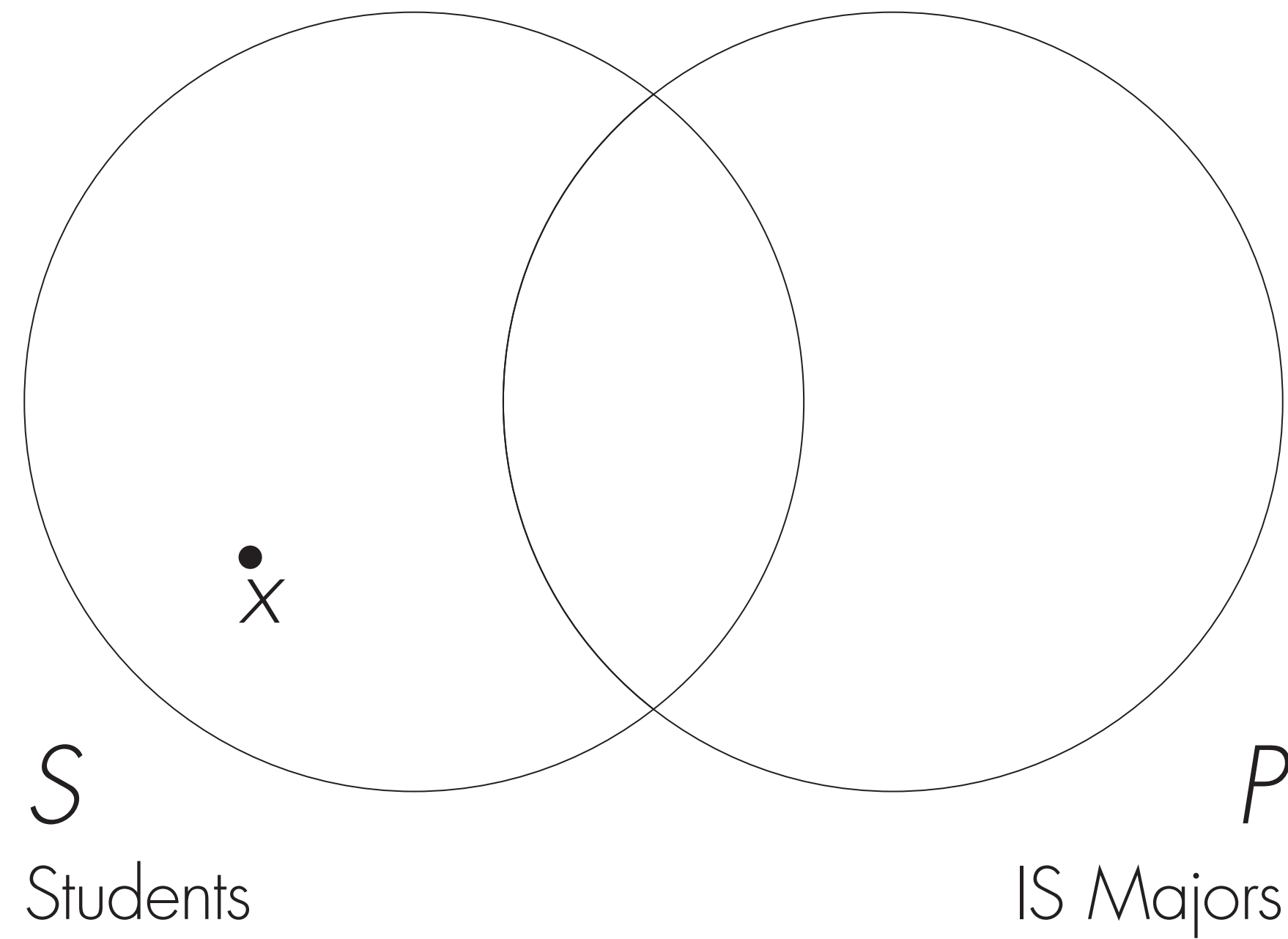
Statement #1

Draw a Venn diagram for the following statement:

No non-mushroom is poisonous.

