COMP2521 Revision Trivia 2

Question

answer

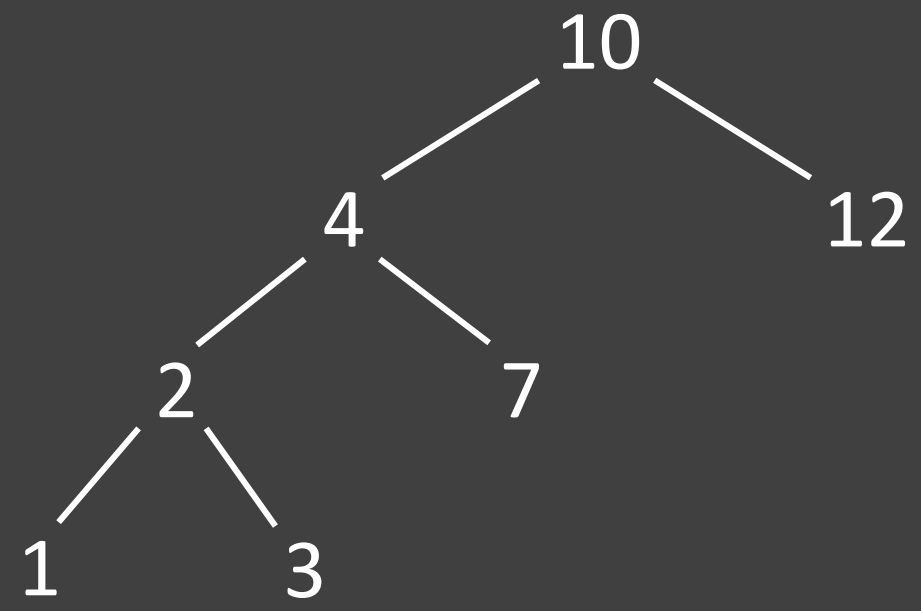
a) What is the best case time complexity for inserting *N* elements into an AVL tree?

b) What is the worst case time complexity?

Question

answer

Show the result of a right rotation at the node with a 4 in the following BST



Question

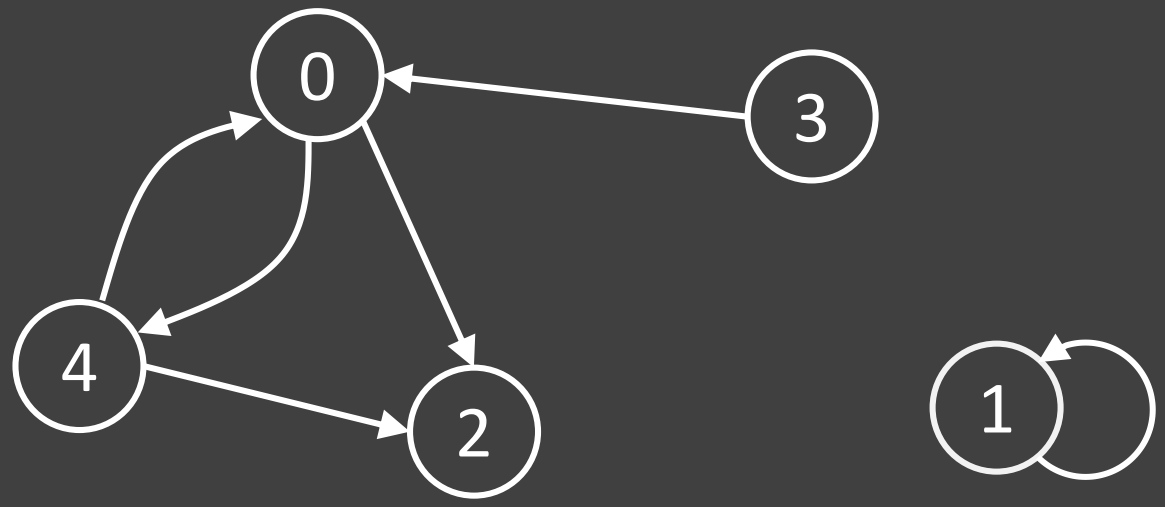
answer

Suppose you are given two sorting programs. You are told that one of them is quick sort (with random pivot) and the other is merge sort, but you are not told which one is which. Describe a test you could run to distinguish them.

