Data Structures (02-24-00108) - Fall 2024/2025
Assignment #2: "A Hash Table for Personal Contacts in Java" (10 Points)

Assigned: Week 6
Due to: Week 9

Problem Description:

Hash tables are usually used to implement the concept of associative arrays, sets and caches. Most like arrays, hash tables provide constant-time complexity O(1) lookup on average, regardless of the number of items to search. The worst-case lookup complexity time in hash table schemes is O(n). Hash tables are most useful when we need to store a large numbers of data records.

The primary operation a hash table should support efficiently is a lookup: given a key (e.g. a person's name), find the corresponding value (e.g. that person's telephone). It works by transforming the key using a hash function into a hash, a number that the hash table uses to locate the desired value. This hash maps directly to a bucket in the array of key/value pairs, hence the name hash map. The mapping method lets us directly access the storage location for any key/value pair.

```
public static long calc_hash( String key, int table_size) {
   int i, l = key.length();
   long hash = 0;

   for (i = 0; i < l; i++) {
      hash += Character.getNumericValue(key.charAt(i));
      hash += (hash << 10);
      hash ^= (hash >> 6);
   }
   hash += (hash << 3);
   hash ^= (hash >> 11);
   hash += (hash << 15);

   if ( hash > 0) return hash % table_size;
   else return -hash % table_size;
}
```

In this assignment, you are requested to implement the hash table shown below (hash table size = 1009) with hash collision resolved by a method of your choice.

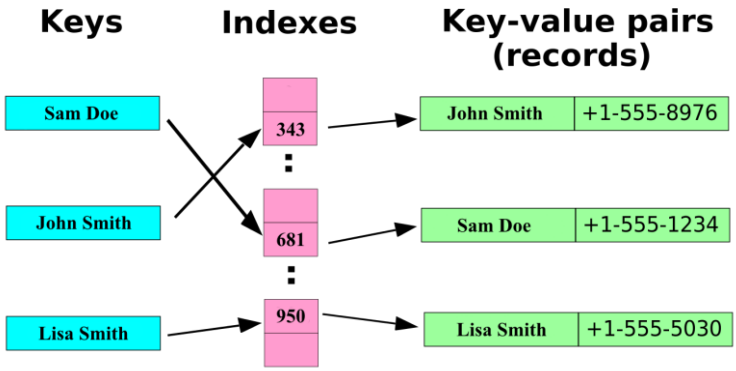

Figure 1. The basic hash table

Requirements:

Hash Table Design:

- Use a **hash table** to store the phone list. The keys will be the contact **names**, and the associated values will be the **phone numbers**.
- Implement the given hash function to compute indices based on the contact names.
- Implement **collision handling** using a method of your choice, such as **separate chaining** (linked lists) or **open addressing** (e.g., linear probing or quadratic probing).

The hash table class should include operations to:

1. Create the hash table,
2. Insert a new contact (name, phone number).
3. Search for a contact by name to retrieve their phone number.
4. Delete a contact by name.
5. Update a contact number.
6. Display all contacts currently stored in the phone list.

Good Luck