Exercise 1. Consider inserting the following keys into an initially empty hash table of M = 5 lists, using separate chaining. Use the hash function $h(k) = k \mod M$ to transform the kth letter of the alphabet into a table index, where $1 \le k \le 26$.

EASYQUTION

a. What is the value of h(18)?

b. What is the state of the array st?

Exercise 2. Consider inserting the following keys (assume values to be non null and arbitrary) into a binary search tree (ordered) symbol table st, an object of type BST.

SYMBOLTAEXP

a. What is the binary search tree (BST) that results? List the keys along with their indices (starting at 1) in level order.

b. What is the height of the BST (assume root to be at height 0)?

c. What is the order in which the keys are visited if we traverse the BST in pre-order?

d. What is the order in which the keys are visited if we traverse the BST in in-order?

e. What is the order in which the keys are visited if we traverse the BST in post-order?

f. What is the order in which the keys are visited if we traverse the BST in level-order?

g. What is the BST that results if we delete the smallest key from the initial tree?

h. What is the BST that results if we delete the largest key from the initial tree?

i. What is the BST that results if we delete the key B from the initial tree?

Exercise 3. How is the following 10-dimensional sparse vector represented economically as a symbol table?

0 0 3.14159 0 2.71828 0 0 0 0 0

Exercise 4. How is the following 5-by-10 sparse matrix represented economically as an array of sparse vectors (symbol tables)?

0	0	0	0	0	0	0	0	0	0
0	0	6	0	0	0	0	0	9	0
7	0	0	0	0	2	0	0	2	0
9	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	4

Solutions

Solution 1.

```
a. 3
          0 -> T -> Y -> E -> null
U -> A -> null
b. o:
   1:
          Q -> null
   2:
   3:
          null
         N -> I -> S -> null
   4:
```

Solution 2.

a. 1: S, 2: M, 3: Y, 4: B, 5: O, 6: T, 8: A, 9: L, 11: P, 13: X, 18: E

b. 4

c. sM B A L E O P Y T X d. A B E L M O P S Т Х Ү е. А E L B P 0 М X T Y S f.s m y b o t a l p x e g. 1: S, 2: M, 3: Y, 4: B, 5: O, 6: T, 9: L, 11: P, 13: X, 18: E

h. 1: S, 2: M, 3: T, 4: B, 5: O, 7: X, 8: A, 9: L, 11: P, 18: E

i. 1: S, 2: M, 3: Y, 4: E, 5: O, 6: T, 8: A, 9: L, 11: P, 13: X

Solution 3. {2: 3.14159, 4: 2.71828}

Solution 4.

- 0: {} 1:
- {2: 6, 8: 9} {0: 7, 5: 2, 8: 2} {0: 9, 3: 1} {9: 4} 2:
- 3: 4: