# Lab 5-2 Hash Table Assignment Details

The focus of these problems will be working with information extracted from a municipal government data feed containing bids submitted for auction of property. The data set is provided in two comma-separated files:

1. eBid\_Monthly\_Sales.csv (larger set of 17,937 bids)
2. eBid\_Monthly\_Sales\_Dec\_2016.csv (smaller set of 179 bids)

This assignment is designed to explore hashing algorithms by implementing a hash with chaining of collisions for bids loaded from a CSV file.

We provide a starter console program that uses a menu to enable testing of the hash table logic you will complete. It also allows you to pass in the path to the bids CSV file to be loaded, enabling you to try both files. In this version the following menu is presented when the program is run:

**Menu:**

**1. Load Bids**

**2. Display All Bids**

**3. Find Bid**

**4. Remove Bid**

**9. Exit**

**Enter choice:**

The HashTable.cpp program is partially completed - it contains empty methods representing the programming interface used to interact with a hash table. You will need to add logic to the methods to implement the necessary behavior. Here is the public API for HashTable that you have to complete:

public:

HashTable();

virtual ~HashTable();

void Insert(Bid bid);

void PrintAll();

void Remove(string bidId);

Bid Search(string bidId);

You will need to perform the following steps to complete this activity:

Setup: Begin by creating a new C++ Project with a Project Type of "Hello World C++ Project"

1. Name the project ‘HashTable’, remember to pick the correct compiler in **Toolchains** and click Finish. This will create a simple HashTable.cpp source file under the **/src** directory.
2. Download the starter program files and copy them to the project’s **/src** directory, replacing the existing auto-generated one. Remember to right-click on the project in the Project Explorer pane on the left and **'Refresh'** the project so it adds all the new files to the src folder underneath.
3. Because this activity uses C++ 11 features you must follow the instructions under “C++ Compiler Version” in the *C++ Development Installation guide* to add **-std=c++11** compiler switch to the Miscellaneous settings.

Task 1: Define structures to hold bids

Hint: You may choose either an array or a vector for storage. Note that Lab2-2 and Lab4-2 both used vectors for their storage and Lab3-3 used a Node structure for implementing a linked list. Reusing code from these labs may save you time.

Task 2: Initialize the structures used to hold bids

Task 3: Implement logic to free storage when class is destroyed

Task 4: Implement logic to calculate a hash value using the bid Id as the source for calculating the key

Task 5: Implement logic to insert a bid

Be sure to check for key collisions and use the chaining technique with a linked list to store the additional bids

Task 6: Implement logic to print all bids

Task 7: Implement logic to remove a bid

Task 8: Implement logic to search for and return a bid

Here is sample output from running the completed program:

> ./HashTable ~/Downloads/eBid\_Monthly\_Sales\_Dec\_2016.csv

> HashTable.exe Downloads\eBid\_Monthly\_Sales\_Dec\_2016.csv

## Load bids from CSV and display the hash table contents:

| **Example Input** | **Choice: 1** | **Choice: 2** |
| --- | --- | --- |
| **Display** | Menu:  1. Load Bids  2. Display All Bids  3. Find Bid  4. Remove Bid  9. Exit  Enter choice: 1 | Menu:  1. Load Bids  2. Display All Bids  3. Find Bid  4. Remove Bid  9. Exit  Enter choice: 2 |
| **Output** | Loading CSV file eBid\_Monthly\_Sales.csv  179 bids read  time: 3069 clock ticks  time: 0.003069 seconds | Key 2: 98094 | Credenza | 57 | General Fund  2: 98273 | Nike Tennis Shoes Size: 11.5 | 84 | Enterprise  Key 5: 98276 | Nike Tennis Shoes Size: 11.5 | 83.99 | Enterprise  Key 8: 98279 | Nike Tennis Shoes Size: 11 | 51.57 | Enterprise  Key 10: 98102 | Battery Cart | 42 | Enterprise  Key 12: 98104 | 3 Ticket Booths | 395.01 | Enterprise  12: 98283 | Jordan Tennis Shoes Size: 11 | 160 | Enterprise  Key 13: 98105 | 2 PS4 Games | 11 | Enterprise  13: 98284 | Jordan Tennis Shoes Size: 11 | 89.01 | Enterprise  ...  ...  Key 176: 98268 | Dayton Pallet Jack | 78.85 | Enterprise  Key 177: 98269 | 5 Extron Control Systems | 25 | General Fund |
|  | | |

Note that Keys 2, 12, and 13 highlighted above indicate key collisions occurred.

## Finding and Removing and existing bid:

| **Example Input** | **Choice: 3** | **Choice: 4** |
| --- | --- | --- |
| **Display** | Menu:  1. Load Bids  2. Display All Bids  3. Find Bid  4. Remove Bid  9. Exit  Enter choice: 3 | Menu:  1. Load Bids  2. Display All Bids  3. Find Bid  4. Remove Bid  9. Exit  Enter choice: 4 |
| **Output** | 98109: Whirlpool Washer & Dryer | 225.46 | Enterprise  time: 59 clock ticks  time: 5.9e-05 seconds | {no output shown} |

## Finding a bid that no longer exists:

| **Example Input** | **Choice: 3** | **Choice: 9** |
| --- | --- | --- |
| **Display** | Menu:  1. Load Bids  2. Display All Bids  3. Find Bid  4. Remove Bid  9. Exit  Enter choice: 3 | Menu:  1. Load Bids  2. Display All Bids  3. Find Bid  4. Remove Bid  9. Exit  Enter choice: 9 |
| **Output** | Bid Id 98109 not found.  time: 12 clock ticks  time: 1.2e-05 seconds | Good bye. |