Hashing

Summary Slides
Hash Table

• simulates the fastest searching technique, knowing the index of the required value in a vector and array and apply the index to access the value, by applying a hash function that converts the data to an integer

• After obtaining an index by dividing the value from the hash function by the table size and taking the remainder, access the table. Normally, the number of elements in the table is much smaller than the number of distinct data values, so collisions occur.

• To handle collisions, we must place a value that collides with an existing table element into the table in such a way that we can efficiently access it later.
Hash Table (Cont...) 

• average running time for a search of a hash table is $O(1)$
• the worst case is $O(n)$
Collision Resolution

- Two types:
  1) linear open probe addressing
     - the table is a vector or array of static size
     - After using the hash function to compute a table index, look up the entry in the table.
     - If the values match, perform an update if necessary.
     - If the table entry is empty, insert the value in the table.
Collision Resolution (Cont…)

- Two types:
  1) linear open probe addressing
     - Otherwise, probe forward circularly, looking for a match or an empty table slot.
     - If the probe returns to the original starting point, the table is full.
     - you can search table items that hashed to different table locations.
     - Deleting an item difficult.
2) chaining with separate lists.
   - the hash table is a vector of list objects
     - Each list is a sequence of colliding items.
   - After applying the hash function to compute the table index, search the list for the data value.
     - If it is found, update its value; otherwise, insert the value at the back of the list.
   - you search only items that collided at the same table location
Collision Resolution (Cont…)

- there is no limitation on the number of values in the table, and deleting an item from the table involves only erasing it from its corresponding list