Question

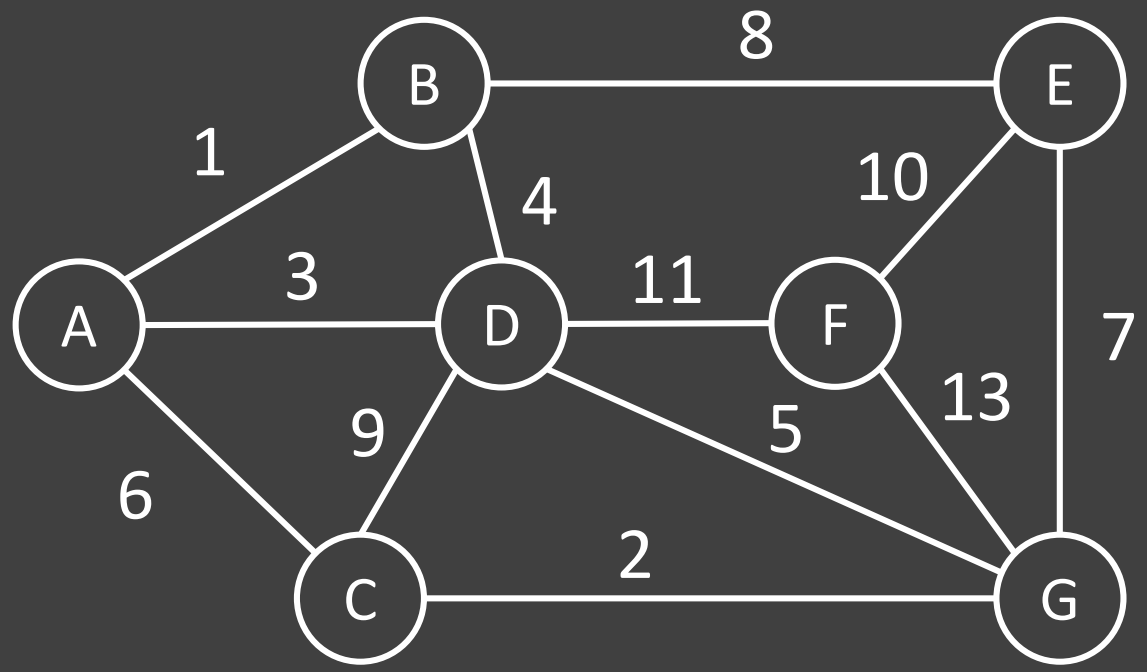
answer

Draw the adjacency list representation for this graph. (Assume the lists are kept in order.)



Question

Apply Prim's algorithm to this graph starting at vertex C and show the order that the edges are added to the MST. What is the total cost of the MST?



answer

Question

Consider the following sequence of numbers:

5 4 6

Draw a BST such that preorder traversal of the BST would give this sequence.

Repeat for postorder traversal and level-order traversal.

answer

Question

You have asked your friends Alice and Bob to implement a hash table that uses double hashing.

answer

Alice implements a hash table of size $N = 11$ that uses a primary hash function of $h_1(x) = x \% 11$ and a secondary hash function of $h_2(x) = x \% 5$.

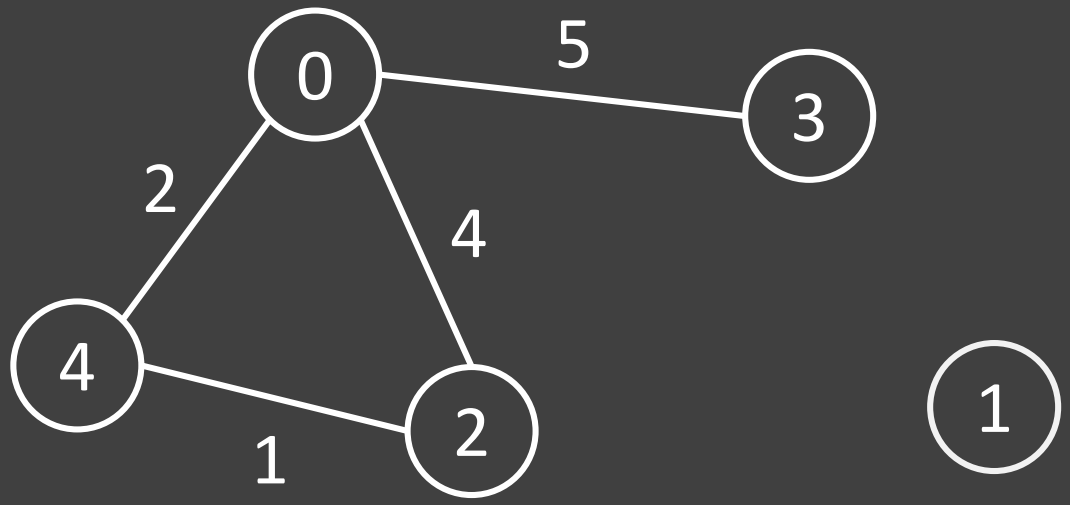
Bob implements a hash table of size $N = 10$ that uses a primary hash function of $h_1(x) = x \% 10$ and a secondary hash function of $h_2(x) = 7 - (x \% 7)$.