Statement #1: *Terms Identified*

No non-mushroom is poisonous.

Subject (*S*): Mushrooms.

Predicate (*P*): Poisonous things.

Note: As before, notice that *grammatically* "non-mushrooms" is indeed the subject, but *logically* "mushrooms" is the subject term. As always, logic treats that "non" part as a complement.

Statement #1: *Form Identified*

No non-mushroom is poisonous.

Subject (*S*): Mushrooms.

Predicate (*P*): Poisonous things.

Quantity: Universal because it is referring to *all* non-mushrooms.

Quality: Negative because it *denies* that non-mushrooms are also poisonous things.

Logical Form: **E** (universal negative), "No non-*S* is *P*".

Statement #1: *Creating the Venn Diagram*

No non-mushroom is poisonous.

Recall that for "normal" **E** statements like "No *S* is *P*", we create the Venn diagram by shading in the zone that *S* and *P* share.
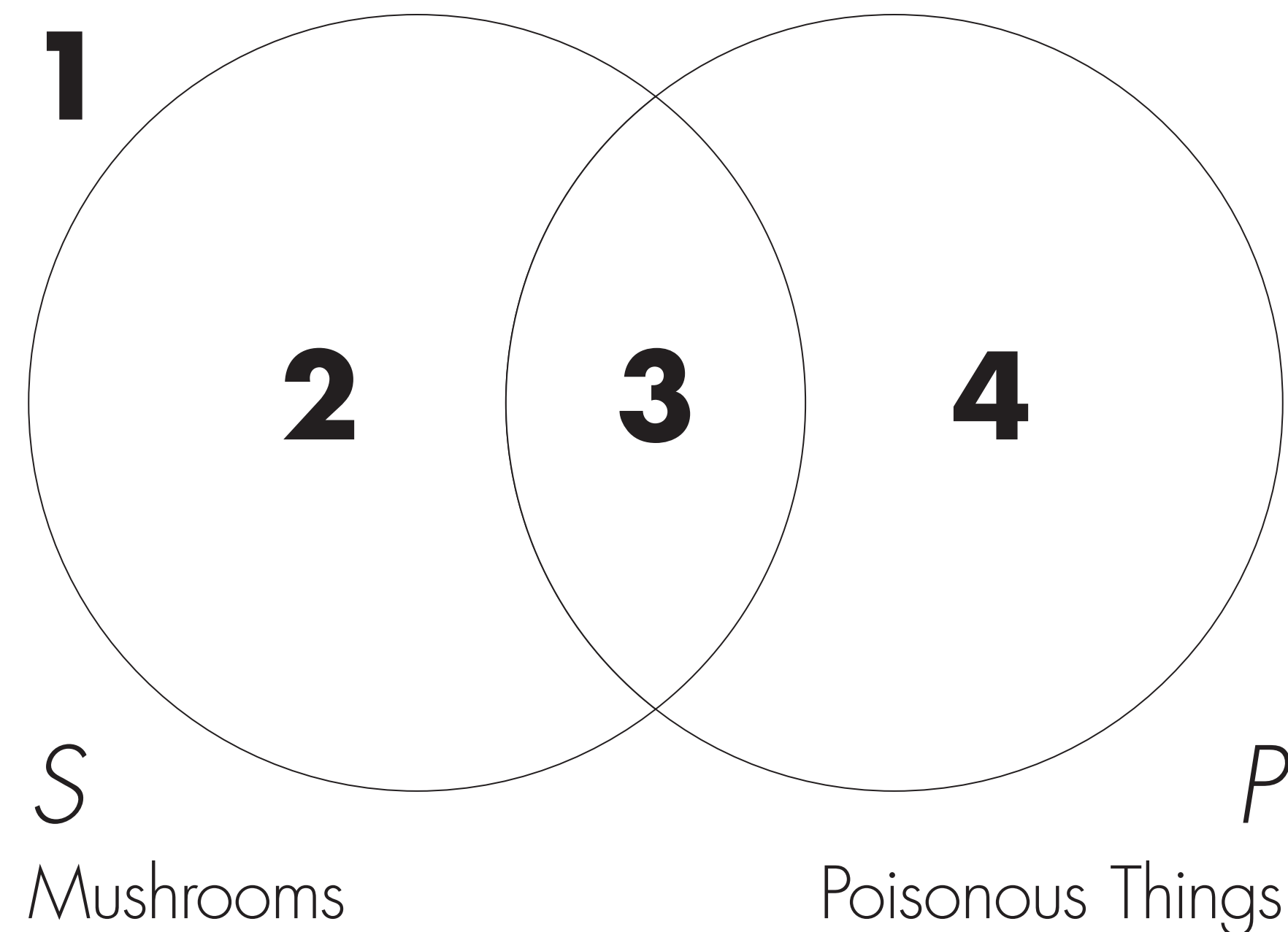
However, this statement is different: it has non-*S* instead of *S*!

That is okay. We just follow the same pattern for **E** statements by shading in the zone that non-*S* and *P* share.

Statement #1: *Creating the Venn Diagram*

No non-mushroom is poisonous.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.

1

2   **3**   **4**

S

Mushrooms

P

Poisonous Things

Statement #1: *Creating the Venn Diagram*

No non-mushroom is poisonous.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.

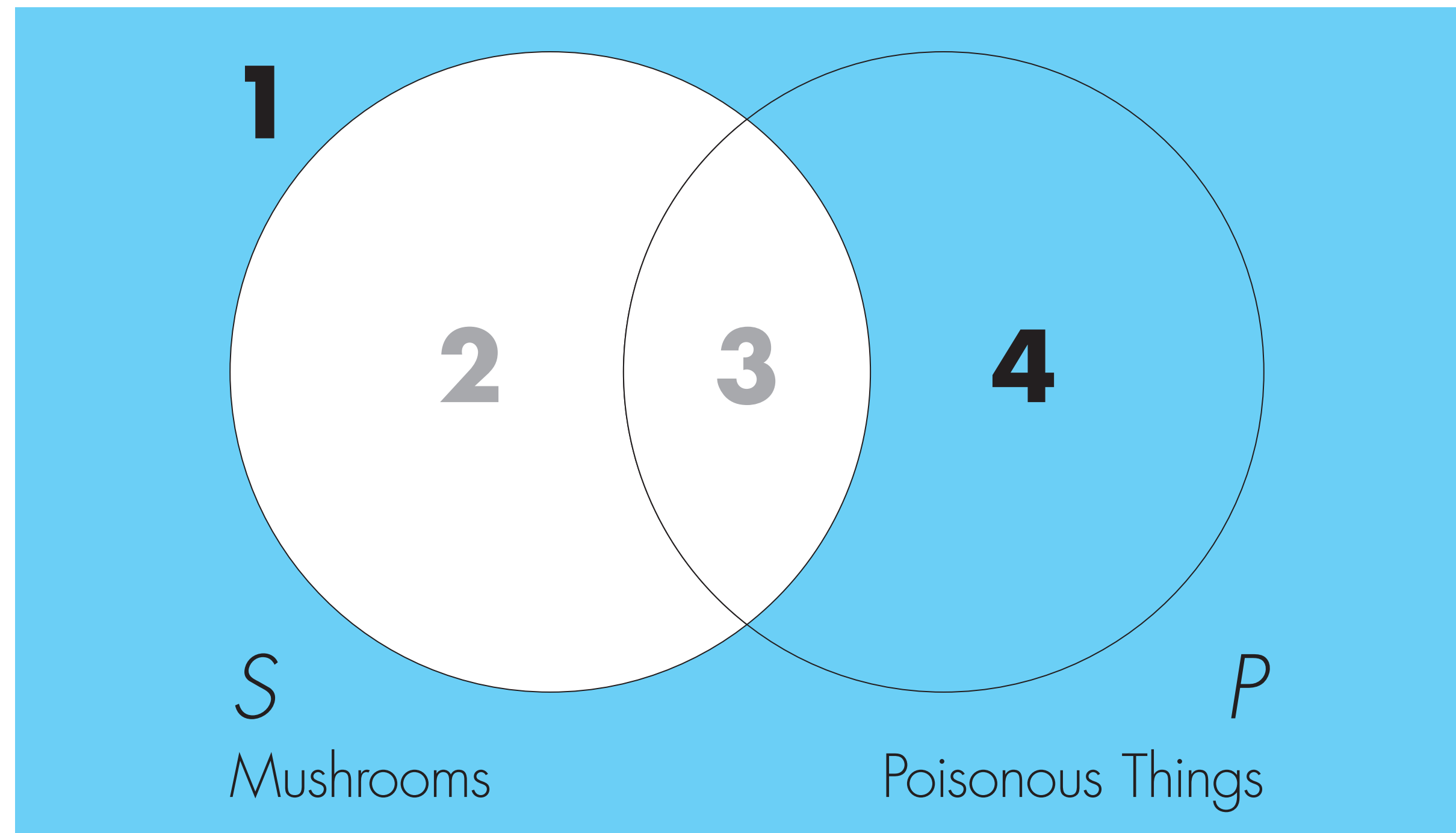non-*S* consists of everything *outside* *S*: zones 1 and 2.

