Homework 5

Alexander Gould

February 6, 2015

125

1A. *List all members of the set of real numbers so that* $x^2 = 1$.

$\{-1, 1\}$

1B. *List all members of the set of positive integers less than 12.*

$\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$

1C. List all squares of an integer less than 100.

$\{1, 4, 9, 16, 25, 36, 49, 64, 81\}$

1D. *List all integers so that* $x^2 = 2$.

$\emptyset$

3. *For each of these pairs of sets, determine whether the first is a subset of the second, the second is a subset of the first, or neither is a subset of the other.*

3A. *The set of airline flights from New York to New Delhi, the set of nonstop airline flights from New York to New Delhi.*

The second set is a subset of the first, but they aren't equal; the first is larger.

3B. *The set of people who speak English, the set of people who speak Chinese.*

Neither is a subset of the other.

3C. *The set of flying squirrels, the set of living creatures that can fly.*

Neither is a subset of the other; they don't ebven intersect. (Flying squirrels can't fly, they glide on air currents.)

5A. $\{1, 3, 3, 3, 5, 5, 5, 5\} = \{5, 3, 1\}$?

No. The elements aren't the same.

5B. $\{1\}, 1, 1$

No. The second set contains 2 1's.

5C. $\emptyset, \emptyset$

No. The empty set is not the same thing as a set containing the empty set.

7A. *Is 2 an element of the set of integers greater than 1?*

Yes.

7B. *Is 2 an element of numbers that are squares of an integer?*

No.

7C. *Is 2 an element of* $\{2, \{2\}\}$*?*

Yes. It's the first element.

7D. *Is 2 an element of* $\{\{2\}, \{\{2\}\}\}$*?*

No. The set of just 2 is not equal to 2.

7E. *Is 2 an element of* $\{\{2\}, \{2, \{2\}\}\}$*?*

No. It has to be in the set, not nested in some other set.

7F. *Is 2 an element of* $\{\{\{2\}\}\}$*?*

No. See above.

10A. $\emptyset \in \{\emptyset\}$?

Yes. (I have no idea what explanations I could give that aren't obvious other than that $\emptyset \neq \{\emptyset\}$.

10B. $\emptyset \in \{\emptyset, \{\emptyset\}\}$?

Yes.

10C. $\{\emptyset\} \in \{\emptyset\}$?

No.

10D. $\{\emptyset\} \in \{\{\emptyset\}\}$?

Yes.

10E. $\{\emptyset\} \subset \{\emptyset, \{\emptyset\}\}$?

Yes.

10F. $\{\{\emptyset\}\} \subset \{\emptyset, \{\emptyset\}\}$?

No.

10G. $\{\{\emptyset\}\} \subset \{\{\emptyset\}, \{\emptyset\}\}$

No.

11A $x \in \{x\}$?

Yes.

11B. $\{x\} \subseteq \{x\}$?

Yes.

11C. $\{x\} \in \{x\}$?

No. A set doesn't have to be an element of another set to be a subset (or equivelant)

11D. $\{x\} \in \{\{x\}\}$?

Yes.

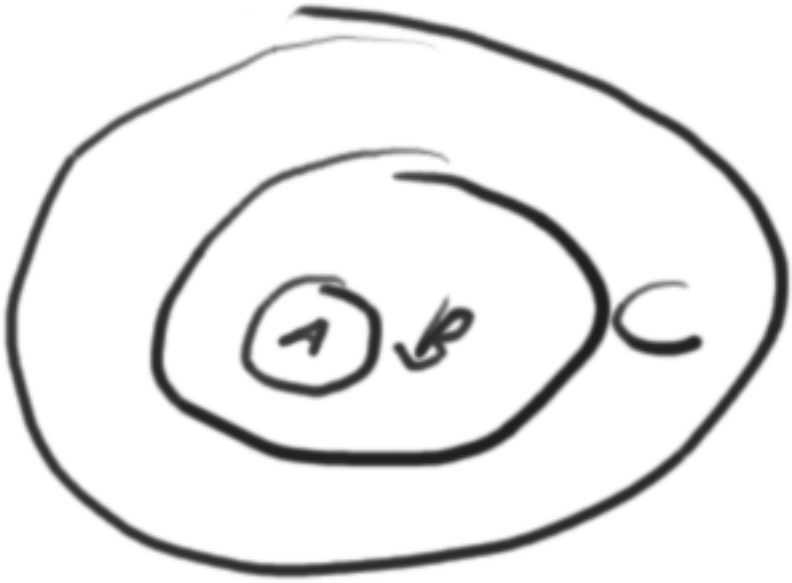
11E. $\emptyset \subseteq \{x\}$?