Whose implementation is flawed? Explain why.

Question

answer

Draw the adjacency list representation for this graph. (Assume the lists are kept in order.)



Question

answer

State two drawbacks of non-comparison-based sorting algorithms.

Give an example of a non-comparison-based sorting algorithm.

Question

answer

What is the worst case time complexity of the Knuth-Morris Pratt algorithm? Explain.

Question

answer

Describe one advantage and one disadvantage of using a linked list instead of an array.

Question

answer

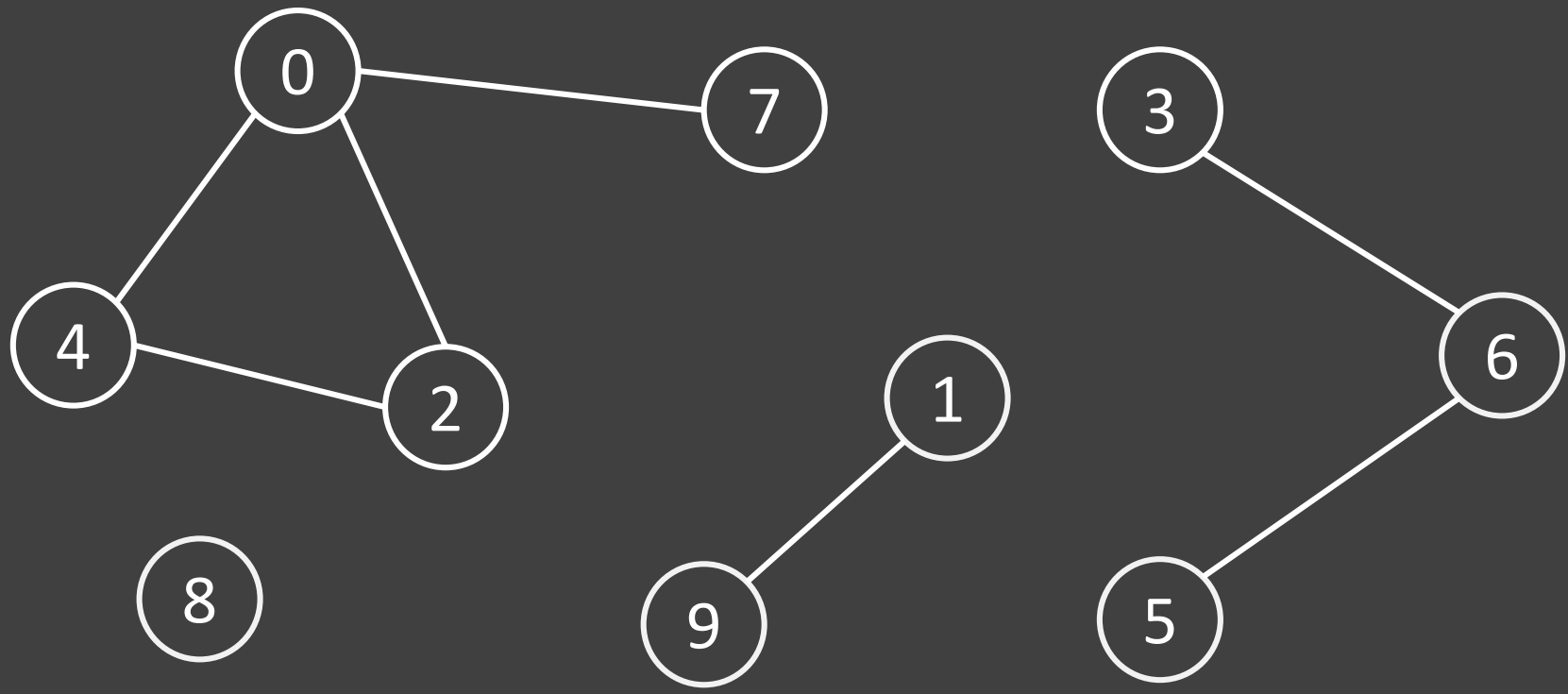
Construct a trie from these words:

trees, trie, tree, try, teal, tie, tea

How many nodes does it contain?
How many finishing nodes does it contain?

