**Introduction to Sets**

* A set is a collection of objects, with elements denoted by curly brackets. Uppercase letters represent sets, while lowercase letters denote elements.
* Sets can be explicitly listed or defined through conditions.
* There are few types of ways to define numbers; ℕ: Natural numbers, ℤ: Integers, ℚ: Rational numbers, ℝ: Real numbers, ℂ: Complex numbers.
* Sets A and B are equal if they contain the same elements. Cardinality (|A|) represents the number of elements in a set. Null set (∅) contains no elements, and the universal set (U) contains all elements.
* There are 2 types of subsets; A is a subset of B (A ⊆ B) if every element of A is in B. Proper subset (A ⊊ B) indicates A is a subset but not equal to B.
* It is mainly used for conceptual foundation, logical reasoning, inventory management, statistics, and computer science, and mathematics.

**Applying Set Operations**

* There are 4 different operations;
  + Union (A ∪ B) – set of all elements in A or B
  + Intersection (A ∩ B) – set of all elements
  + Complement (Ā) – set of elements not in A
  + set difference (A \ B or A – B) – set of elements in A excluding those in B.
* we can use De Morgan’s law in set operations as well. Where ∨ corresponds with ∪, ∧ corresponds with ∩, ¬ corresponds with C (complement), T corresponds with U, F corresponds with ∅.
* There are several laws applied on the set operations; identity, domination, idempotent, double complement, commutative, associative, distributive, De Morgan’s, complement, absorption Laws.
* Venn diagrams are used to illustrate the relationship between the sets. But Venn diagrams are not formal proofs but useful to understanding the concept.
* It is mainly used for conceptual foundation, logical reasoning, inventory management, statistics, and computer science, and mathematics.

**Functions**

* Functions assign labels to elements in a set
* A function, denoted as f: X -> Y, maps elements from set X to set Y.
* The main key terms in this are domain (X), co-domain(Y), image, and pre-image.
* Range (f(X)) may or may not be the same as the co-domain Y but is always a subset of Y.
* There are few types of functions:
  + Floor functions – Rounds down to closest integer.
  + Ceiling functions – rounds up to the closest integer.
  + Injective functions – are those in which distinct inputs produce distinct outputs, this is important for scenarios where uniqueness is desired, like assigning unique identifiers.
  + Surjective functions – this covers the entire co-domain Y. every element in the co-domain has at least one pre-image in the domain.
  + Bijective function – a bijective function is where a function is both injective and surjective.
* It is mainly used for conceptual foundation, logical reasoning, inventory management, statistics, and computer science, and mathematics. It can be used in constructing proofs and arguments as well.

References

1. Unacademy. (n.d.). *Set Theory in Day-to-Day Life*. [online] Available at: <https://unacademy.com/content/jee/study-material/mathematics/set-theory-in-day-to-day-life/#:~:text=Sets%20are%20a%20fundamental%20idea>.
2. 'APPLICATIONS OF SETS' (2022) *APPLICATIONS OF SETS* [Preprint]. <https://www.jetir.org/papers/JETIR1901H53.pdf>.