IQ ACADEMY

Exercise set (2.1)

5. 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.

a) the set of airline flights from New York to New Delhi, the set of nonstop airline flights from New York to New Delhi

b) the set of people who speak English, the set of people who speak Chinese

c) the set of flying squirrels, the set of living creatures that can fly

a) second set $\subseteq$ first set

b) neither

c) first set $\subseteq$ second set

6. 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.

a) the set of people who speak English, the set of people who speak English with an Australian accent

b) the set of fruits, the set of citrus fruits

c) the set of students studying discrete mathematics, the set of students studying data structures

a) second set $\subseteq$ first set

b) second set $\subseteq$ first set

c) neither

7. Determine whether each of these pairs of sets are equal.

a) $\{1, 3, 3, 3, 5, 5, 5, 5, 5\}, \{5, 3, 1\}$

b) $\{\{1\}\}, \{1, \{1\}\}$ **c)** $\emptyset, \{\emptyset\}$

a) equal

b) $\{\{1\}\} \neq \{1, \{1\}\}$

c) $\emptyset \neq \{\emptyset\}$

8. Suppose that $A = \{2, 4, 6\}$, $B = \{2, 6\}$, $C = \{4, 6\}$, and $D = \{4, 6, 8\}$. Determine which of these sets are subsets of which other of these sets.

$B \subseteq A$

$C \subseteq A$

$C \subseteq D$

9. For each of the following sets, determine whether 2 is an element of that set.

a) $\{x \in \mathbf{R} \mid x \text{ is an integer greater than } 1\}$
b) $\{x \in \mathbf{R} \mid x \text{ is the square of an integer}\}$
c) $\{2, \{2\}\}$
d) $\{\{2\}, \{\{2\}\}\}$
e) $\{\{2\}, \{2, \{2\}\}\}$
f) $\{\{\{2\}\}\}$

a) Yes

b) No

c) Yes

d) No

e) No

f) No

10. For each of the sets in Exercise 9, determine whether $\{2\}$ is an element of that set.

a) No

b) No

c) Yes

d) Yes

e) Yes

f) No

11. Determine whether each of these statements is true or false.

a) $0 \in \emptyset$ False
b) $\emptyset \in \{0\}$ False
c) $\{0\} \subset \emptyset$ False
d) $\emptyset \subset \{0\}$ True
e) $\{0\} \in \{0\}$ False
f) $\{0\} \subset \{0\}$ False
g) $\{\emptyset\} \subseteq \{\emptyset\}$ True

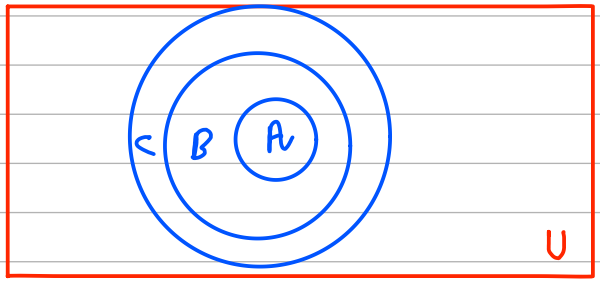
12. Determine whether these statements are true or false.

a) $\emptyset \in \{\emptyset\}$ True
b) $\emptyset \in \{\emptyset, \{\emptyset\}\}$ True
c) $\{\emptyset\} \in \{\emptyset\}$ False
d) $\{\emptyset\} \in \{\{\emptyset\}\}$ True
e) $\{\emptyset\} \subset \{\emptyset, \{\emptyset\}\}$ True
f) $\{\{\emptyset\}\} \subset \{\emptyset, \{\emptyset\}\}$ True
g) $\{\{\emptyset\}\} \subset \{\{\emptyset\}, \{\emptyset\}\}$ False

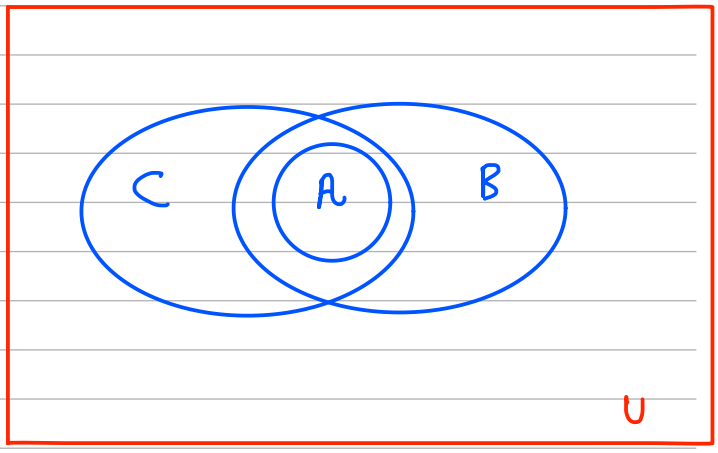
13. Determine whether each of these statements is true or false.

a) $x \in \{x\}$ True
b) $\{x\} \subseteq \{x\}$ True
c) $\{x\} \in \{x\}$ False
d) $\{x\} \in \{\{x\}\}$ True
e) $\emptyset \subseteq \{x\}$ True
f) $\emptyset \in \{x\}$ False

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



18. Use a Venn diagram to illustrate the relationships $A \subset B$ and $A \subset C$.



29. Let $A = \{a, b, c, d\}$ and $B = \{y, z\}$. Find

a) $A \times B$. **b)** $B \times A$.

a) $\{(a,y), (a,z), (b,y), (b,z), (c,y), (c,z), (d,y), (d,z)\}$

b) $\{(y,a), (y,b), (y,c), (y,d), (z,a), (z,b), (z,c), (z,d)\}$

34. Let $A = \{a, b, c\}$, $B = \{x, y\}$, and $C = \{0, 1\}$. Find

a) $A \times B \times C$. **b)** $C \times B \times A$.

c) $C \times A \times B$. **d)** $B \times B \times B$.

a) {(a, x, 0), (a, x, 1), (a, y, 0), (a, y, 1), (b, x, 0), (b, x, 1), (b, y, 0), (b, y, 1), (c, x, 0), (c, x, 1), (c, y, 0), (c, y, 1)}

b) {(0, x, a), (0, x, b), (0, x, c), (0, y, a), (0, y, b), (0, y, c), (1, x, a), (1, x, b), (1, x, c), (1, y, a), (1, y, b), (1, y, c)}

c) {(0, a, x), (0, a, y), (0, b, x), (0, b, y), (0, c, x), (0, c, y), (1, a, x), (1, a, y), (1, b, x), (1, b, y), (1, c, x), (1, c, y)}

d) {(x, x, x), (x, x, y), (x, y, x), (x, y, y), (y, x, x), (y, x, y), (y, y, x), (y, y, y)}