Statement #1: *Creating the Venn Diagram*

No non-mushroom is poisonous.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.

non-*S* consists of everything *outside* *S*: zones 1 and 2.

P consists of zones 3 and 4.

1

2   3   4
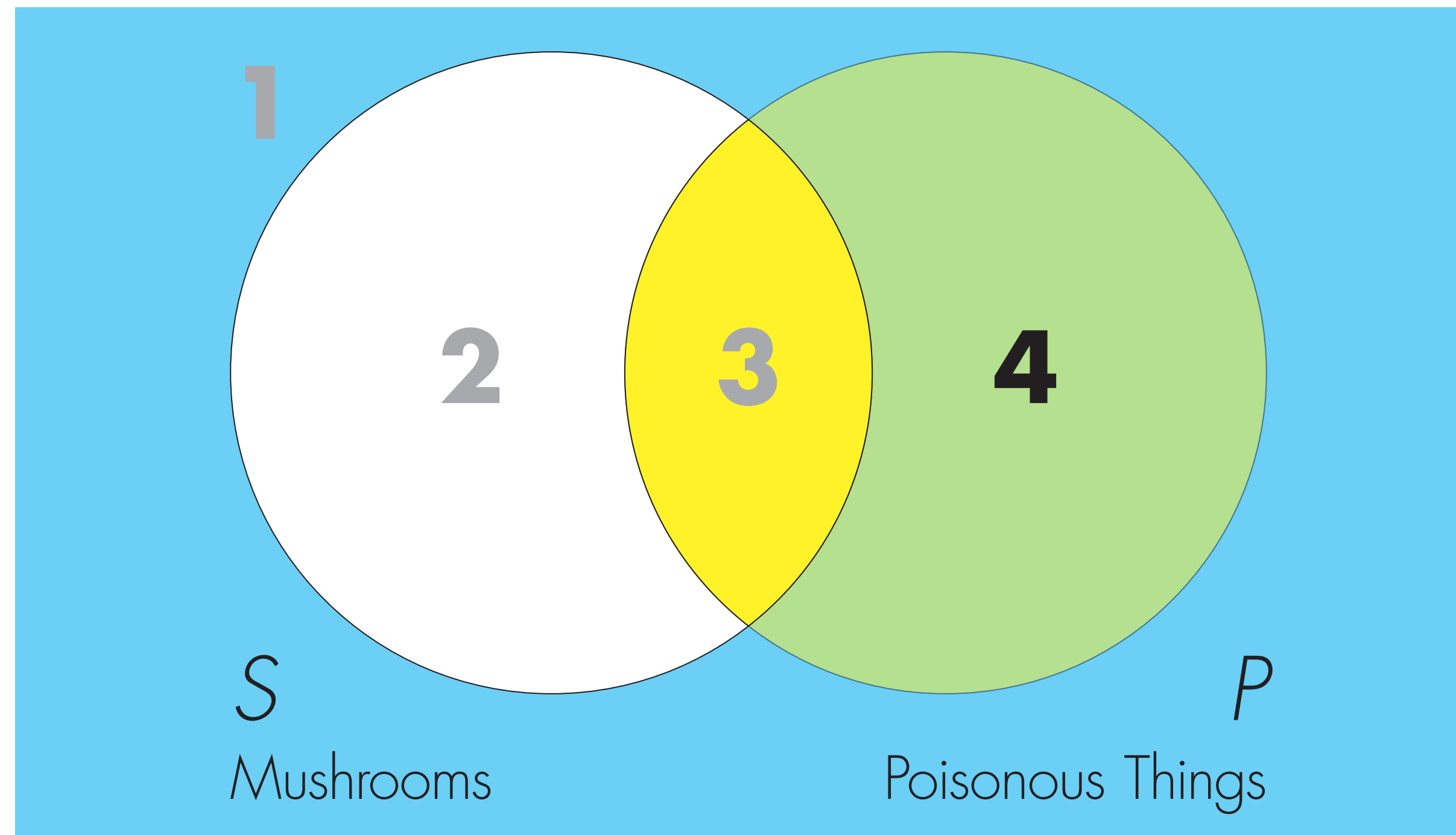
S
Mushrooms

P
Poisonous Things

Statement #1: *Creating the Venn Diagram*

No non-mushroom is poisonous.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.

non-*S* consists of everything *outside* *S*: zones 1 and 2.

P consists of zones 3 and 4.

non-*S* and *P* share zone 4!

1

2   3   **4**

S
Mushrooms

P
Poisonous Things

Statement #1: *Creating the Venn Diagram*

No non-mushroom is poisonous.

This is an **E**-type categorical statement of the form "No non-*S* is *P*". So we are shading in the zone that non-*S* and *P* share.

non-*S* consists of everything *outside* *S*: zones 1 and 2.