Question

Give a possible connected components array for this graph:

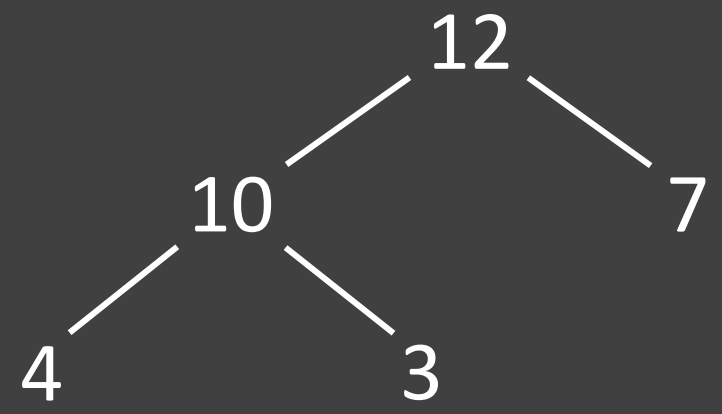


answer

Question

answer

Consider the following max heap.



Show the result of deleting the largest item.

Question

Consider the following hash table of size $N = 11$. It uses the primary hash function $h_1(x) = x \% 11$, and uses double hashing to resolve collisions, with the secondary hash function $h_2(x) = x \% 5 + 1$.

0	1	2	3	4	5	6	7	8	9	10
	21	14	9			17		8	30	6

Suppose 47 was inserted into the table. At what index will it end up? How many comparisons are made in the process?

answer

Answers

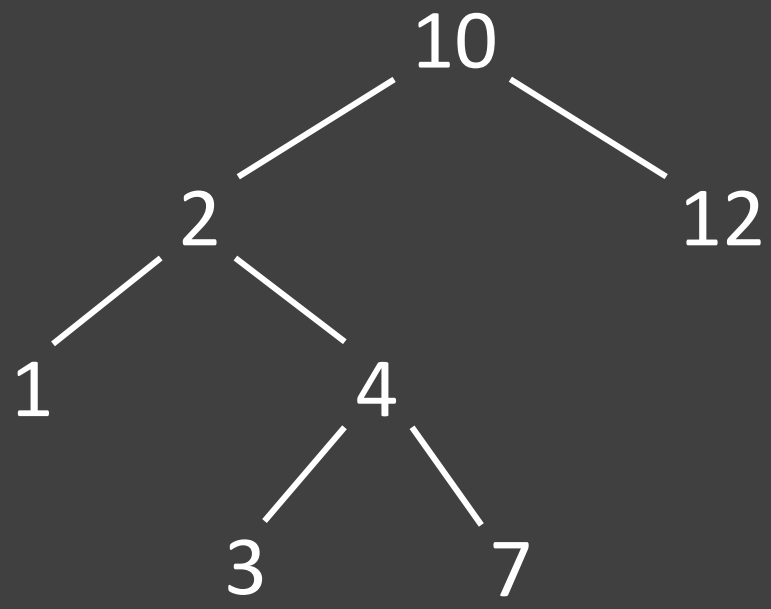
Answer

question

a) O(*N* log *N*)

b) O(*N* log *N*)