Yes. The null set is a subset of every set.

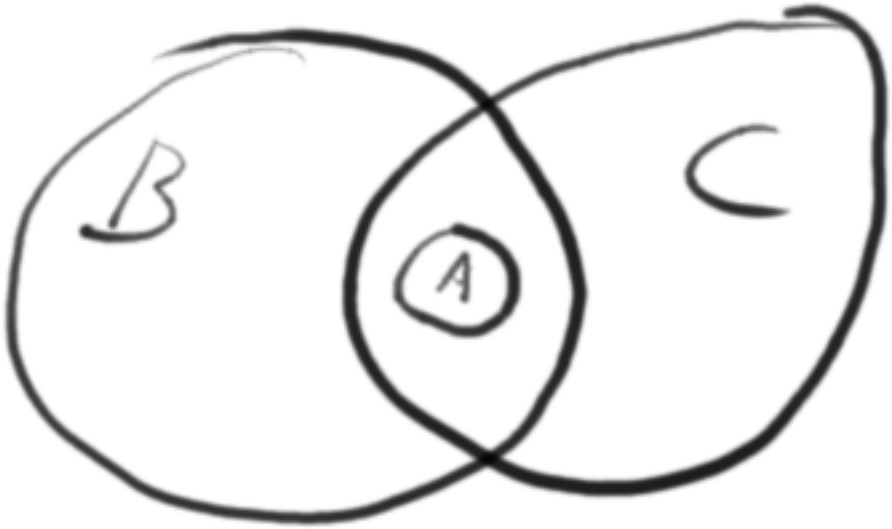
11F. $\emptyset \in \{x\}$?

No. While it's a subset of every set, it's not an element unless expressley added.

14. *Use a Venn diagram to illustrate the relationship* $A \subseteq B$ *and* $B \subseteq C$*.*



16. *Use a Venn diagram to illustrate the relationship* $A \subset B$ *and* $A \subset C$.



23A. *How many elements does* $\{a, b\{a, b\}\}$ *have?*
3.
23B. *How many elements does* $\{\emptyset, a, \{a\}, \{\{a\}\}\}$ *have?*
4
23C. *How many elements does* $\emptyset$ *have?*

0.

27A. $\{a, b, c, d\} \times \{y, z\}$

$(a, y), (a, z), (b, y), (b, z), (c, y), (c, z), (d, y), (d, z)$

27B. $\{y, z\} \times \{a, b, c, d\}$

$(y, a), (y, b), (y, c), (y, d), (z, a), (z, b), (z, c), (z, d)$

33A. $\{0, 1, 3\}^2$

$(0, 0), (0, 1), (0, 3), (1, 0), (1, 1), (1, 3), (3, 0), (3, 1), (3, 3)$

33B. $\{1, 2, a, b\}^2$

$(1, 1), (1, 2), (1, a), (1, b), (2, 1), (2, 2), (2, a), (2, b) (a, 1), (a, 2), (a, a), (a, b), (b, 1), (b, 2), (b, a), (b, b)$

34A. $\{a\}^3$

(a, a, a)

34B. $\{0, a\}^3$

$(0, a), (a, 0)$

36. *How many different elements does $A \times B \times C$ have if A has m elements, B has n elements, and C has p elements?*

nmp elements.

42A. *Translate $\exists x \in R\left(x^3 = -1\right)$ and determine its truth value.*

"There exists a real number that, when cubed, is -1." True, the number is -1.

42B. $\exists x \in Z\,(x + 1 > x)$

"There exists an integer that grows when 1 is added." True for all numbers.

42C. $\forall x \in Z\,(x - 1 \in Z)$

"All integers are still integers when 1 is subtracted." True.

42D. $\forall x \in Z\left(x^2 \in Z\right)$

"All integers are still integers when squared." True.

44A. *Find the truth set of all integers that satisfy $x^3 \geq 1$.*

All integers greater than 1.

44B. $x^2 = 2$

No integer values.

44C. $x < x^2$

All integers, excluding -1, 0 and 1.