

Long Question Bank (UNIT-1)

Part-1

1. What do you mean by algorithm? Write the characteristics of algorithm? (2014-15)
2. Sort the following array using heap-sort techniques $\{5, 13, 2, 25, 7, 17, 20, 8, 4\}$ & also Discuss its worst case and average case time complexities. (2015-16)
(2012-13)
3. What do you understand by asymptotic notations? Describe the important ^{types} of asymptotic notation? (2016-16)
(2010-11)
4. Write the merge sort algorithm of sorting a set of n points. Draw the recursion tree for $n=13$. (2016-17)
5. Prove that Quick sort algorithm takes $O(n^2)$ time to sort an array of n elements in the worst case? (2011-12)
6. Sort the elements of the given array A using shell sort algorithm (2012-13)
 $A = \{20, 35, 18, 8, 14, 41, 3, 39\}$.
7. Write & Explain Partitioning algorithm for Quicksort. (2011-12)
8. Consider the following recurrence
* $T(n) = T(n/3) + T(2n/3) + n$
Obtain asymptotic bound using recursion tree method. (2015-16)
* $T(n) = 2T(n/2) + n^2$.

9. Sort the array 15, 10, 5, 20, 25, 30, 40, 35 using merge sort technique (2016-17) (2015-16)

10. Define Insertion Sort and Selection Sort.



Long Question Bank

UNIT-1

Part-2

- ① Solve the following by using Recursion tree method. (AKTU 2017-18)

$$T(n) = n + T\left(\frac{n}{5}\right) + T\left(\frac{4n}{5}\right)$$

- ② Explain HEAP-SORT on the array. Illustrate the operation of HEAP-SORT on the array. (AKTU-2017-18)
(AKTU 2018-19)

$$A = \{6, 14, 3, 25, 2, 10, 20, 7, 6\}$$

- ③ The recurrence $T(n) = 7T\left(\frac{n}{2}\right) + n^2$, describe the running time of an algorithm A. A competing algorithm A' has running time of $T'(n) = aT'\left(\frac{n}{4}\right) + n^2$. What is the largest integer value of a A' is asymptotically faster than A? (AKTU 2017-18)

- ④ Use a recursion tree to give an asymptotically tight solution to the recurrence $T(n) = T(\alpha n) + T((1-\alpha)n) + cn$, where α is a constant in the range $0 < \alpha < 1$ and $c > 0$ is also a constant. (AKTU 2018-19)

- ⑤ (i) Solve the recurrence $T(n) = 2T\left(\frac{n}{2}\right) + n^2 + 2n + 1$
(ii) Prove the worst case running time of any comparison sort is $\Omega(n \log n)$ (AKTU 2018-19)

6) Among Merge, Insertion and Quick which sorting technique is the best in worst case.
Apply the best one among these algo's to sort the list E, X, A, M, P, L, E in alphabetic order. (AKTU - 2019-20)

7) Solve the recurrence using recursion tree method.
 $T(n) = T(n/2) + T(n/4) + T(n/8) + n$. (AKTU 2019-20)

8) Write an algo for counting sort? Illustrate the operation of counting sort on following array (AKTU 2020-21)

$$A = \{4, 0, 2, 0, 1, 3, 5, 4, 1, 3, 2, 3\}$$

9) Write an algo for insertion sort? Find time complexity of all cases (AKTU 2020-21)

10) Solve the recurrence. (AKTU 2021-22)

i) $T(n) = 3T(n/4) + cn^2$ using recursion tree

ii) $T(n) = n + 2T(n/2)$ using Iteration

11) Write Merge sort algorithm and sort the following sequence {23, 11, 5, 15, 68, 31, 4, 17} using merge sort (AKTU 2021-22)

12) Examine the following relation (AKTU 2022-23)

(i) $T(n) = T(n-1) + n^4$

(ii) $T(n) = T(n/4) + T(n/2) + n^2$

13) Explain the ~~following~~ algo of counting sort?

Illustrate the operation of counting sort on the following array $A = \{0, 1, 3, 0, 3, 2, 4, 5, 2, 4, 6, 2, 2, 3\}$

(AKTU 2022-23)

Short Question Bank

②

Unit - 1

- ① Discuss the basic steps in the complete development of an algo? (AKTU 2022-23)
- ② Explain and compare best & worst case time complexity of Quick sort? (AKTU 2022-23)
- ③ Discuss skip list & its operations (AKTU 2022-23)
(AKTU 2020-21)
- ④ How analyze the performance of an algo in different cases. (AKTU 2021-22)
(AKTU 2020-21)
- ⑤ What is recurrence relation? How is a recurrence solved using master's theorem. (AKTU 2020-21)
- ⑥ What is asymptotic notation? Explain Omega notation (Ω)? (AKTU 2020-21)
- ⑦ Solve the recurrence $T(n) = 4T(\frac{n}{2}) + n^2$? (AKTU 2020-21)
- ⑧ Take the following list of functions and arrange them in ascending order of growth rate (AKTU 2019-20)
 $f_1(n) = n^{2.5}$
 $f_2(n) = \sqrt{2}^n$
 $f_3(n) = n + 10$
 $f_4(n) = 10n$
 $f_5(n) = 100n$
 $f_6(n) = n^2 \log n$

