

## Homework Assignment 2

*Handed Out: April 16***Due:** *April 23*

1. (10 pts) Given the hash function  $h(x) = x \bmod 7$ , and the following set of numbers as input  $\{4378, 1321, 6178, 4199, 4346, 9673, 1988, 7759\}$ , show the resulting:
  - (a) Separate chaining hash table,
  - (b) Open addressing hash table with linear probing.
2. (10 pts) Consider open-addressing hash table with load factor  $\alpha = n/m < 1$ , where  $m$  is the size of the table and  $n$  is the number of keys stored in the hash table. Show that the number of probes in an unsuccessful search is at most  $1/(1 - \alpha)$ , assuming uniform hashing.
3. (15 pts) Suppose  $H$  is a binary min-heap with  $n$  nodes. Show the following facts for  $H$ 
  - (a)  $H$  has exactly  $\lceil n/2 \rceil$  leaves.
  - (b) The **maximum** key is at one of the leaves.
  - (c) Any algorithm that correctly performs findMax must inspect every leaf node in  $H$ .
4. (15 pts) Suppose we use the array representation to store a  $d$ -heap. For an entry located in position  $i$ , where are its parent and children located? Give both the formulae and their justification.