Set Theory Exercise 2.2 MCQs with Solutions

Set Theory MCQs (Exercise 2.2)

The following multiple-choice questions test key set theory concepts from Exercise 2.2. Questions are divided into low, medium, and high difficulty levels.

Questions

1. What does it mean for two sets to be equivalent?

    a) They have the same elements

    b) They have the same number of elements

    c) They are subsets of each other

    d) They are disjoint

2. Which pair of sets is equal?

    a) {1, 2} and {2, 3}

    b) {1, 2} and {2, 1}

    c) {1, 2, 3} and {1, 2}

    d) {a, b} and {1, 2, 3}

3. In a Venn diagram, what does the rectangle represent?

    a) A subset

    b) The universal set

    c) The intersection of sets

    d) The empty set

4. If A = {1, 2} and B = {2, 3}, what is A ∪ B?

    a) {2}

    b) {1, 2, 3}

    c) {1, 3}

    d) {∅}

5. If A = {1, 2} and B = {2, 3}, what is A ∩ B?

a) {1, 2, 3}

b) {2}

c) {1, 3}

d) {∅}

6. What is the empty set?

    a) {0}

    b) {∅}

    c) {}

    d) {1, 2}

7. Which sets are disjoint?

    a) {1, 2} and {2, 3}

    b) {1, 2} and {3, 4}

    c) {1, 2} and {1, 2, 3}

    d) {1, 2} and {1}

8. If A = {1, 2, 3} and B = {2, 4}, what is A - B?

    a) {1, 3}

    b) {2}

    c) {1, 2, 3, 4}

    d) {4}

9. If U = {1, 2, 3, 4} and A = {1, 2}, what is A'?

    a) {1, 2}

    b) {3, 4}

    c) {1, 2, 3, 4}

    d) {∅}

10. Which sets are overlapping?

    a) {1, 2} and {3, 4}

    b) {1, 2} and {2, 3}

    c) {1, 2} and {1, 2}

    d) {1, 2} and {∅}

11. If A ⊆ B, what is A ∩ B?

    a) A

    b) B

c) ∅

d) A ∪ B

12. Which property states A ∪ B = B ∪ A?

    a) Associative property

    b) Commutative property

    c) Distributive property

    d) De Morgan's Law

13. If A = {1, 2} and B = {3, 4}, what is n(A ∪ B)?

    a) 2

    b) 4

    c) 0

    d) 6

14. If U = {1, 2, 3}, what is U'?

    a) {1, 2, 3}

    b) {∅}

    c) {0}

    d) {}

15. If A ⊆ B, what is A - B?

    a) A

    b) B

    c) ∅

    d) A ∪ B

16. Which is true according to De Morgan's Laws?

    a) (A ∪ B)' = A' ∪ B'

    b) (A ∩ B)' = A' ∩ B'

    c) (A ∪ B)' = A' ∩ B'

    d) (A ∩ B)' = A ∪ B

17. If A = {1, 2} and B = {2, 3}, what is (A ∪ B)' if U = {1, 2, 3, 4}?

    a) {4}

    b) {1, 2, 3}

    c) {1, 3}

    d) {2}

18. If $A \cap B = \emptyset$, what is $n(A \cup B)$?

    a) $n(A) + n(B)$

    b) $n(A) - n(B)$

    c) $n(A) \times n(B)$

    d) $n(A \cap B)$

19. If $A = B'$, what is $A \cup B$?

    a) $\emptyset$

    b) A

    c) B

    d) U

20. Which is true for $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$?

    a) Commutative property

    b) Associative property

    c) Distributive property

    d) De Morgan's Law

Solutions with Explanations

1. **Answer: B** Equivalent sets have the same number of elements (cardinality), not necessarily the same elements.

2. **Answer: B** $\{1, 2\}$ and $\{2, 1\}$ have the same elements, so they are equal (order doesn't matter).

3. **Answer: B** In a Venn diagram, the rectangle represents the universal set containing all elements under consideration.

4. **Answer: B** $A \cup B$ combines all elements: $\{1, 2\} \cup \{2, 3\} = \{1, 2, 3\}$.

5. **Answer: B** $A \cap B$ includes common elements: $\{1, 2\} \cap \{2, 3\} = \{2\}$.

6. **Answer: C** The empty set has no elements, denoted $\{\}$ or $\emptyset$. $\{\emptyset\}$ contains one element, the empty set.

7. **Answer: B** Disjoint sets have no common elements. $\{1, 2\} \cap \{3, 4\} = \emptyset$.

8. **Answer: A** A - B includes elements in A not in B: $\{1, 2, 3\} - \{2, 4\} = \{1, 3\}$.

9. **Answer: B** A' includes elements in U not in A: $\{1, 2, 3, 4\} - \{1, 2\} = \{3, 4\}$.

10. **Answer: B** Overlapping sets have at least one common element: $\{1, 2\} \cap \{2, 3\} = \{2\}$.

11. **Answer: A** If $A \subseteq B$, all elements of A are in B, so $A \cap B = A$.

12. **Answer: B** $A \cup B = B \cup A$ is the commutative property of union.

13. **Answer: B** A = {1, 2}, B = {3, 4}, A ∩ B = ∅, so n(A ∪ B) = n(A) + n(B) = 2 + 2 = 4.

14. **Answer: D** The complement of the universal set is empty: U' = U - U = {}.

15. **Answer: C** If A ⊆ B, all elements of A are in B, so A - B = ∅ (no elements in A are outside B).

16. **Answer: C** De Morgan's Law: (A ∪ B)' = A' ∩ B'. The other options are incorrect or incomplete.

17. **Answer: A** A ∪ B = {1, 2, 3}, so (A ∪ B)' = {1, 2, 3, 4} - {1, 2, 3} = {4}.

18. **Answer: A** If A ∩ B = ∅, then n(A ∪ B) = n(A) + n(B) by the cardinality rule for disjoint sets.

19. **Answer: D** If A = B', then A ∪ B = B' ∪ B = U (all elements in the universal set).

20. **Answer: C** A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C) is the distributive property of intersection over union.