Q21)

A)

To insert the given list of elements \((36, 48, 66, 27, 23, 87, 10, 12)\) into a Hash Table of size 10 using Linear Probing, we will follow these steps:

1. \*\*Hash Function\*\*: \( h(k) = k \mod 10 \)

2. \*\*Linear Probing\*\*: If there is a collision at a position, we try the next position in a linear sequence (i.e., position \((h(k) + 1) \mod 10\), \((h(k) + 2) \mod 10\), and so on) until we find an empty slot.

Let's insert each element step-by-step:

1. \*\*Insert 36\*\*:

- Hash value: \( 36 \mod 10 = 6 \)

- Position 6 is empty, so insert 36 at position 6.

Hash Table: \([ \\_, \\_, \\_, \\_, \\_, \\_, 36, \\_, \\_, \\_ ]\)

2. \*\*Insert 48\*\*:

- Hash value: \( 48 \mod 10 = 8 \)

- Position 8 is empty, so insert 48 at position 8.

Hash Table: \([ \\_, \\_, \\_, \\_, \\_, \\_, 36, \\_, 48, \\_ ]\)

3. \*\*Insert 66\*\*:

- Hash value: \( 66 \mod 10 = 6 \)

- Position 6 is occupied, so try next position (linear probing).

- Position 7 is empty, so insert 66 at position 7.

Hash Table: \([ \\_, \\_, \\_, \\_, \\_, \\_, 36, 66, 48, \\_ ]\)

4. \*\*Insert 27\*\*:

- Hash value: \( 27 \mod 10 = 7 \)

- Position 7 is occupied, so try next position (linear probing).

- Position 8 is occupied, so try next position.

- Position 9 is empty, so insert 27 at position 9.

Hash Table: \([ \\_, \\_, \\_, \\_, \\_, \\_, 36, 66, 48, 27 ]\)

5. \*\*Insert 23\*\*:

- Hash value: \( 23 \mod 10 = 3 \)

- Position 3 is empty, so insert 23 at position 3.

Hash Table: \([ \\_, \\_, \\_, 23, \\_, \\_, 36, 66, 48, 27 ]\)

6. \*\*Insert 87\*\*:

- Hash value: \( 87 \mod 10 = 7 \)

- Position 7 is occupied, so try next position (linear probing).

- Position 8 is occupied, so try next position.

- Position 9 is occupied, so try next position.

- Position 0 is empty, so insert 87 at position 0.

Hash Table: \([ 87, \\_, \\_, 23, \\_, \\_, 36, 66, 48, 27 ]\)

7. \*\*Insert 10\*\*:

- Hash value: \( 10 \mod 10 = 0 \)

- Position 0 is occupied, so try next position (linear probing).

- Position 1 is empty, so insert 10 at position 1.

Hash Table: \([ 87, 10, \\_, 23, \\_, \\_, 36, 66, 48, 27 ]\)

8. \*\*Insert 12\*\*:

- Hash value: \( 12 \mod 10 = 2 \)

- Position 2 is empty, so insert 12 at position 2.

Hash Table: \([ 87, 10, 12, 23, \\_, \\_, 36, 66, 48, 27 ]\)

Thus, the final state of the Hash Table after inserting all elements using linear probing is:

\[

[ 87, 10, 12, 23, \\_, \\_, 36, 66, 48, 27 ]

\]

Q25)  
A)

To insert the given list of elements \((16, 23, 43, 18, 34, 59, 30, 22, 24, 46)\) into a Hash Table of size 10 using Separate Chaining, we will follow these steps:

1. \*\*Hash Function\*\*: \( h(k) = k \mod 10 \)

2. \*\*Separate Chaining\*\*: Each position in the hash table will hold a linked list of elements that hash to that position.

Let's insert each element step-by-step:

1. \*\*Insert 16\*\*:

- Hash value: \( 16 \mod 10 = 6 \)

- Position 6 is empty, so insert 16 at position 6.

Hash Table: \([ \\_, \\_, \\_, \\_, \\_, \\_, [16], \\_, \\_, \\_ ]\)

2. \*\*Insert 23\*\*:

- Hash value: \( 23 \mod 10 = 3 \)

- Position 3 is empty, so insert 23 at position 3.

Hash Table: \([ \\_, \\_, \\_, [23], \\_, \\_, [16], \\_, \\_, \\_ ]\)

3. \*\*Insert 43\*\*:

- Hash value: \( 43 \mod 10 = 3 \)

- Position 3 has [23], so add 43 to the list at position 3.

Hash Table: \([ \\_, \\_, \\_, [23, 43], \\_, \\_, [16], \\_, \\_, \\_ ]\)

4. \*\*Insert 18\*\*:

- Hash value: \( 18 \mod 10 = 8 \)

- Position 8 is empty, so insert 18 at position 8.

Hash Table: \([ \\_, \\_, \\_, [23, 43], \\_, \\_, [16], \\_, [18], \\_ ]\)

5. \*\*Insert 34\*\*:

- Hash value: \( 34 \mod 10 = 4 \)

- Position 4 is empty, so insert 34 at position 4.

Hash Table: \([ \\_, \\_, \\_, [23, 43], [34], \\_, [16], \\_, [18], \\_ ]\)

6. \*\*Insert 59\*\*:

- Hash value: \( 59 \mod 10 = 9 \)

- Position 9 is empty, so insert 59 at position 9.

Hash Table: \([ \\_, \\_, \\_, [23, 43], [34], \\_, [16], \\_, [18], [59] ]\)

7. \*\*Insert 30\*\*:

- Hash value: \( 30 \mod 10 = 0 \)

- Position 0 is empty, so insert 30 at position 0.

Hash Table: \([ [30], \\_, \\_, [23, 43], [34], \\_, [16], \\_, [18], [59] ]\)

8. \*\*Insert 22\*\*:

- Hash value: \( 22 \mod 10 = 2 \)

- Position 2 is empty, so insert 22 at position 2.

Hash Table: \([ [30], \\_, [22], [23, 43], [34], \\_, [16], \\_, [18], [59] ]\)

9. \*\*Insert 24\*\*:

- Hash value: \( 24 \mod 10 = 4 \)

- Position 4 has [34], so add 24 to the list at position 4.

Hash Table: \([ [30], \\_, [22], [23, 43], [34, 24], \\_, [16], \\_, [18], [59] ]\)

10. \*\*Insert 46\*\*:

- Hash value: \( 46 \mod 10 = 6 \)

- Position 6 has [16], so add 46 to the list at position 6.

Hash Table: \([ [30], \\_, [22], [23, 43], [34, 24], \\_, [16, 46], \\_, [18], [59] ]\)

Thus, the final state of the Hash Table after inserting all elements using separate chaining is:

\[

\begin{align\*}

0 & : [30] \\

1 & : [\\_] \\

2 & : [22] \\

3 & : [23, 43] \\

4 & : [34, 24] \\

5 & : [\\_] \\

6 & : [16, 46] \\

7 & : [\\_] \\

8 & : [18] \\

9 & : [59] \\

\end{align\*}

\]