non-*S* and *P* share zone 4!
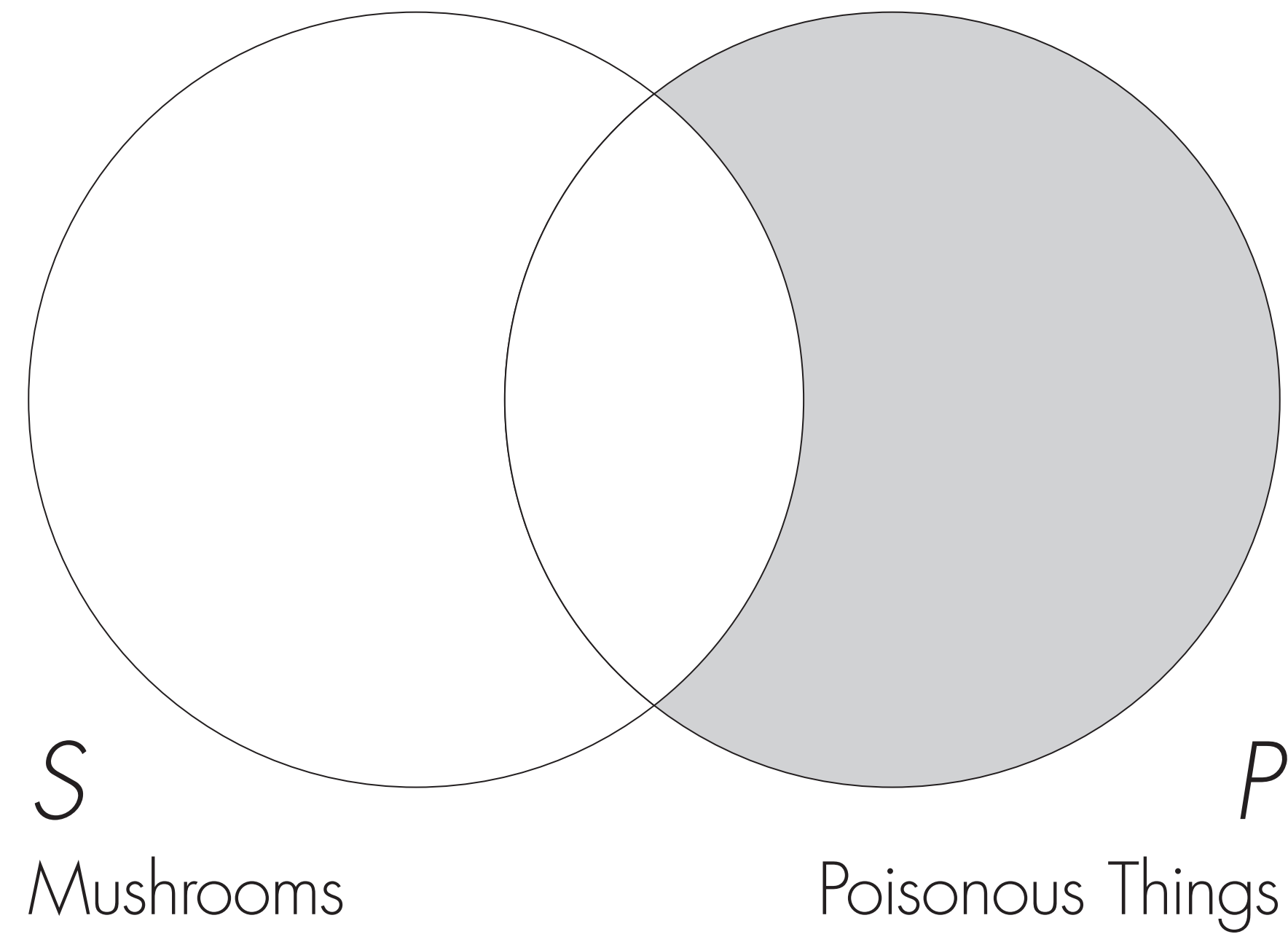
P consists of zones 3 and 4.

1

2 **3** **4**

So zone 4 is shaded in!