9) How do you compare the performance of various algo's? (AKTU-2019-20)

10) Rank the following by growth rate:-
 n , $2^{\log \sqrt{n}}$, $\log n$, $\log \log n$, $\log^2 n$, $(\log n)^{\log n}$,
 4 , $(3/2)^n$, $n!$ (AKTU 2018-19)

11) Solve the following recurrence (AKTU 2017-18)
 $T(n) = 4T(n/3) + n^2$

12) Name the sorting algo that is most practically used & also write its time complexity (AKTU 2017-18)

$$T(n) = n + T(n/10) + T(7n/5)$$

13) What are the characteristics of algo. (2017-18)

14) Compare Time complexity & space complexity (2017-18)

Short Question Bank

Unit-2

① Discuss the properties of Binomial trees

(AKTU 2022-23)
(AKTU 2020-21)

② Explain the left rotation in RBT tree (AKTU 2021-22)

③ Write down the properties of Fibonacci heap.
(AKTU 2021-22)

④ Prove that if $n \geq 1$, then for any n -key
BTree of height h and min degree $t \geq 2$
 $h \leq \log_2((n+1)^{1/t})$ (AKTU 2018-19)

⑤ Discuss the properties of BTree?

⑥ Discuss the properties of R.B tree?

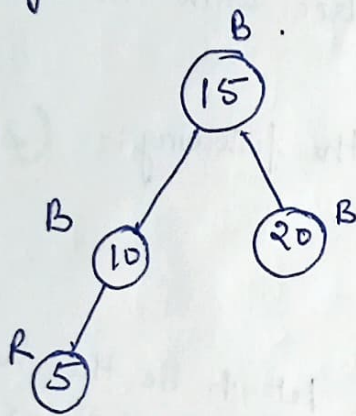
Long Question Bank (UNIT-2)

Part-1

1. Define Red-Black Tree and State their Applications. (2015-16)
2. Prove that the maximum degree of any node in a n -node binomial tree is $\log n$. (2015-16)
3. Show the results of inserting the keys -
F, S, B, K, C, L, H, T, V, W, M, R, N. (2016-17)
into an Empty Binary tree with $\text{min deg} = 2$. (2014-15)
4. Write short notes on the following:- (2016-17)
 - (i) B-Trees.
 - (ii) Fibonacci Heaps.
5. Define Red Black Tree. Let h be the height of a red-black tree and let n be the number of internal nodes in the tree. Then show that (2014-15)
$$h \leq 2 \log_2(n+1)$$
6. Consider T is a B-tree of order m and height h . Let $d = m/2$ and let n be the number of elements in T . Then show that
$$\log_m(n+1) \leq h \leq \log_d \frac{(n+1)}{2} + 1.$$
 (2015-16) (2012-13)

7. What is Fibonacci Heap? Discuss the applications of Fibonacci heap? (2014-15)

8. Consider the following valid red-black tree where R indicates a red node and "B" indicates a black node. Note that the black dummy sentinel leaf nodes are not shown. Show the resulting red-black tree after inserting key 3 into & deleting 15 from the original tree (2015-16)



9. Write the algorithm for deleting an element from a binomial heap. Show the binomial heap that results when the element 21 is removed from H given below. (2014-15)

10. Explain RB Tree. Show steps of inserting the keys 41, 38, 31, 12, 19, 8 into initially empty RB Tree. (2015-16), (2016-17)

Long Question Bank

Unit: - 2 (Part-2)

- ① What are the various differences in Binomial and fibonacci Heap? (AKTU 2022-23)
- ② Discuss the various cases for insertion in RB tree & also insert sequence of key in an empty red-black tree = { 15, 13, 12, 16, 19, 23, 5, 8 }
(AKTU 2022-23)
(AKTU 2021-22),
(AKTU 2020-21)
- ③ Explain & write algo for union of two binomial heaps & write its time complexity
(AKTU 2022-23)
(AKTU 2020-21)
(AKTU 2019-20) (AKTU 2017-18)
- ④ What is Binomial Heap? write down the algo for DECREASE Key operation in Binomial Heap and also write its time complexity?
(AKTU 2021-22)
- ⑤ ~~Is~~ Insert the following element in a initially empty RB tree. (AKTU 2020-21)
12, 9, 81, 76, 23, 43, 65, 88, 76, 132, 54
Now Delete 23 & 81.
- ⑥ Explain the algorithm to delete a given element in a binomial heap. Give an example for the same. (AKTU 2019-20)

⑦ Using minimum degree $t=3$ insert the following sequence of integers 10, 25, 20, 35, 55, 40, 45, 50, 55, 60, 75, 70, 65, 80, 65 & 90 in an initially empty B-Tree. (AKTU 2019-20)

⑧ Insert the elements 8, 20, 11, 14, 9, 4, 12 in a RB tree and delete 12, 4, 9, 14, respectively. (AKTU 2018-19)

⑨ Insert the following keys in 2-3-4 tree.
40, 35, 22, 90, 12, 45, 58, 78, 67, 60

and then delete key 35 & 22 one after other. (AKTU 2018-19)

⑩ Write an algo. for insertion in a RB tree? (AKTU 2017-18)