Answer



question

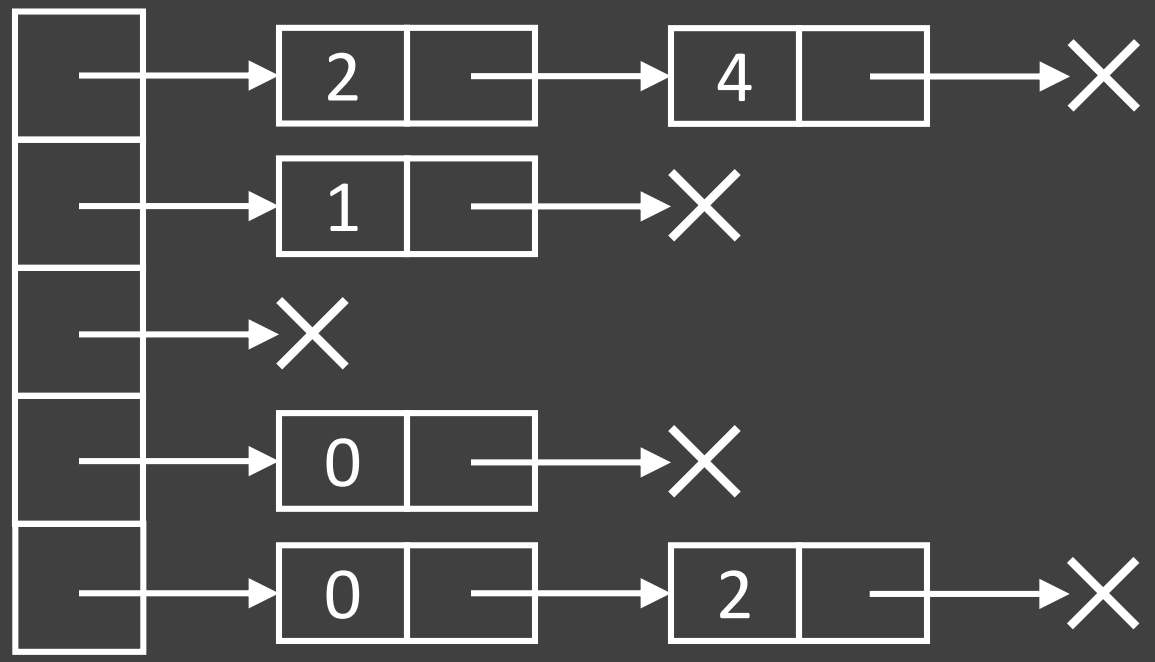
Answer

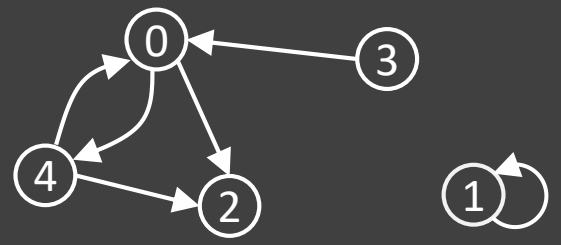
Both quick sort and merge sort have an average time complexity of O(n log n), and it's impossible to force quick sort to run for O(n^2) time, since it uses a random pivot. So timing tests will not help. Instead, we can use the fact that merge sort is stable, while quick sort is not, and test both sorts for stability by including multiple items with the same key in the input. We may need to test with multiple inputs, since an unstable sorting algorithm can produce a stable sort by chance for some inputs.

