Chapter 8

1. Consider a hash function $h(k) = k\%D$ where D is not given. We want to figure out what value of D is being used. We wish to achieve this using ad few attempts as possible, where an attempt consists of supplying the function with k and observing $h(k)$. Indicate how this may be achieved in the following two cases.

   (a) D is known to be a prime number in the range [10,20].

   (b) D is of the form 2^k, where k is an integer in [1,5].

2. Explain what is hashing? What determines the quality of a hash function? If we use remainder of division as hash function, what would be a good way to select a divisor?

3. Suppose you are given the following numbers: 20, 62, 31, 14, 1, 25, 3, 19, 11 and the following hash function: $H(x) = x \ mod \ 11$, You are asked to store these numbers by hashing. Let the size of the hash table be 11. Please build and show the hash table using the following overflow handing techniques:

   (a) Linear probing.

   (b) Chaining.

4. Draw the final result after keys 5, 19, 28, 15, 20, 17, 10, 33 are inserted into a hash table with collisions resolved by

   (a) Chaining.

   (b) Linear probing.

   Assume the table has eight slots with its address starts at 0, and let the hash function be $h(k) = k \ mod \ 8$.

5. Using the module-division method and linear probing, store the keys shown below in an array with 17 elements. How many collisions occurred? What is the density of the list after all keys have been inserted?

   426, 183, 902, 348, 724, 274, 198, 853, 603

6. Demonstrate the insertion of the keys 5, 28, 19, 15, 20, 33, 12, 17, 10 into a hash table which collisions resolved by chaining. Let the table have 9 slots, and let the hash function be $h(k) = k \ mod \ 9$.

7. Consider inserting the keys 10, 22, 31, 4, 15, 28, 17, 88, 59 into a hash table of length m = 11 using open addressing with the primary hash function $h'(k) = k \ mod \ m$. Illustrate the result of inserting these keys using

   (a) Linear probing.

   (b) Double hashing with $h_2(k) = 1 + (k \ mod \ (m - 1))$.

8. Demonstrate the insertion of the keys 12, 5, 88, 128, 17, 10, 33, 45, 27, 14, 64, 129 into a hash table with collision resolved by chaining. Let the table have 7 slots, and let the hash function be $h(k) = k \ mod \ 7$. Demonstrate the insertion of the above keys into a table with 13 slots (the hash function should be $h(k) = k \ mod \ 13$) and collision resolved by linear probing.