KATHMANDU UNIVERSITY
End Semester Examination
July/August 2024

Level : B.E.
Year : II
Time : 2 hrs. 30mins.

06 AUG 2024

Course : COMP 202
Semester : I
F. M. : 40

SECTION "B"
[6Q. × 4 = 24 marks]

Attempt ANY SIX questions.

1. Clarify circular linked list with suitable example. How do you implement linked list operation in singly linked list? Explain.

2. What is the difference between file structure and storage structure? How can you implement a stack using queues?

3. What is the main idea behind the selection sort? Is the heap sort always better than the quick sort? Make justification with an example.

4. What are some examples of divide and conquer algorithms? What are the advantages of binary search over a linear search?

5. What do you mean by graph traversal? Explain with an example.

6. Mention the steps to insert data at the starting of a singly linked list. Write an algorithm to add an item to the beginning of the list.

7. Define minimum cost spanning tree. Prove that the maximum number of edges that a graph with n Vertices is n*(n-1)/2.

SECTION "C"
[2Q. × 8 = 16 marks]

Attempt ANY TWO questions.

8. a. What is Graph? Write and explain the prim's algorithm and depth first search algorithm.
   b. Define searching. What are the collision resolution methods? Explain with examples.

9. a. Provide a concise and accurate description of a good way for quick sort to improve its performance by using insertion sort.
   b. What is sorting and what are its types? Arrange following elements in insertion sort with step-by-step procedure:

   11 17 19 43 22 27 33 29

10. What are the steps to convert a general tree into binary tree? Explain the tree traversals with algorithms and examples.

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Marks Scored:

Level : B.E.
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Course : COMP 202
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Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 06 AUG 2024

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices.

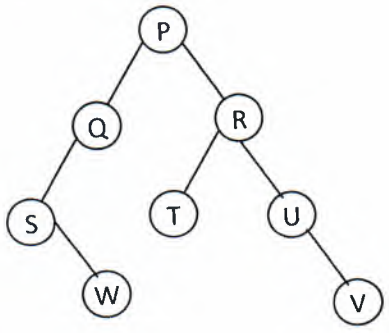
1. What is the maximum number of elements a Stack can hold?
   [ ] Stack can hold a limited number of elements
   [ ] Stack can hold an infinite number of elements
   [ ] It depends on the data type of the elements
   [ ] It depends on the memory available

2. An algorithm performs $(\log N)^{1/2}$ find operations, N insert operations, $(\log N)^{1/2}$ delete operations, and $(\log N)^{1/2}$ decrease-key operations on a set of data items with keys drawn from a linearly ordered set. For a delete operation, a pointer is provided to the record that must be deleted. For the decrease-key operation, a pointer is provided to the record that has its key decreased. Which one of the following data structures is the most suited for the algorithm to use, if the goal is to achieve the best total asymptotic complexity considering all the operations?
   [ ] Sorted array
   [ ] Sorted doubly linked list
   [ ] Unsorted array
   [ ] Min-heap

3. In linked list implementation of a queue, front and rear pointers are tracked. Which of these pointers will change during an insertion into a NONEMPTY queue?
   [ ] Both front and rear pointer
   [ ] Only front pointer
   [ ] Only rear pointer
   [ ] No pointer will be changed

4. Which one of the following is the overflow condition if linear queue is implemented using an array with a size MAX_SIZE?
   [ ] rear = front
   [ ] rear=MAX_SIZE -1
   [ ] rear = front+1
   [ ] rear = MAX_SIZE

5. Provide the breath first traversal for the following tree in fig.
   [ ] PQSWRTUV
   [ ] WSQTVURP
   [ ] SWQPTRUV
   [ ] PQRSTUWV



6. In the worst case, the number of comparisons needed to search a singly linked list of length n for a given element is

[ ] log (2*n) [ ] n/2 [ ] log (2*n) -1 [ ] n

7. Quick sort is run on 2 inputs shown below to sort in ascending order

A. 1, 2, 3……n

B. n, n – 1, n – 2 …… 1

Let C1 and C2 be the number of comparisons made for A and B respectively. Then

[ ] C1 > C2 [ ] C1 = C2

[ ] C1 < C2 [ ] Cannot say anything for arbitrary n

8. How could you differentiate a circular linked list from a normal linked list?

[ ] You cannot have the 'next' pointer point to null in a circular linked list

[ ] In a circular linked list, each node points to the previous node instead of the next node

