

SOLVED BY ADIL ALVI

CS301 CURRENT PAPERS FALL 2021

1) What is Hash function?

A hash function is any function that can be used to map data of arbitrary size to fixed-size values.

2) What is Symbol table?

A symbol table is a data structure used by a language translator such as a compiler or interpreter, where each identifier (or symbol) in a program's source code is associated with information relating to its declaration or appearance in the source.

3) How does heap sort work?

Heapsort divides its input into a sorted and an unsorted region, and it iteratively shrinks the unsorted region by extracting the largest element from it and inserting it into the sorted region.

4) Write two application of hashing?

1) Message Digest, 2) Password Verification.

5) Write Pseudo Code of the Maze Generation?

```
Makemaze(int size) {  
    Entrance = 0; exit = size-1;  
    While (find(entrance) != find(exit)) {  
        Cell1 = randomly chosen cell  
        Cell2 = randomly chosen adjacent cell  
        If (find(cell1) != find(cell2)) {  
            Knock down wall between cells  
            Union(cell1, cell2)  
        }  
    }  
}
```

6) What is meant by abstract data type (ADT), write its properties

An abstract data type (ADT) is a mathematical model for data types.

Properties of Abstract Data Types:

The data structure can only be accessed with defined operations. This set of operations is called interface and is exported by the entity. An entity with the properties just described is called an abstract data type (ADT).

7) What is collision write two methods of collision?

When two values hash to the same array location, this is called a collision there are a number of collision resolution techniques, but the most popular are chaining and open addressing.

8) How is traversing of nodes done in a threaded binary tree?

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In order traversal of a Binary tree can either be done using recursion or with the use of an auxiliary stack. A binary tree is made threaded by making all right child pointers that would normally be NULL point to the in order successor of the node (if it exists).

9) Write Steps of insertion sort?

1) If it is the first element, it is already sorted. 2) Pick the next element. 3) Compare with all the elements in sorted sub-list. 4) Shift all the elements in sorted sub-list that is greater than the value to be sorted. 5) Insert the value. 6) Repeat until list is sorted.

10) What is the use of collision in hashing?

A collision occurs when more than one value to be hashed by a particular hash function hash to the same slot in the table or data structure (hash table) being generated by the hash function.

11) Write Skip list characteristics?

The skip list is a probabilistic data structure that is built upon the general idea of a linked list. The skip list uses probability to build subsequent layers of linked lists upon an original linked list. Each additional layer of links contains fewer elements, but no new elements.

12) Write two conditions of first deletion in avl tree?

Following are two basic operations that can be performed to re-balance a BST without violating the BST property ($\text{keys}(\text{left}) < \text{key}(\text{root}) < \text{keys}(\text{right})$).

1) Left Rotation, 2) Right Rotation

13) How we can generate a maze with the help of union?

Using disjoint-set we can generate a maze

- Randomly remove walls until the entrance and exit cells are in the same set.
- Removal of the wall is the same as doing a union operation.
- Do not remove a randomly chosen wall if the cells it separates are already in the same set.

14) 4 inclusion criteria of pixel?

- 1) Fraction Mode (Area Weighting), 2) Binary Mode (>50% inclusion)
- 3) Binary Mode (100% inclusion), 4) Compatibility Mode (Versions <3.6)

15) What is Dummy node?

A dummy node at the front/end of the list that is there only to reduce the need for special-case code in the linked-list operations. It is an empty template to build new nodes later.

16) Define heap, minimum heap and maximum heap?

A heap is a tree-based data structure that allows access to the minimum and maximum element in the tree in constant time. A min-heap is used to access the minimum element in the heap whereas the Max-heap is used when accessing the maximum element in the heap.

17) What is Purpose of Huffman coding?

Huffman coding is a lossless data compression algorithm. Huffman coding provides an efficient, unambiguous code by analyzing the frequencies that certain symbols appear in a message.

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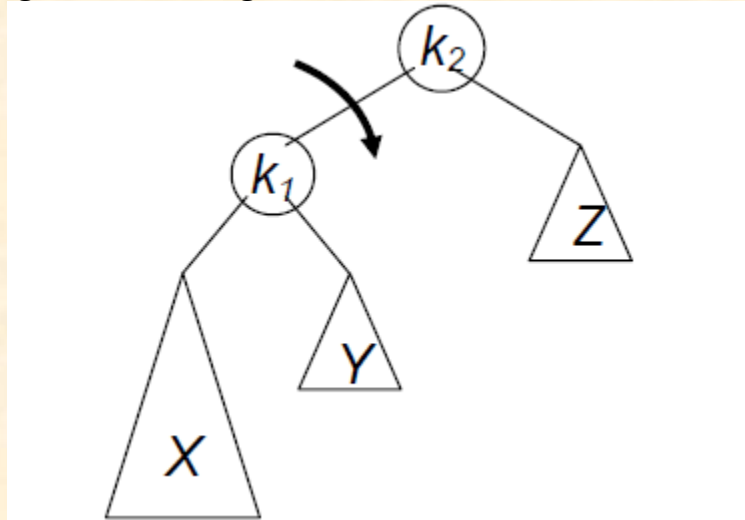
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Symbols that appear more often will be encoded as a shorter-bit string while symbols that aren't used as much will be encoded as longer strings.

