HOMEWORK 3

Guidelines:

- Attempt all questions by yourself before discussing with peers, this is practice to strengthen your concepts.
- For coding questions, try writing clean, readable code on paper.
- Since this homework is ungraded, focus on learning rather than using LLMs to generate codes and get answers.
- If you get stuck, you are encouraged to:
  - Post your doubts on the course Slack channel.
  - Visit the TAs during office hours for guidance.

Section A: Multiple Choice Questions (MCQs)

Q1. What is the worst-case time complexity of searching in a hash table with linear probing?

a) O(1)
b) O(log n)
c) O(n)
d) O(n log n)

Q2. Which of the following collision resolution strategies may lead to clustering?

a) Linear Probing
b) Quadratic Probing
c) Separate Chaining
d) Double Hashing

Q3. Which one of the following hash functions on integers will distribute keys most uniformly into 10 buckets (0–9) for keys ranging from 0 to 2020?

a) $h(i) = i \bmod 10$
b) $(i) = (7i+3) \bmod 8$
c) $h(i) = (2i) \bmod 10$
d) $h(i) = i \bmod 8$

Q4.Which of the following hash functions will distribute integers most uniformly into 12 buckets (0–11) for keys ranging from 0 to 5000?

a) $h(k) = k \bmod 6$

b) h(k) = (7k+4) mod 12
c) h(k) = (2k) mod 12
d) h(k) = k mod 8

Q5. Given the following input keys: 275, 123, 687, 543, 815, 927, 364, 482, and hash function(k) = k mod 10, determine which keys hash to the same value.

Q6.A hash table of size 10 uses open addressing with hash function h(k) = k mod 10 and linear probing. After inserting 6 values, the table appears as follows:

Index	Value
0	
1	
2	42
3	52
4	34
5	33
6	23
7	46
8	–
9	–

Which of the following insertion orders could have resulted in this table?

(a) 46, 33, 52, 23, 34, 42

(b) 52, 46, 33, 42, 34, 46

(c) 42, 52, 34, 33, 23, 46

(d) 34, 33, 46, 52, 23, 42

Section B: Short Questions

Q1.. Insert the following keys into a hash table of size 10 using Linear Probing:
Keys = {12, 22, 42, 32, 52}
Show the final state of the table.

Q2. Given the following keys: 117, 124, 127, 155, 133, 144, 185, 186, 111
And hashing function: K mod 9
Construct the final hashed table of size 9, with open addressing and linear probing.

Q3.Given the same keys as before, but a hashing function: 2K mod 4, use separate chaining on an array of pointers of size 4.
Q4.

20	17	10	22	31	4	15

- ➔ Determine the function that resulted in this table
- ➔ Show the probing sequence for key 17

Q5. Write a C++ function that counts the frequency of elements in an array using an unordered_map

Q6.Consider a hash table with 100 slots. Collisions are resolved using chaining. Assuming simple uniform hashing, what is the probability that the first 3 slots are unfilled after the first 3 insertions?