Tablas Hash

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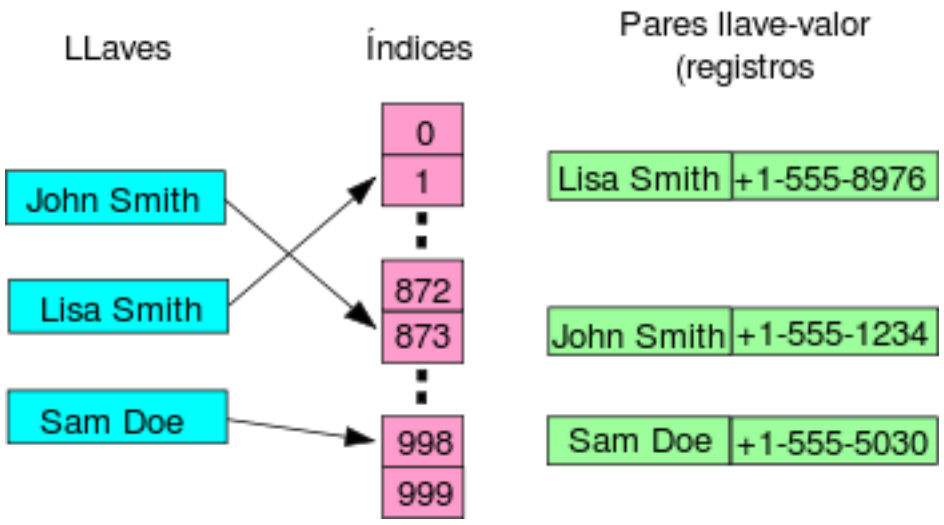
I. Introducción

Una tabla hash, matriz asociativa, hashing, mapa hash, tabla de dispersión o tabla fragmentada es una estructura de datos que asocia llaves o claves con valores. La operación principal que soporta de manera eficiente es la búsqueda: permite el acceso a los elementos (teléfono y dirección, por ejemplo) almacenados a partir de una clave generada (usando el nombre o número de cuenta, por ejemplo). Funciona transformando la clave con una función hash en un hash, un número que identifica la posición (casilla o cubeta) donde la tabla hash localiza el valor deseado.

1) **Ejemplo:**



ClaseNodo.h C++:

```cpp
template <typename K,
          typename V>
struct Node
{
 public:
  /*************************************************************************************************
  * Constructors
  *************************************************************************************************/

  /**
  *  @brief Default constructor
  */
  Node() = default;

  /**
  *  @brief Constructor with parameters
  *  @param key for this value
  *  @param actual value in the bucket
  */
  Node(K key, V value) : m_key(key),
                         m_value(value) {}

  /**
  *  @brief Default destructor
  */
  ~Node() = default;

  /*************************************************************************************************
  * Members
  *************************************************************************************************/

  /**
  *  @brief
  */
  K m_key;

  /**
  *  @brief
  */
  V m_value;
};
```

ClaseHashMap.h C++:

```
template <typename K,
          typename V>
class Table
{
 public:
  /*************************************************************************************************
  * Constructors
  *************************************************************************************************/

  /**
  *  @brief Default constructor
  */
  Table();

  /**
  *  @brief
  *  @param
  */
  Table(unsigned int capacity);

  /**
  *  @brief Default destructor
  */
  ~Table() = default;

  /*************************************************************************************************
  * Methods
  *************************************************************************************************/

  /**
  *  @brief
  *  @param
  *  @return
  */
  int
  hashCode(K key);

  /**
  *  @brief
  *  @param
  *  @param
  */
  void
  insertNode(K key, V value);

  /**
  *  @brief
  *  @param
  *  @return
  */
  V
  deleteNode(int key);

  /**
  *  @brief
  *  @param
  *  @return
  */
  V
  get(int key);

  /**
  *  @brief
  *  @return
  */
  int
  size();

  /**
  *  @brief
  *  @return
  */
  bool
```

```
    isEmpty();

    /**
    *  @brief
    */
    void
    display();

    /*****************************************************************************************
    * Members
    *****************************************************************************************/

    /**
    *  @brief
    */
    Vector<Node<K, V>*> m_array;

    /**
    *  @brief
    */
    int m_capacity;

    /**
    *  @brief
    */
    int m_size;
  };

  template <typename K,
            typename V>
  void
  HashTable::Table<K, V>::display() {
    //for(int i = 0; i < capacity; i++)
    //{
    //  if(m_array[i] != nullptr && m_array[i]->key != -1)
    //    cout << "key = " << m_array[i]->key
    //    << "  value = " << m_array[i]->value << endl;
    //}
  }

  template <typename K,
            typename V>
  bool
  HashTable::Table<K, V>::isEmpty() {
    return m_size == 0;
  }

  template <typename K,
            typename V>
  int
  HashTable::Table<K, V>::size() {
    return m_size;
  }

  template <typename K,
            typename V>
  V
  HashTable::Table<K, V>::get(int key) {
    int hashIndex = hashCode(key);
    int counter = 0;

    while(m_array[hashIndex] != nullptr)
    {
      int counter = 0;
      if(++counter > m_capacity)
        return static_cast<V>(-1);

      if(m_array[hashIndex]->m_key == key)
        return m_array[hashIndex]->m_value;
      ++hashIndex;
      hashIndex %= m_capacity;
    }

    return static_cast<V>(-1);
  }

  template <typename K,
```

```
152             typename V>
153   V
154   HashTable::Table<K, V>::deleteNode(int key) {
155     int hashIndex = hashCode(key);
156
157     while(m_array[hashIndex] != nullptr)
158     {
159       if(m_array[hashIndex]->m_key == key)
160       {
161         Node<K, V> *temp = m_array[hashIndex];
162
163         m_array[hashIndex] = nullptr;
164
165         --m_size;
166         return temp->m_value;
167       }
168       ++hashIndex;
169       hashIndex %= m_capacity;
170     }
171
172     return static_cast<V>(-1);
173   }
174
175   template <typename K,
176             typename V>
177   void
178   HashTable::Table<K, V>::insertNode(K key, V value) {
179     auto* temp = new Node<K, V>(key, value);
180
181     int hashIndex = hashCode(key);
182
183     while(m_array[hashIndex] != nullptr && m_array[hashIndex]->m_key != key
184           && m_array[hashIndex]->m_key != -1)
185     {
186       ++hashIndex;
187       hashIndex %= m_capacity;
188     }
189
190     if(m_array[hashIndex] == nullptr || m_array[hashIndex]->m_key == -1)
191     {
192       ++m_size;
193     }
194     m_array[hashIndex] = temp;
195   }
196
197   template <typename K,
198             typename V>
199   int
200   HashTable::Table<K, V>::hashCode(K key) {
201     return key % m_capacity;
202   }
203
204   template <typename K,
205             typename V>
206   HashTable::Table<K, V>::Table(unsigned int capacity) : m_capacity(capacity),
207                                     m_size(0) {
208     m_array.resize(m_capacity);
209   }
210
211   template <typename K,
212             typename V>
213   HashTable::Table<K, V>::Table() : m_capacity(20),
214                                     m_size(0) {
215     m_array.resize(m_capacity);
216
217   }
218 }
```