Quiz III: Hash Table

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Part A: Hash Table Definitions (Conceptual Understanding)

Q1. Define "collision" in the context of hash tables.

A1: 衝突，表示多個鍵值被分配到同一索引 +15.

Q2. What is a "bucket" in a hash table?

A2: 桶，一種數據結構 以陣列存放的地方

Q3. Define "load factor (α)" and explain why it affects performance.

A3: 負載(α)因素是 collision handling 中造成 Open addressing 影響性能原因 因為不同方法的使用

Q4. What is "primary clustering," and which probing method suffers from it?

A4: 線性探測會導致 primary clustering

Q5. What is "secondary clustering," and how is it different from primary clustering?

A5: 二次探測會導致 secondary clustering 多於 primary clustering 且其有

Q6. Briefly explain the difference between:

- Open addressing
- Separate chaining

A6: 不同在於 Separate chaining 會因為鏈結長度過長而影響性能 Open addressing 則是方法不同影響有線性探測、二次探測、雙重雜湊

Hash Function Calculation (Collision & Pattern Observation)

Show your steps clearly.

Hash Function 1 — Division Method

$$h_1(k) = k \bmod 10$$

Hash Function 2 — Folding Method

Split key into two-digit chunks and sum the chunks.

$$h_2(k) = (sum\ of\ 2-digit\ groups) \bmod 11$$

Example:

Key = 8429 → groups: 84 + 29 → 113 → 113 mod 11 = 3

Q7. (Compute using Hash Function 1)

Given keys: 27, 37, 47, 57, 67

Compute their hash values using:

$h_1(k) = k \bmod 10$

A7: $h_1(27) = 27 \bmod 10 = 7$

$h_1(37) = 37 \bmod 10 = 7$

$h_1(47) = 47 \bmod 10 = 7$

$h_1(57) = 57 \bmod 10 = 7$

$h_1(67) \bmod 10 = 7$

Q8. (Identify collision pattern)

From your results in Q7:

- What pattern do you observe?
- Explain why these keys collide.

A8: ① 用 Open addressing 和 Separate chaining

② 會將的hash values都一樣導致衝突

Q9. (Compute using Hash Function 2)

Compute $h_2(k)$ for: 1234, 9217, 4519, 9902

A9:

$h_2(k)$: 1234, 9217, 4519, 9902

$12+34 \rightarrow 46 \rightarrow 46 \bmod 11 \rightarrow 2$

$92+17 \rightarrow 109 \rightarrow 109 \bmod 11 \rightarrow 10$

$45+19 \rightarrow 64 \rightarrow 64 \bmod 11 \rightarrow 9$

$99+02 \rightarrow 101 \rightarrow 101 \bmod 11 \rightarrow 2$

Q10. (Compare distribution)

- Which hash function (h_1 or h_2) produced more collisions for the input set?
- Which seems to spread keys more evenly?
- Provide 1–2 sentences of explanation.

A10: ① h_1

② h_2

③ h_1 同樣的 hash values 更多，

h_2 相對較少