

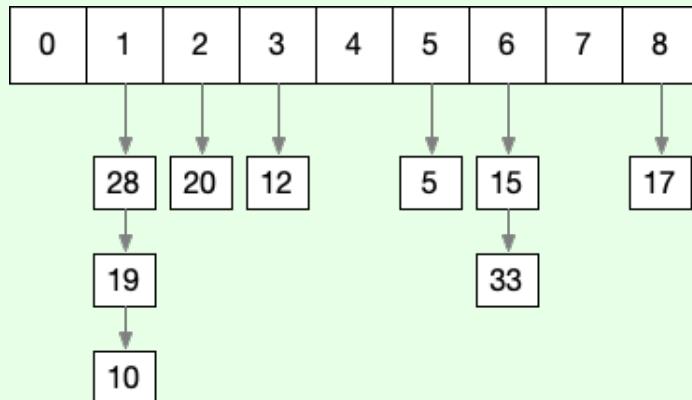
Practice Problems Set 9

Fall 25

1. Hash Practice (attributed to CLRS Exercises 11.2-2 and 11.3-4)

- (a) Consider a hash table with 9 slots and the hash function $h(k) = k \bmod 9$. Demonstrate what happens upon inserting the keys 5, 28, 19, 15, 20, 33, 12, 17, 10 with collision resolved by chaining.

Solution:



- (b) Consider a hash table of size $m = 1000$ and a corresponding hash function $h(k) = \lfloor m(kA \bmod 1) \rfloor$ for $A = (\sqrt{5} - 1)/2$. Compute the locations to which the keys 2024, 2025, 2026 are mapped.

Solution:

900, 518, 136

2. Open Addressing (attributed to CLRS Exercise 11.4-3)

Consider an open-address hash table with independent uniform permutation hashing and no deletions. Give upper bounds on the expected number of probes in an unsuccessful search and on the expected number of probes in a successful search when the load factor is $3/4$ and when it is $7/8$.

Solution:

By the theorem for unsuccessful search, the expected number of probes in an unsuccessful search is at most $1/(1 - \alpha)$. This quantity equals 4 when $\alpha = 3/4$, and it equals 8 when $\alpha = 7/8$. The theorem for successful search bounds the expected number of probes in a successful search by $(1/\alpha) \ln(1/(1 - \alpha))$. This quantity equals 1.8483 when $\alpha = 3/4$, and it equals 2.376 when $\alpha = 7/8$.