question

Answer

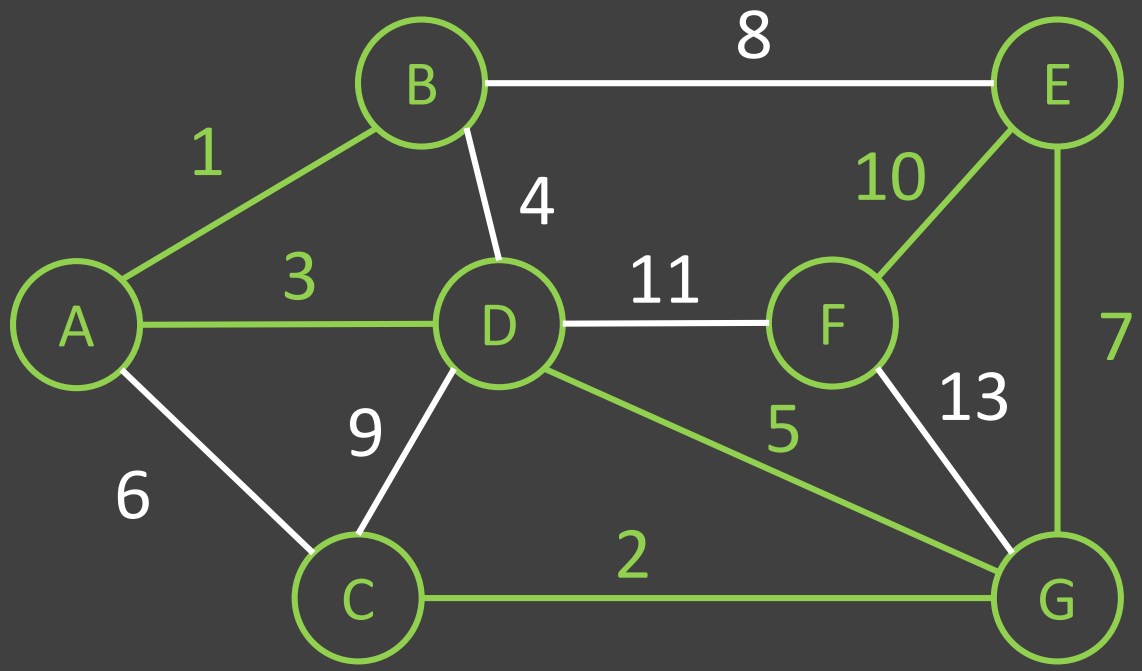
question





Answer

Edges added in order: C-G, D-G, A-D, A-B, E-G, E-F
Total cost: 28

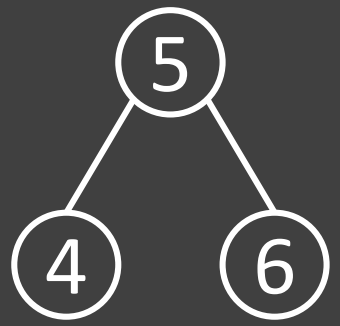


question

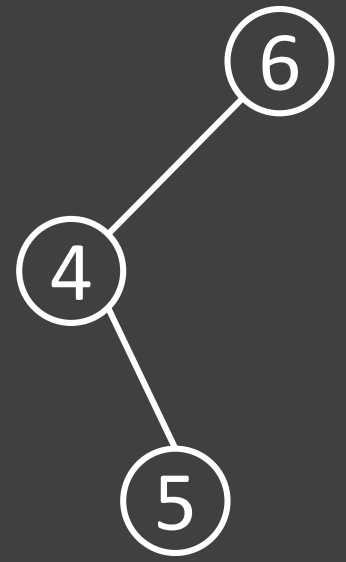
5

Answer

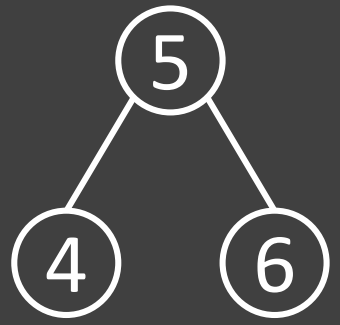
Preorder traversal:



Postorder traversal:



Level-order traversal:



question

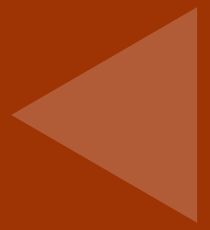
Answer

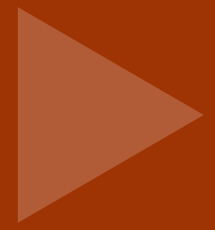
question

Both implementations are flawed.

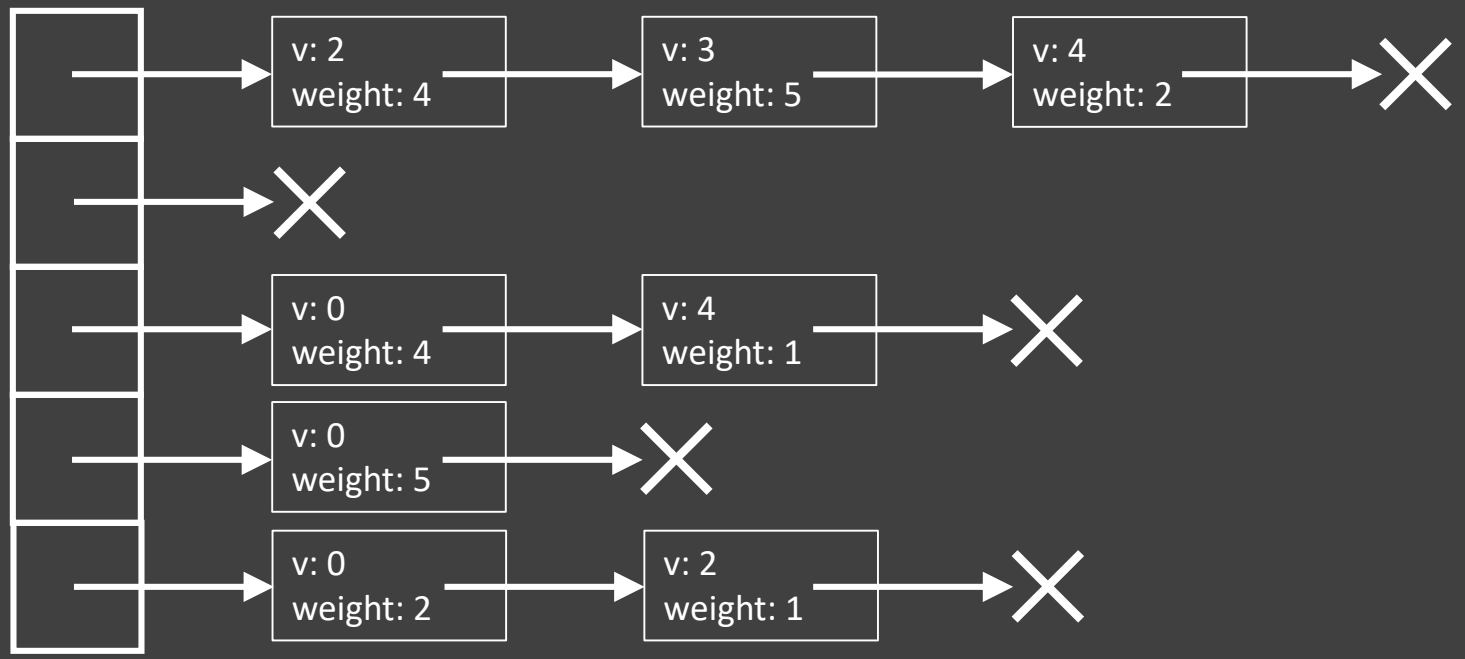
In Alice's implementation, the secondary hash function can return 0, which is not a valid increment.

