**TAD’S of the used data structures.**

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| **Type Abstract Data (TAD): Hashtable** |
| **Description:**  Hashtable is a synchronized data structure in Java that stores key-value pairs and provides efficient storage and retrieval based on their associated keys. |
| **Invariants:**  1. Each key in the Hashtable is associated with a unique value.  2. Keys and values must be of non-null reference types.  3. The Hashtable maintains a balanced load factor for efficient performance. |
| **Primitive Operations:**  1. Insertion (put):  - Description: Associates a key with a value in the Hashtable.  - Precondition: Key and value must be different from null.  - Postcondition: The key-value pair is added to the Hashtable, and the previous value associated with the key (if any) is returned. If the key already exists, its associated value is updated.  2. Retrieval (get):  - Description: Retrieves the value associated with a given key from the Hashtable.  - Precondition: The key must be different from null.  - Postcondition: Returns the value associated with the key if it exists in the Hashtable; otherwise, returns “null”.  3. Deletion (remove):  - Description: Removes the key-value pair associated with a given key from the Hashtable.  - Precondition: The key must be different from null.  - Postcondition: Removes the key-value pair from the Hashtable and returns the previously associated value (if the key existed). If the key is not found, returns “null”.  4. Size (size):  - Description: Returns the number of key-value pairs in the Hashtable.  - Precondition: None.  - Postcondition: Returns the number of key-value pairs currently stored in the Hashtable.  5. Containment (containsKey):  - Description: Checks if the Hashtable contains a specific key.  - Precondition: The key must be different from null.  - Postcondition: Returns “true” if the key exists in the Hashtable; otherwise, returns “false”.  6. Iteration:  - Description: Supports iteration through keys or key-value pairs using iterators or Enumeration. |