

CS2011 Tutorial 5: Hashing and Trees

1. Given a hash table size of 10 and hash function $h(x) = x \bmod 10$, show the result of inserting the data

4371, 1323, 6173, 4199, 4344, 9679, 1989

into

- i) an open hash table
 - ii) a closed hash table using linear probing
 - iii) a closed hash table using quadratic probing
 - iv) a closed hash table using a secondary hash function $h_2(x) = 7 - (x \bmod 7)$
2. A room contains n people. Let $P(n)$ denote the probability that at least two people in the room share the same birthday. Denote by $Q(n)$ the probability that *no two people* in the room have the same birthday. Explain to your tutor why
- i) $P(n) = 1 - Q(n)$
 - ii)

$$Q(1) = 1$$

$$Q(2) = Q(1) \frac{364}{365}$$

$$Q(3) = Q(2) \frac{363}{365}$$

$$Q(n) = Q(n-1) \frac{365-n+1}{365}$$

Write a short program to evaluate $P(n)$ and find the first value of n such that $P(n) > 0.5$, i.e. the smallest n such that, in a room containing n people there is a better than an even chance of two people sharing the same birthday.

What lesson should you draw from this regarding the likelihood of clashes occurring in hash tables?

3. Explain to your tutor what AVL trees are, and how their type invariant is maintained after insertion or deletion of elements. Show the result of inserting 2, 1, 4, 5, 9, 3, 6, 7 into an initially empty AVL tree.