18) What is Quad node?

Fast and easy Quad Tree implementation for node. Quad trees are the two-dimensional analog of octrees and are most often used to partition a two-dimensional space by recursively subdividing it into four quadrants or regions

19) Draw Single Right Rotation diagram?



20) How threaded binary tree make it possible not to use stack and recursion in traverses?

The idea of threaded binary trees is to make in order traversal faster and do it without stack and without recursion. A binary tree is made threaded by making all right child pointers that would normally be NULL point to the in order successor of the node (if it exists).

21) Write steps of Bubble sort?

The steps in the bubble sort can be described as below

- Exchange neighboring items until the largest item reaches the end of the array
- Repeat the above step for the rest of the array

22) What is Equivalence relation in data structure?

An equivalence relation allows one to partition a set of objects into equivalence classes: that is, a collection of subsets where all entries in a given equivalence class are related to all other elements within the same equivalence class.

23) Write Operation of table ADT

1) Insert, 2) find, 3) remove

24) How implementation of disjoint set is better than Boolean matrix?

It provides operations for adding new sets, merging sets (replacing them by their union), and finding a representative member of a set. The last operation allows to find out efficiently if any two elements are in the same or different sets.

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25) Write code of Minimum heap?

Begin

Declare function build_minheap(int *a,int n).

Declare k of the integer datatype.

For(k = n/2; k >= 1; k--)

Call function min_heap(a,k,n)

End.

26) What is Divide and conquer algorithm?

A divide-and-conquer algorithm recursively breaks down a problem into two or more sub-problems of the same or related type, until these become simple enough to be solved directly.

The solutions to the sub-problems are then combined to give a solution to the original problem.\

27) When Hashing is NOT suitable?

Hash tables are not so good if there are many insertions and deletions, or if table traversals are needed in this case, AVL trees are better.

28) What is Selection Problem?

Is an optimization problem which deals with the selection of non-conflicting activities that needs to be executed by a single person or machine in a given time frame.

29) Write the name of three elementary sorting algorithms?

Three of the simplest algorithms are Selection Sort, Insertion Sort and Bubble Sort.

30) Write two application of sorting?

We have seen two important applications of sorting: (1) as an aid to searching, and (2) for matching entries in lists. Sorting is also used in the solution of many other more complex problems.

31) Smaller lists is best for insertion sort and larger lists is best for quick sort why? Justify

Insertion sort is faster for small n because Quick Sort has extra overhead from the recursive function calls. Insertion sort is also more stable than Quick sort and requires less memory.

Quicksort is probably more effective for datasets that fit in memory. For larger data sets it proves to be inefficient so algorithms like merge sort are preferred in that case.

32) Three characteristics of good hashing function?

Characteristics of a Good Hash Function. There are four main characteristics of a good hash function: 1) The hash value is fully determined by the data being hashed. 2) The hash function uses all the input data. 3) The hash function "uniformly" distributes the data across the entire set of possible hash values.

33) When hashing suitable?

A good hash algorithm should be complex enough such that it does not produce the same hash value from two different inputs. If it does, this is known as a hash collision. A hash algorithm can only be considered good and acceptable if it can offer a very low chance of collision.

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34) Write code of bubble sort?

```
Void bubblesort(int *arr, int N)
{
    Int i, temp, bound = N-1;
    Int swapped = 1;
    While (swapped > 0 )
    {
        Swapped = 0;
        For(i=0; i < bound; i++)
            If ( arr[i] > arr[i+1] )
            {
                Temp = arr[i];
                Arr[i] = arr[i+1];
                Arr[i+1] = temp;
                Swapped = i;
            }
        Bound = swapped;
    }
}
```

35) Write Code of insertion sort?

```
Void insertionsort(int *arr, int N)
{
    Int pos, count, val;
    For(count=1; count < N; count++)
    {
        Val = arr[count];
        For(pos=count-1; pos >= 0;
        Pos--)
            If (arr[pos] > val)
                Arr[pos+1]=arr[pos];
            Else break;
        Arr[pos+1] = val;
    }
}
```

36) Name of two divide and conquer algorithms name?

1) Merge Sort, 2) Quick Sort, 3) Heap Sort

37) How we can Searching an element in Skip list?

1) Key of next node is less than search key then we keep on moving forward on the same level.
2) Key of next node is greater than the key to be inserted then we store the pointer to current node i at update[i] and move one level down and continue our search.

38) Write name of two $N \log_2 N$ algorithm?

