

Homework #6

Grading policy: Only P1-P5 will be graded. The others are for your practice.

P1: 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 $h(k)=k \bmod m$. Illustrate the result of inserting these keys using

1. Linear probing
2. Quadratic probing
3. Double hashing with $hash2(k) = 1 + (k \bmod (m - 1))$

P2: Demonstrate what happens when we insert the keys 5, 28, 19, 15, 20, 33, 12, 17, 10 into a hash table with collisions resolved by chaining. Let the table has 9 slots, and let the hash function be $h(k) = k \bmod 9$.

P3: Consider the following hash-insert algorithm for open addressing hash table.

```
HASH-INSERT(T, k)
  i = 0
  repeat
    q = h(k, i)
    if T[q] == NIL
      T[q] = k
      return q
    else i = i + 1
  until i == m
  error ``hash table overflow''
```

Now you want to make the algorithm support deletion by using a flag DELETE. Write pseudocode for HASH-DELETE and the modified HASH-INSERT to handle the special value DELETE.

P4: Consider a hash table with m slots that uses chaining for collision resolution. The table is initially empty. What is the probability that after 4 keys are inserted that a chain of size 4 is created? (Assume simple uniform and independent hashing is used).

P5 Two-Sum: Write the pseudocodes or the programming language you like.

Leetcode 1. Two sum

Given an array of integers `nums` and an integer `target`, return indices of the two numbers such that they add up to target.

You may assume that each input would have exactly one solution, and you may not use the same element twice.

You can return the answer in any order.

Example 1:

Input: `nums = [2,7,11,15]`, `target = 9` Output: `[0,1]` Explanation: Because `nums[0] + nums[1] == 9`, we return `[0, 1]`.

Example 2:

Input: `nums = [3,2,4]`, `target = 6` Output: `[1,2]`

Example 3:

Input: `nums = [3,3]`, `target = 6` Output: `[0,1]`

P6: Let's assume a hash table with m slots, a uniformly distributed hash function. What is the probability that there is no collision happens after you insert n keys?

P7: Leetcode 205. Isomorphic Strings

P8: Leetcode 2490. Circular Sentence

P9: Leetcode Find Substring With Given Hash Value

P10: Leetcode 554. Brick Wall

P11: Leetcode 963. Mnimum Area Rectangle II