S
Mushrooms

P
Poisonous Things
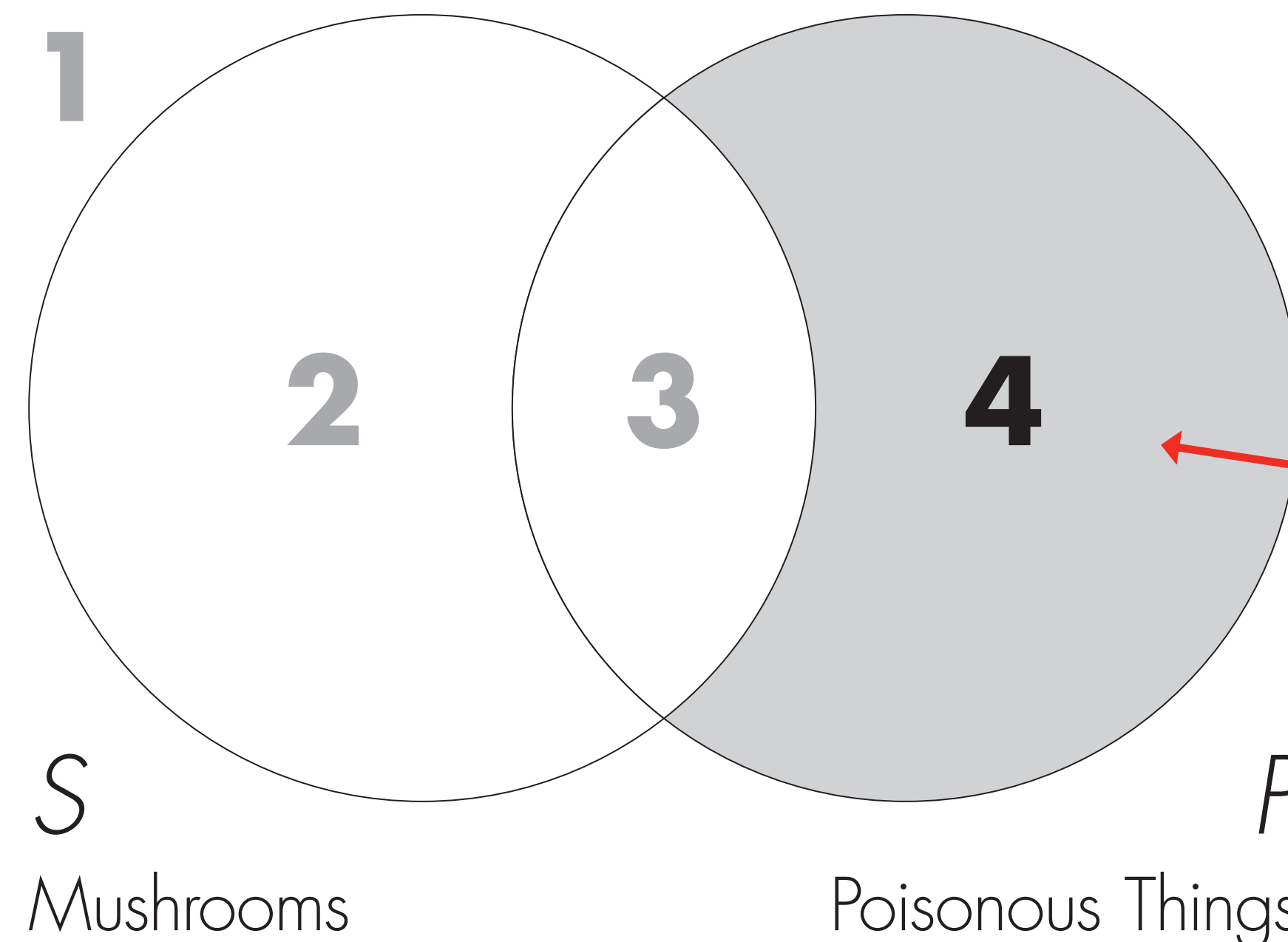
Statement #1: *The Venn Diagram*

No non-mushroom is poisonous.

S
Mushrooms

P
Poisonous Things

Categorical Statements & Venn Diagrams

Now you are in position to create a Venn diagram for any categorical statement in one of the four traditional forms, with and without complements involved. Just remember these four rules:

(**A**)   All *X* is *Y*: Shade in all of *X* not shared with *Y*.

(**E**)   No *X* is *Y*: Shade in all of *X* shared with *Y*.

(**I**)   Some *X* is *Y*: Dot-*x* in *X* shared with *Y*.

(**O**)   Some *X* is not *Y*: Dot-*x* in *X* not shared with *Y*.

Note: It is okay for a complement like non-*S* or non-*P* to substitute for *X* or *Y*. E.g., we just did the **E** rule for "No non-*S* is *P*" (statement #1), where non-*S* was *X* and *P* was *Y*.

Next Class…

We will have a workshop on identifying categorical statements and drawing their Venn diagrams.

References

Gray, D. E. (2016A, May 14). [Pumpkin cat]. [Digital image]. (Unpublished).

Gray, D. E. (2016B, May 14). [Snowflake cat]. [Digital image]. (Unpublished).