

a) Primary Collisions

Conclusion: The number of primary collisions will be the same whether you choose probing or chaining.

Justification: A primary collision occurs when two records map to the same home slot. The home slot is determined solely by the hash function, the key, and the size of the hash table. The collision resolution strategy, whether probing or chaining, does not influence the initial calculation of the home slot. Thus, the number of primary collisions remains unaffected by the choice between probing and chaining.

b) Searching Efficiency: Linear Probing vs. Chaining

Conclusion: Searching will generally be more efficient with chaining than with linear probing.

Justification:

- **Chaining:** When a collision occurs, all records that hash to the same home slot are stored in a linked list. To search for a specific record, only the records in that particular linked list need to be traversed. This means the traversal is limited to the number of elements that collided at the same home slot.
- **Linear Probing:** When a collision occurs, the algorithm searches for the next available slot in a linear sequence. This can cause records that hash to different home slots to end up in the same sequence, leading to potential longer search times. If the table becomes more crowded, linear probing can result in longer chains of occupied slots to check.

In the best-case scenario, linear probing may encounter the same number of records as chaining. However, in most practical scenarios, linear probing can involve examining more records than chaining, especially as the table fills up and more collisions occur.

c) Searching Efficiency: Quadratic Probing vs. Chaining

Conclusion: While quadratic probing reduces the likelihood of secondary collisions compared to linear probing, searching with chaining is still generally more efficient.

Justification:

- **Quadratic Probing:** This method aims to reduce clustering by probing quadratically (i.e., probing slots at increasing intervals). This can help minimize the likelihood of secondary collisions compared to linear probing. However, it does not eliminate them entirely, and there is still a chance that elements will end up colliding and causing longer search times.
- **Chaining:** As with the previous comparison, chaining confines the search to the linked list at the home slot. Even with quadratic probing's improvement over linear probing, the need to potentially check multiple non-consecutive slots can still result in less efficient searches compared to chaining.

In summary, despite the improvements quadratic probing offers over linear probing in reducing secondary collisions, chaining still provides a more consistent and efficient search mechanism when dealing with collisions.