Sets – Exercises (No Answers)

1. Collections

Write out the following:

The set of A:

The set of the set of A:

The set of A and B:

The set of both A and the set of A:

The set of A, B, and C:

If x is {A, B} and y is {C, D} then write out:

{x} =

{x, y} =

{{x}} =

{{x}, y} =

Answer the following (true or false):

1 = {1}?

{1} = {{1}}?

{1, 1} = {1, {1}}?

{1, B, 2} = {2, 1, B}?

{A, A} = {A}?

{A, A} = {{A}}?

2. Membership

True or false:

Is A ∈ {A}?

Is {A} ∈ {{A}}?

Is A ∈ {{A}}?

Is {B} ∈ {{A}, {B}}?

Is {A, B} ∈ {A, B}?

Is {} ∈ {A}?

3. Set Builders

Using the set Y = {1, A, 2, B, 3, C}, write out the following sets:

$\{ x \in Y \mid x \text{ is a letter}\} =$

$\{ x \in Y \mid x \text{ is a number}\} =$

If X = {A, B, C, 1, 2, 3}, Y = {A, B, C}, and Z = {1, 2, 3}, then write:

$\{x \in X \mid x \text{ is also in } Y\} =$

$\{x \in X \mid x \in Z\} =$

4. Unions

Write out:

$\{a, b\} \cup \{1\} =$

$\{a, b\} \cup \{c, d\} =$

$\{a\} \cup \{b\} \cup \{c\} =$

$\{\{A\}\} \cup \{\{B\}\} =$

$\{a\} \cup \{\{1\}\} =$

$\{A\} \cup \{\{A\}\} =$

5. Intersections

$\{a, b\} \cap \{a\} =$

$\{a, b\} \cap \{\{a\}\} =$

$\{1, 2, 3\} \cap \{a, b\} =$

$\{\{\}, A\} \cap \{A, \{\}\} =$

$\{\{\}, 2, 3\} \cap \{\{\}\} =$

$\{a, b, c\} \cap \{b, c, d\} =$

6. Subsets

{A, B} is a subset of {A, B, C}?

{A} is a subset of {A, B}?

A is a subset of {A}?

{A} is a subset of {{A}}?

{A} is a subset of {A, {A}}?

{A, B} is a subset of {A, B}?

Write the subsets of {1, 2}:

7. Rank

Assume that A, B, and C are individuals on rank 0.

rank of {A} =

rank of {{{B}}, {C}} =

rank of {A, {A}} =

rank of {{A, B}, {C}} =

8. Power Sets

The power set of {1, A} is:

The power set of {Q} is:

The power set of {{}} is:

Write the power set of the power set of {A}:

9. Some Transformations of Sets

Suppose X = {A, B, C}.
Write the set that results from replacing each $x \in$ X with $\{x\}$:

Suppose X = {{{A}, {B}}, {{C}}}.
Write the set that results from replacing each $x \in$ X with $\cup x$:

10. Diagramming Sets

Use names or dots for sets and an arrow from *x* to *y* iff *x* is a member of *y*.

Draw the diagram for {A, B}.

Draw the diagram for {A, {A}}

Draw the diagram for {{A}, {B}}.

Draw the diagram for {{}, {{}}}.

11. Sets and Selections

Fill in the table with 0s and 1s to express all selections. Write the selected set in the rightmost cell of each row.

{}	A	{A}	

Now write the set of all sets from the rightmost cell of each row:

12. Numbers as Sets

Using the idea that n is the set of all numbers less than n, write out:

0

1

2

3

4

13. Diagramming Numbers as Sets

Draw a diagram for each of the numbers in exercise 12 above:

0

1

2

3

4

14. Iteration versus Accumulation

An *iterative hierarchy* says that every next level is just the power set of the previous level.

Consider this iterative hierarchy:

$H(0) = \{A\}; \qquad H(n+1) = \text{pow } H(n).$

Write out levels H(0), H(1), and H(2) of this iterative hierarchy:

H(0) =

H(1) =

H(2) =

A *cumulative hierarchy* says that every next level is the power set of the previous level unioned with the previous level. Consider this cumulative hierarchy:

$K(0) = \{A\}; \quad K(n+1) = \text{pow } K(n) \cup K(n).$

Write out levels K(0), K(1), and K(2) of this cumulative hierarchy:

K(0) =

K(1) =

Write out pow K(1). (How can exercise 11 help you?)

K(2) =

Give an example of an object that appears on K(1) but not on H(1):

List all objects that appear on K(2) but not on H(2):

Explain why $K(n+1)$ is richer than $H(n+1)$ for $n > 0$:

15. Ordered Pairs

Diagram (Sue, Bob)

Diagram (Bob, Bob)

Diagram (Sue, {Sue})

Diagram ({}, {{}})

16. Cartesian Products

Write the Cartesian Product $\{A, B\} \times \{1, 2\}$.

Write the Cartesian Product $\{Abe, Bob, Sue\} \times \{Happy, Sad\}$.