E-Learning Day 1

Review: Set Theory

https://www.khanacademy.org/math/statistics-probability/probability-library/basic-set-ops/v/intersection-and-union-of-sets?referrer=share_link

Learning Objectives

By the end of this module, I will be able to:

1. Define and use basic terms in set theory.
2. Compare sets using equality, subset relations, equivalence, and power sets.
3. Determine the cardinality of sets and distinguish between finite and infinite sets.

Basic Terms and Concepts in Set Theory

- **Set:** A well-defined collection of distinct objects, called *elements*.
  - Example: A={1,2,3,4}

    (Collection of First four natural numbers)
- **Element:** A member of a set.
  - Example: A={1,2,3}

    - $2 \in A$
- **Well-defined set:** A set where it is clear whether an element belongs or not.
    - Example: "Set of all prime numbers less than 10" → $\{2,3,5,7\}$
    - Not well-defined: "Set of the most beautiful colors."
- **Empty set (Null set):** A set with no elements.
    - Symbol: $\emptyset$ or $\{\}$

- **Cardinal number (Cardinality):** The number of elements in a set.
    - Example: If $A=\{2,4,6\}$ then $n(A)=3$.

Comparing Sets

- **Equality of sets:** Two sets are equal if they contain the exact same elements.
    - Example: $A=\{1,2,3\}$, $B=\{3,1,2\}$.

- **Subset:** $A \subseteq B$ if every element of A is also in B

- **Proper subset:** $A \subset B$ if $A \subseteq B$ but $A \neq B$

A **proper subset** (or strict subset) of a set A is a subset that contains some elements of A but is **not equal** to A itself

- **Equivalence of sets:** Two sets are equivalent if they have the same cardinality (same number of elements), even if elements differ.
  - Example: {a,b,c} and {1,2,3} are equivalent.

- **Power set:** The set of all subsets of a given set.
  - If A={1,2}, then P(A)={∅,{1},{2},{1,2}}
  - If A has n elements, then P(A) has 2^n elements.

Cardinality of Sets

- **Finite set:** A set with a countable number of elements.
  - Example: A={1,2,3,4,5},n(A)=5A = \{1, 2, 3, 4, 5\}, n(A) = 5A={1,2,3,4,5},n(A)=5.

- **Infinite set:** A set with unlimited elements.
  - Example: N={1,2,3,4,…}N = \{1, 2, 3, 4, …\}N={1,2,3,4,…}.

- **Cardinality notation:** n(A) = number of elements in set A.

Set Theory Worksheet

Multiple Choice Questions

1. Which of the following is a well-defined set?

- A) Set of tall students in the class
- B) Set of even numbers less than 10
- C) Set of beautiful colors
- D) Set of popular movies

2. The symbol Ø represents:

- A) Universal set
- B) Null set
- C) Power set
- D) Subset

3. If A = {1,2,3}, then n(A) = ?

- A) 1
- B) 2
- C) 3
- D) 4

4. Which of the following is true about the empty set?

- A) It contains one element
- B) Its cardinality is zero
- C) It is not a set

- D) It is equal to the universal set

5. If A = {a, b, c}, then the number of elements in P(A) is:

- A) 3
- B) 6
- C) 8
- D) 9

6. If A = {1,2,3}, B = {3,2,1}, then:

- A) $A \neq B$
- B) $A = B$
- C) $A \subset B$ only
- D) None

7. Which of the following is an infinite set?

- A) {2,4,6,8}
- B) {x | x is a natural number}
- C) {1,2,3,4,5}
- D) {a,b,c}

8. If A = {1,2}, then P(A) = ?

- A) {1,2}
- B) {∅, {1}, {2}, {1,2}}
- C) {∅}
- D) {1}

9. Which of the following shows subset relation?

- A) {1,2} ⊆ {1,2,3}
- B) {1,2,3} ⊂ {1,2}
- C) {a,b} ⊂ {1,2}
- D) {x} ⊂ ∅

10. The set {x | x is a prime number less than 10} equals:

- A) {2,3,5,7}
- B) {1,2,3,5}
- C) {2,4,6,8}
- D) {3,5,7,9}

11. The cardinality of ∅ is:

- A) 0
- B) 1
- C) Undefined
- D) Infinite

12. Which notation means ‘is an element of’?

- A) $\in$
- B) $\subset$
- C) $\subseteq$
- D) $\emptyset$

13. If A = {1,2,3}, B = {1,2,3,4}, then:

- A) A = B
- B) $A \subset B$
- C) $B \subset A$
- D) $A \neq B$ but not a subset

14. Two sets are equivalent if:

- A) They are identical
- B) They have the same number of elements
- C) They are subsets
- D) They have different elements

15. Power set of $\emptyset$ is:

- A) $\emptyset$
- B) $\{\emptyset\}$

- C) {∅, {∅}}
- D) None

16. Which of the following is finite?

- A) Set of integers
- B) Set of real numbers
- C) Set of weekdays
- D) Set of natural numbers

17. If A has 4 elements, the number of subsets is:

- A) 8
- B) 12
- C) 16
- D) 32

18. If A = {2,4,6}, B = {x | x is an even number less than 7}, then:

- A) A = B
- B) A ⊂ B
- C) B ⊂ A
- D) A ≠ B

19. Which of the following is not a set?

- A) {1,2,3}
- B) Set of months of the year
- C) Set of popular songs
- D) {a,e,i,o,u}

20. If A = {a,b}, B = {1,2}, which statement is true?

- A) A = B
- B) A ≠ B but equivalent
- C) A ⊂ B
- D) None

21. If A = {1,2,3,4}, what is n(P(A))?

- A) 4
- B) 8
- C) 12
- D) 16

22. Universal set U = {1,2,3,4,5}, A = {2,4}. Then A ⊂ U?

- A) Yes
- B) No
- C) Maybe

- D) Cannot determine

23. The set of vowels in English alphabet is:

- A) {a,e,i,o,u}
- B) {a,b,c}
- C) {e,o,u}
- D) {a,e}

24. Which symbol shows ‘proper subset’?

- A) $\subset$
- B) $\subseteq$
- C) $\in$
- D) =

25. The set of all subsets of {a,b,c} has:

- A) 6 elements
- B) 8 elements
- C) 9 elements
- D) 12 element

1. Identify the type of set: S={}

2. Compare: $A=\{1,2,3\}, B=\{1,2,3,4\}$ Is $A \subseteq B$

3. Find the power set of $\{x,y\}$

4. State whether the set of natural numbers is finite or infinite.