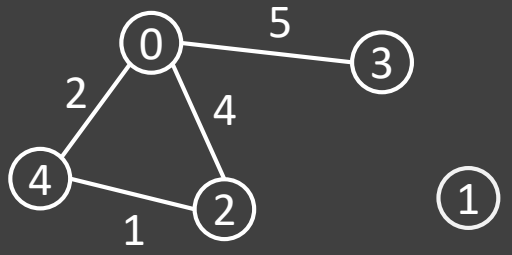
In Bob's implementation, the secondary hash function could return an increment that is a factor of the table size (e.g., 2 or 5), which means not all of the slots will be checked when there is a hash collision.





Answer





question

Answer

question

Non-comparison-based sorting algorithms usually require more space. They also often make assumptions about the type, range or distribution of the input data. An example of a non-comparison based sorting algorithm is radix sort.

Answer

O(N + M), where N is the length of the text and M is the length of the pattern.

The failure function can be constructed in O(M) time. In the main part of the algorithm, after every character comparison, we either move on to the next character in the text, or we shift the pattern. Since the length of the text is N, we can't shift the pattern more than N times. This means the main part of the algorithm is O(N).

Hence, the time complexity is O(M + N).

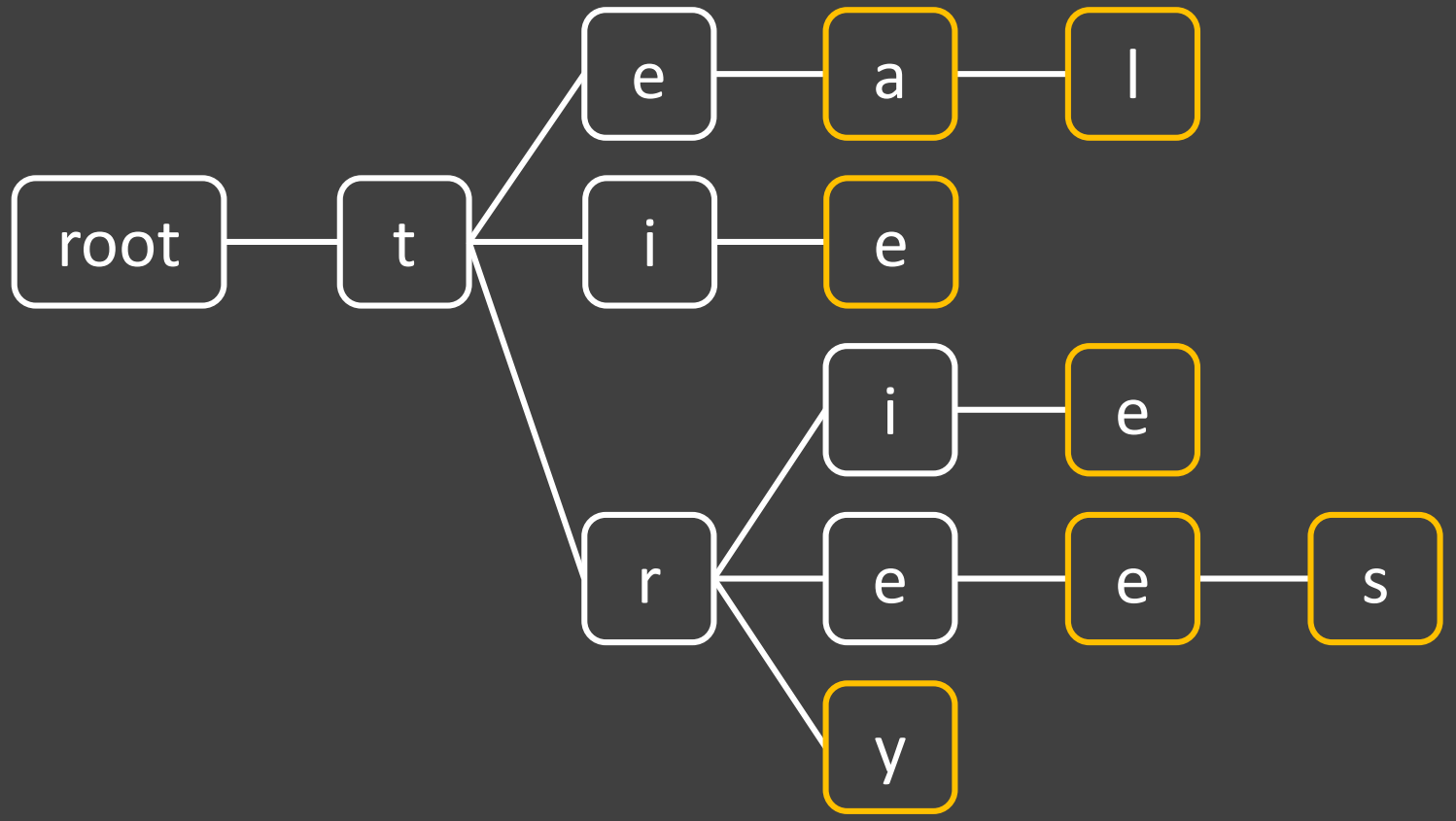
question

Answer

question

Advantage: Can be easily extended to add more items.
Disadvantage: No random access for a linked list. Need to start from the beginning to access any item in the list.

Answer



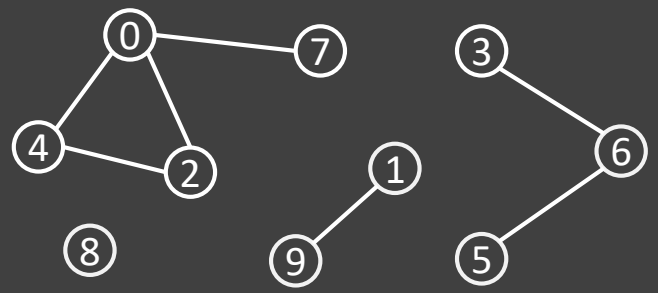
There are 14 nodes in total (including the root node).
There are 7 finishing nodes.

question

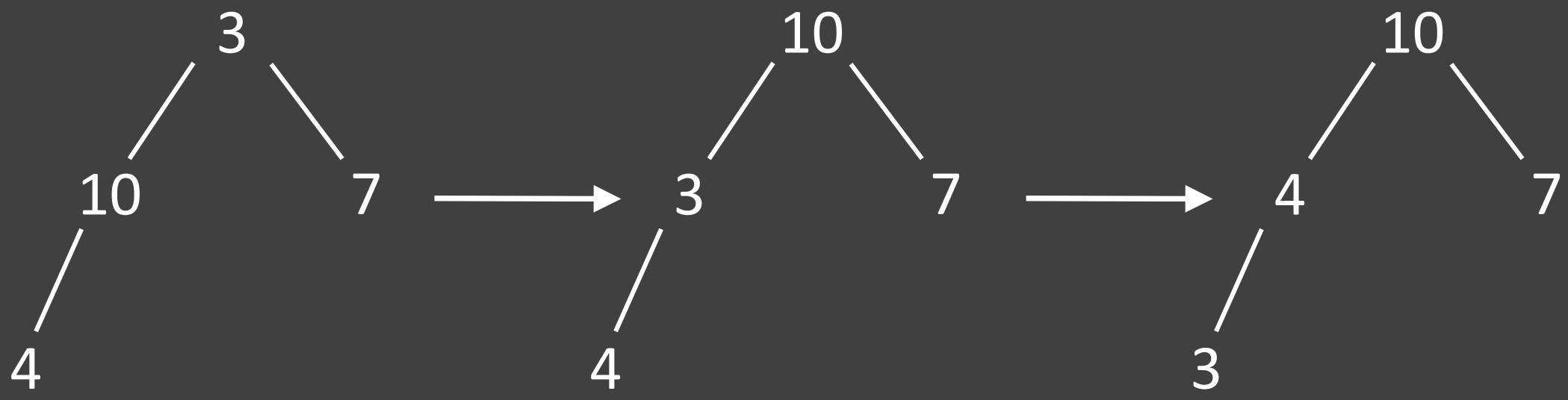
Answer

question

0	1	2	3	4	5	6	7	8	9
0	1	0	2	0	2	2	0	3	1



Answer



Final

Answer

question

The 47 will end up at index 4.
4 comparisons are made in the process (to ensure we don't insert duplicates).

0	1	2	3	4	5	6	7	8	9	10
	21	14	9			17		8	30	6