**11.4-1.**

Consider inserting the keys $10, 22, 31, 4, 15, 28, 17, 88, 59$ into a hash table of length $m = 11$ using open addressing with the auxiliary hash function $h'(k) = k$. Illustrate the result of inserting these keys using linear probing, using quadratic probing with $c_1 = 1$ and $c_2 = 3$, and using double hashing with $h_1(k) = k$ and $h_2(k) = 1 + (k \bmod (m - 1))$.

**Answer.**

Figure 1 shows the result of inserting these keys using linear probing.



**Figure 1.** Insertion by linear probing. Since $59 \equiv 4 \bmod 11$, we insert the key 59 into empty slot 8, after examining slots 4, 5, 6, 7 and finding them to be occupied.

Figure 2 shows the result of inserting these keys using quadratic probing.



**Figure 2.** Insertion by quadratic probing. Since $59 \equiv 4 \bmod 11$, we insert the key 59 into empty slot 7, after examining slots 4, 8 and finding them to be occupied.

Figure 3 shows the result of inserting these keys using double hashing.

**Figure 3.** Insertion by double hashing. Since $59 \equiv 4 \bmod 10$, we insert the key 59 into empty slot 2, after examining slots 4, 3 and finding them to be occupied.