Exercise 4.1 - Hashing: chaining

Insert the keys 8, 12, 15, 16, 19, 38, 27, 5, 21, 49, 65, 42 into a hash table with collisions resolved by chaining. Let the table have 15 slots and let the hash function be \( h(k) = k \mod 15 \). Show the resulting table.

Exercise 4.2 - Hashing: open addressing

Consider an empty hash table of size 15. Insert the following keys

\[ 8, 12, 15, 16, 19, 38, 27, 5, 21, 49, 65, 42 \]

using \( h(k) = k \mod 15 \) and:

1. Linear probing.
2. Quadratic probing.
3. Double hashing with \( h'(k) = 1 + (k \mod 13) \).

Give the resulting tables.

Exercise 4.3 - Universal Hashing

JUST FOR FUN. Let \( U = \{0, \ldots, N-1\} \), where \( N \) is 49 and \( m \) is 35. Let \( a_i = 42 \cdot i \) and \( b_i = 28 \cdot i \). Now consider the following class of hash functions.

\[ H = \{ h_i(k) = ((a_i \cdot k + b_i) \mod N) \mod m \} \text{ for } i \in \{1, \ldots, N(N-1)\} \]

Is \( H \) universal? Prove your answer.