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JAVA

1. **WHY MAP IS NOT UNDER THE COLLECTIONS:**

- The Collection interface (and its sub-interfaces like List, Set, and Queue) represents a group of individual objects (elements). Collections are used to hold and manage a set of objects, and they provide methods like add(), remove(), size(), etc., that operate on individual elements.
- The Map interface, on the other hand, represents a collection of key-value pairs, where each key is mapped to a specific value. A Map allows you to store data in such a way that each element is a pair consisting of a key and its corresponding value. Map does not directly handle individual elements but rather pairs of elements (key-value).

In other words, Collection works with individual objects, while Map works with pairs of objects (keys and values).

2. **Deque:**
   a Deque is a double-ended queue that allows elements to be added or removed from both ends (front and rear). It is an interface in the java.util package, which extends the Queue interface and provides additional methods for inserting, removing, and inspecting elements at both ends of the queue.

- **Double-Ended**: The primary feature of a Deque is that it allows insertion and removal of elements from both ends (front and back). This makes it more versatile compared to a regular Queue, which typically only allows operations on one end (FIFO: First-In-First-Out).
- **Bidirectional**: Since it supports operations at both ends, a Deque can be used as:
  - **Queue**: With operations at the rear (add elements) and front (remove elements).
  - **Stack**: By pushing and popping elements at the front or rear of the deque.
- This makes it useful for implementing both queues and stacks.
- **Interface**: Deque is an interface, and it has implementations like Array Deque and LinkedList in the Java Collections Framework.

3. **VECTOR:**
   - In Java, a Vector is a type of collection that implements the List interface and is part of the java.util package. It is similar to an ArrayList, but with a few key differences.

- Dynamic Array: A Vector is essentially a resizable array that can grow or shrink dynamically as elements are added or removed. Unlike arrays, which have a fixed size, Vectors automatically resize themselves when needed.
- Thread-Safety: Vector is synchronized, which means it is thread-safe. Multiple threads can access a Vector without causing data corruption. However, this synchronization can introduce overhead, so if thread-safety is not required, ArrayList is generally preferred over Vector for better performance.
- Growable Size: A Vector grows by doubling its size (by default) when it runs out of space, meaning it can accommodate more elements as needed.
- Indexed Access: Like an array or an ArrayList, a Vector provides fast, constant-time access to elements by index.

4. **THREAD SAFTEY:**
   - Thread safety refers to the concept of ensuring that multiple threads can access and modify shared data (or resources) without causing data corruption or inconsistent results. In a multi-threaded environment, when more than one thread operates on shared data concurrently, the possibility of conflicts arises, leading to issues like race conditions, deadlocks, and inconsistent states.
   - In Java, thread safety is particularly important when dealing with mutable data structures, collections, and objects accessed by multiple threads. Java provides several mechanisms to ensure that data is accessed safely in a multi-threaded environment.

5. **MULTI-THREADING:**
   - Multithreading in Java refers to the ability of a CPU (Central Processing Unit) to provide multiple threads of execution within a single process. A thread is the smallest unit of a CPU's execution, and multithreading enables multiple threads to run concurrently, which can improve the performance and efficiency of programs, especially on multi-core processors.

   - In Java, multithreading is achieved by using the Thread class or implementing the Runnable interface.

6. **SET:**

- A Set is a collection in Java that does not allow duplicate elements. It is part of the Java Collections Framework and is defined by the Set interface, which extends the Collection interface. The main property of a Set is that it does not store duplicate elements and allows only unique elements.

- In addition to not allowing duplicates, Set does not guarantee any particular order of the elements unless it is a specific type of set (like LinkedHashSet or TreeSet).

7. **<u>HASH MAP:</u>**

- A HashMap is a part of the Java Collections Framework and provides a key-value pair data structure. It implements the Map interface and allows for the efficient storage and retrieval of data based on a key.
- In a HashMap, each key is unique, and each key maps to exactly one value. The main benefit of using a HashMap is its fast lookup time for values based on the key. It uses a hash table for storing the data, which makes it efficient for operations like searching, insertion, and deletion.

8. **<u>WHY CAN'T THE CLASS BE BASE FOR THE COLLECTION:</u>**

- Java Collections Framework Design: The Java Collections Framework (JCF) is designed around interfaces rather than concrete classes. This allows for flexibility and extensibility. At the top of this hierarchy is the Collection interface, which is the root interface for most of the collection types (such as Set, List, Queue, etc.).
- Collection is an Interface, Not a Concrete Class:
- The Collection interface is an abstraction that represents a group of objects. It defines common methods (like add(), remove(), contains(), size(), etc.) that all collections should have.
- Interfaces in Java are meant to define contracts or behavior without implementing the details. They allow multiple classes to implement the same set of methods but in different ways. A class can implement multiple interfaces, offering great flexibility.
- Why Collection is not a Base Class:
- If Collection were a base class, it would imply that all collections (such as List, Set, Queue, Map, etc.) would inherit from Collection. However, Map is a major collection type in Java that doesn't extend Collection. This is because:
    - A Map stores key-value pairs, while the other collection types like Set or List store individual objects.
    - If Map were to extend Collection, the key and value pairs would have to be stored in a way that conflicts with the idea of a single object in a collection.
    - Map is part of the Collections Framework but it does not fit the same model as Set, List, or Queue.
- By using an interface, Java avoids this conflict and allows Map to remain separate from Collection.

- Collection is a Generalization, Not a Concrete Class:
- The goal of Collection is to provide a common interface for all types of collections, but not to implement common functionality that is shared by all collections. For example, the way that List (which allows duplicates and maintains order) is different from Set (which does not allow duplicates) is important, and these behaviors should not be enforced by a base class.
- Since there are many types of collections that behave differently (for example, ArrayList, HashSet, TreeMap, etc.), the abstract behavior must be defined using interfaces, not a concrete base class.

9. **THROW AND THROWS IN EXCEPTION HANDLING:**
   - The throw keyword is used to explicitly throw an exception from a method or a block of code. When an exception is thrown, the normal flow of execution is disrupted, and the control is transferred to the nearest exception handler (a catch block or a calling method).
   - The throws keyword is used in a method declaration to specify that a method may throw one or more exceptions during its execution. It acts as a declaration to indicate to the caller of the method that they need to handle the exception, either by catching it or declaring it further in the method signature.

10. **D/B CLASS AND INTERFACE:**

A **class** is a blueprint for creating objects, defining the properties (fields) and behaviors (methods) that the objects of that class will have.

- **Defines Properties and Methods**: A class can have fields (variables) to store state and methods to define behavior.
- **Can be Instantiated**: You can create instances (objects) of a class using the new keyword.
- **Supports Inheritance**: A class can extend another class to inherit its properties and methods (but only one class can be inherited since Java supports single inheritance).
- **Encapsulation**: A class can have private fields and provide public methods (getters/setters) to access and modify those fields.
- **Constructors**: A class can have constructors to initialize objects when they are created.
- An interface is a reference type in Java, similar to a class, but it can only contain method declarations (abstract methods), default methods (with implementations), and constant fields. Interfaces cannot contain instance variables or concrete methods unless defined as default or static methods.

- Defines Abstract Behavior: An interface defines a contract that classes must adhere to, specifying what methods a class must implement but not how they are implemented.
- Cannot Be Instantiated: You cannot create an instance of an interface directly.
- Multiple Inheritance: A class can implement multiple interfaces, allowing for more flexible design (Java supports multiple inheritance through interfaces).
- Abstract Methods: All methods in an interface are implicitly abstract unless declared as default or static.
- Fields are Constants: Any fields in an interface are implicitly public, static, and final.