1. Give the contents of the hash table that results when you insert items with the keys E A S Y Q U E S T I O N in that order into an initially empty table of M = 5 lists, using separate chaining with unordered lists. Use the hash function h(x) = k mod M to transform the kth letter of the alphabet into a table index, e.g., hash(I) = hash (9) = 9 % 5 = 4.

|  |
| --- |
| h(x) = k mod M |
| hash(E) = hash (5) =5%5=0 |
| hash(A) = hash (1) =1%5=1 |
| hash(S) = hash (19) =19%5=4 |
| hash(Y) = hash (25) =25%5=0 |
| hash(Q) = hash (17) =17%5=2 |
| hash(U) = hash (21) =21%5=1 |
| hash(E) = hash (5) =5%5=0 |
| hash(S) = hash (19) =19%5=4 |
| hash(T) = hash (20) =20%5=0 |
| hash(I) = hash (9) =9%5=4 |
| hash(O) = hash (15) =15%5=0 |
| hash(N) = hash (14) =14%5=4 |

Result :

|  |  |
| --- | --- |
| 0 | E -> Y -> E -> T -> O |
| 1 | A -> U |
| 2 | Q |
| 3 |  |
| 4 | S -> S -> I -> N |

2. Give the contents of the hash table that results when you insert items with the keys E A S Y Q U E S T I O N in that order into an initially empty table of size M = 16 using linear probing. Use the hash function h(x) = k mod M to transform the kth letter of the alphabet into a table index.

|  |  |
| --- | --- |
| h(x) = k mod M | h’(x)=h(x)+i |
| hash(E) = hash (5) =5%16=5 | hash(E) = 5 |
| hash(A) = hash (1) =1%16=1 | hash(A) = 1 |
| hash(S) = hash (19) =19%16=3 | hash(S) = 3 |
| hash(Y) = hash (25) =25%16=9 | hash(Y) = 9 |
| hash(Q) = hash (17) =17%16=1 | hash(Q) = 1+1=2 |
| hash(U) = hash (21) =21%16=5 | hash(U) = 5+1=6 |
| hash(E) = hash (5) =5%16=5 | hash(E) = 5+2=7 |
| hash(S) = hash (19) =19%16=3 | hash(S) = 3+1=4 |
| hash(T) = hash (20) =20%16=4 | hash(T) = 4+4=8 |
| hash(I) = hash (9) =9%16=9 | hash(I) = 9+1=10 |
| hash(O) = hash (15) =15%16=15 | hash(O) = 15 |
| hash(N) = hash (14) =14%16=14 | hash(N) = 14 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|  | A | Q | S | S | E | U | E | T | Y | I |  |  |  | N | O |

Result :

3. Give the contents of the hash table that results when you insert items with the keys E A S Y Q U E S T I O N in that order into an initially empty table of size M = 16 using quadratic hashing. Use the hash function h(x) = k mod M for the inital probe and the collision is resolved by finding an available position at (h(x) + i^2) %M), i=1, 2, ...

|  |  |
| --- | --- |
| h(x) = k mod M | h’(x)=h(x)+i2 |
| hash(E) = hash (5) =5%16=5 | hash(E) = 5 |
| hash(A) = hash (1) =1%16=1 | hash(A) = 1 |
| hash(S) = hash (19) =19%16=3 | hash(S) = 3 |
| hash(Y) = hash (25) =25%16=9 | hash(Y) = 9 |
| hash(Q) = hash (17) =17%16=1 | hash(Q) = 1+1=2 |
| hash(U) = hash (21) =21%16=5 | hash(U) = 5+1=6 |
| hash(E) = hash (5) =5%16=5 | hash(E) = 5+32=14 |
| hash(S) = hash (19) =19%16=3 | hash(S) = 3+1=4 |
| hash(T) = hash (20) =20%16=4 | hash(T) = 4+4=8 |
| hash(I) = hash (9) =9%16=9 | hash(I) = 9+1=10 |
| hash(O) = hash (15) =15%16=15 | hash(O) = 15 |
| hash(N) = hash (14) =14%16=14 | hash(N) = 14+32=23 mod 16=7 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|  | A | Q | S | S | E | U | N | T | Y | I |  |  |  | E | O |

Result :

4. What is the value of the Shift Folding Hash Function if K = 432-351-459-763-88 and TSize = 1000?

Shift Folding Hash Function: **(432+351+459+763+88) MOD 1000 = 93**

5. What is the value of the Boundary Folding Hash Function if K = 432-351-459-763-88 and TSize = 1000?

Boundary Folding Hash Function: **(432+153+459+367+88) MOD 1000 = 499**