1) Quick sort, 2) Merge sort

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39) Write Work of find() in operation of table ADT?

Suppose we have data in the table and want to find some particular information. The Find method is given a key and it finds the entry associated with the key.

40) Implementation of Table?

1) Unsorted Sequential Array, 2) Sorted Sequential Array

41) Write one example of hashing?

Hashing can be used to store the data. Suppose we have a list of fruits. The names of Fruits are in string. The key is the name of the fruit. We will pass it to the hash Function to get the hash key.

Hashcode ("apple") = 5

We pass it to the string —apple. Resultantly, it returns a number 5.

42) Difference between Min Heap and Max Heap?

In a Min-Heap the key present at the root node must be less than or equal to among the keys present at all of its children.

In a Max-Heap the key present at the root node must be greater than or equal to among the keys present at all of its children.

43) What is prefix?

A prefix is a group of letters placed before the root of a word.

44) What is sorting?

Sorting means to put the data in a certain order or sequence.

45) How does quicksort work?

Quicksort is a divide-and-conquer algorithm. It works by selecting a 'pivot' element from the array and partitioning the other elements into two sub-arrays, according to whether they are less than or Greater than the pivot.

CS301 Practical Questions:

1) Min heap sey tree draw krna tha or 4 nodes 15,10,12 or 7 add krwany thy

2) data table tha us main bubble sort apply krna tha

3) heap parents cell apply krna tha

4) expration aya tha abc/+* tree draw karna tha

5) Find the parent and left and right children

6) ek mein tree bana hua tha aur I think us k steps likhne thay

7) avl tree draw krna 5 marks ka

8) hashing table bana k results chek karein 23,46,58,68,78,86 ye table tha or mode 11 diye they

9) Q. 6:-

91

77 96

68 81 11

aisey tree bnai hui thi or kaha tha k esko min heap me change kry.

1) nodes find krny ka or links find krny

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- 11) AVL tree me value add kr k balance krna tha rotation k through.
- 12) sets they jinka union krna tha union(7,8) union (1,2)
- 13) Huffman encoding may just frequency btani thi table given tha just values put krni thi
- 14) heap ka tha tree given tha Ye btana tha k Ye MAX heap hai ya MIN or array index banana th
- 15) Sequential Array index given tha is may ek values 98 insert krwani thi bad may usko resultant heap bnana tha
- 16) Nodes 23 deay howay thay uss sy internal nodes internal links external nodes external links find krnay thay
- 17) Aik array d howe thi uss mn 81 insert krna tha
- 18) hashing table dya howa tha uss ko fill krna tha
- 19) bubble sort ka table bnana ha
- 20) Some values were given like 2,4,5,11,12,15 and I have to put them in the Skip list series
- 21) Tree was given and I have to implement it in an array.
- 22) Min heap tree tha os may 4 nodes delete kernay thy or phir tree show kerna tha
- 23) hash tables fill kerna tha or formal diya tha slove kerna tha ?
- 24) avl tree Mn value insert krni thi
- 25) long men expression tree se infix bnana tha and selection sort se array ko arrange tha krna,
- 26) Parse tree bnae expression tree bnao
- 27) Binary tree given the child batany thy
- 28) Huffman table ki diagram bnani thi 1,2,4,4
- 29) AVL tree se node delete kr k balance krna tha step by step,
- 30) Insertion sort apply krna tha numbers par,
- 31) avl tree m se agar parent node delete ho ga tu kitne rotation ho gay
- 32) 24 add in maxheap tree
- 33) make Frequency table of "data structures "
- 34) If array ya pta nhi heap tha have n internal nodes then it will have how many links? Internal links? External links? Or external nodes?
- 35) Ik priority queue ka code tha eroor dhoundni tha iska b 5 kaa
- 36) ik tree bnannan tha Max heap ka
- 37) below is given diagram of unbalance AVL tree, balance the tree by performances a single right rotation and draw final diagram ?
- 38) Union by weight method sy binary tree bnana tha
- 39) 1,3,4,5,7,8 es trha k kuch hidsy thy un ko frequency tree ma convert krna tha (3 marks)
- 40) $3(4*5)$ es ka tree bnana tha
- 41) 1,3,5,6,7,8 es trha hindsy thy unhy mix heap ma convert krna tha
- 42) Bst creation 19 37 9 6 12 10 1 8
- 43) Find Left child, Right Child and Parent nodes of given array.
- 44) $((x+y)*(p+q)/r)-r$ infix expression
- 45) 2,3,7,8,15,18,19,20,26,24,2 Find childre of value 15 in array
- 46) aik array thi us par insertion sort kr k steps btany thy.
- 47) Expression tree bnani thi postfix expression ki.
- 48) if a tree has 6 internal nodes then find total links, external links, internal links.
- 49) Equation ko infix mn change Karna ta
- 50) Array Diya hoa tha max heap bnana tha usy

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