[ ] It is faster to traverse the circular linked list

[ ] Head node is known in circular linked list

9. Which of the following is incorrect with respect to binary trees?

[ ] Let T be a binary tree. For every $k \geq 0$, there are no more than 2k nodes in level k

[ ] Let T be a binary tree with λ levels. Then T has no more than $2^{\lambda - 1}$ nodes

[ ] Let T be a binary tree with N nodes. Then the number of levels is at least ceil(log (N + 1))

[ ] Let T be a binary tree with N nodes. Then the number of levels is at least floor(log (N + 1))In the deletion operation of max heap, the root is replaced by

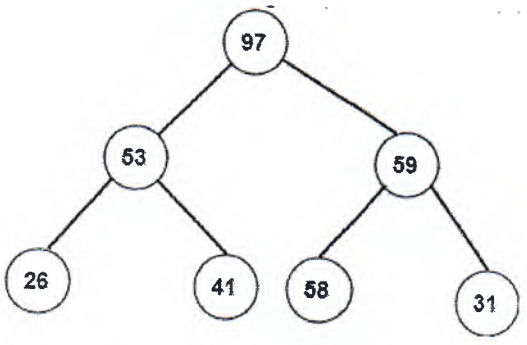
10. Consider the following heap after build heap phase. What will be its corresponding array?

[ ] 97,53,59,26,41,58,31

[ ] 26,31,41,53,58,59,97

[ ] 26,41,53,97,31,58,59

[ ] 26,53,41,97,58,59,31



11. Consider a hash function that distributes keys uniformly. The hash table size is 20. After hashing of how many keys will the probability that any new key hashed collides with an existing one exceed 0.5.

[ ] 5 [ ] 6 [ ] 7 [ ] 10

12. The postfix expression for the infix expression A+B*(C+D)/F+D*E is

[ ] AB+ CD+ *F/D+E* [ ] ABCD+ *F/+ DE*+

[ ] A*B+ CD/F*DE++ [ ] A+*BCD/F*DE++

13. Which of the following step is taken after finding an element having value greater than the element being searched?

[ ] Binary search takes place in the forward direction

[ ] Binary search takes place in a backward direction

[ ] Linear search takes place in the backward direction

[ ] Linear search takes place in the forward direction

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14. What type of sorting technique is applied in the given code ?
int num[] = { 3, 4, 6, 7, 8 }; int i, j, temp;

```
for(i=0; i<n;i++)
        for(j=0;j<n; j++ )
        { if (num[j]>num[j+1]
        { temp = num[j];
          num[j]=num[j+1];
        num[j+1]=temp;
           }}
```

[ ] Bubble sort [ ] Selection sort [ ] Insertion sort [ ] Merge sort

15. How many undirected graphs (not necessarily connected) can be constructed out of a given set V= {V 1, V 2,...V n} of n vertices ?
[ ] n(n-l)/2 [ ] 2^(n(n-1)/2) [ ] 2^n [ ] n!

16. Regarding implementation of Breadth First Search using queues, what is the maximum distance between two nodes present in the queue? (considering each edge length 1)
[ ] At most 1 [ ] Can be anything
[ ] 0 [ ] Insufficient Information

17. The time complexity used for inserting a node in a priority queue on the basis of key is:
[ ] O(n) [ ] O(n2) [ ] O(nlogn) [ ] O(logn)

18. In delete operation of BST, we need inorder successor (or predecessor) of a node when the node to be deleted has both left and right child as non-empty. Which of the following is true about inorder successor needed in delete operation?
[ ] Inorder successor is always either a leaf node or a node with empty right child
[ ] Inorder successor may be an ancestor of the node
[ ] Inorder successor is always either a leaf node or a node with empty left child
[ ] Inorder Successor is always a leaf node

19. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree?
[ ] 7 5 1 0 3 2 4 6 8 9 [ ] 0 2 4 3 1 6 5 9 8 7
[ ] 9 8 6 4 2 3 0 1 5 [ ] 0 1 2 3 4 5 6 7 8 9

20. A hash table of length 10 uses open addressing with hash function h(k)=k mod 10, and linear probing. After inserting 6 values into an empty hash table, the table is as shown below:

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

Which one of the following choices gives a possible order in which the key values could have been inserted in the table?

[ ] 46, 42, 34, 52, 23, 33
[ ] 46, 34, 42, 23, 52, 33
[ ] 34, 42, 23, 52, 33, 46
[ ] 42, 46, 33, 23, 34, 52