CSE 165/ENGR 140
Intro to Object Orient Program
Lecture 26 – STL Map & STL Unordered Maps: Maps Using Hash Tables
Announcement

- Lab #11
  - Due 5/7 at 11:59PM
- Final on Thursday (5/7)
  - Last lecture of semester
  - Review and quiz on Tuesday (5/5)
- Final project is out (in UCMCROPS)
  - Due date: 5/11 (Monday) at 11:59PM
  - Presentation date: 5/12 (Tuesday) at 3:00PM
Maps

- A **map** models a searchable collection of **key-element**, called **entries**.
- The main operations of a map are **searching**, **inserting**, and **deleting** items.
- Multiple items with the same key are **NOT** allowed.
- Applications:
  - Lookup tables
  - Personal identity
  - Counting unique entries
There is a map class in the Standard Template Library in C++

Member functions of STL Map class (given a map M):

- **find(k):** If \( M \) contains an entry \( e = (k,v) \), with key equal to \( k \), then return an iterator \( p \) referring to this entry, and otherwise return the special iterator end.
- **insert(k, v):** If \( M \) does not have an entry with key equal to \( k \), then add entry \( (k,v) \) to \( M \), and do nothing otherwise, and return an iterator to the newly inserted/existing entry.
- **erase(k):** Remove from \( M \) the entry with key equal to \( k \); an error condition occurs if \( M \) has no such entry.
- **begin(), end():** Return iterators to the beginning and end of the \( M \).
- **size(), empty():** Return the size of \( M \), and check if \( M \) is empty.
Examples

See *maps_example_files* for examples
There is a map class implemented by Hash Table in the Standard Template Library in C++.

- It is supported by C++ 11 (C++ version 2011)

Member functions of STL `unordered_map` class (given a map M):

- **find(k):** If M contains an entry \( e = (k,v) \), with key equal to \( k \), then return an iterator \( p \) referring to this entry, and otherwise return the special iterator \( \text{end} \).

- **insert(k, v):** If M does not have an entry with key equal to \( k \), then add entry \( (k,v) \) to M, and do nothing otherwise, and return an iterator to the newly inserted/existing entry.

- **erase(k):** Remove from M the entry with key equal to \( k \); an error condition occurs if M has no such entry.

- **begin(), end():** Return iterators to the beginning and end of the M.

- **size(), empty():** Return the size of M, and check if M is empty.
Member functions of STL unordered_map class (given a map M):

- **max_size()**: Returns the maximum number elements can be stored in M.
- **bucket_count()**: Returns the number of buckets used in M.
- **max_bucket_count()**: Returns the maximum number of buckets can be used in M.
- **load_factor()**: Returns the load factor of M. Load factor is the ratio between number of elements and number of buckets in M.
- **max_load_factor()**: Returns the maximum load factor of M.
- **max_load_factor(float)**: Set the maximum load factor of M. The default value is 1.
- **hash_function()**: Returns the hash function object used by M.
Examples

See *hash_map_example_files* for examples.