



UNIVERSITY OF RUHUNA

Faculty of Engineering

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Module No: EE3302      Module Name: Data Structures and Algorithms

Part-A  
[ 1 hour ]

**Instructions for candidates**

- Write your index number on top of every page.
- Question paper contains 50 multiple choice questions.
- Answer all questions. Each question has only one answer.
- For each question, put an X mark on the letter: (a), (b), (c), or (d) which corresponds to the correct answer, by using a black or blue pen.
- Each correct answer carries 0.5 marks.

1. The run time complexity of the function  $10n^2 + 2000n^2 \log(n) + 10 \log(n) + 5n + 2$  using  $\Theta$  (big-theta) asymptotic notation is
  - (a)  $\Theta(\log(n))$
  - (b)  $\Theta(n^2)$
  - (c)  $\Theta(n^2 \log(n))$
  - (d) none of the above.
2. The time factor, when determining the efficiency of an algorithm is measured by counting
  - (a) microseconds.
  - (b) the number of key operations.
  - (c) the number of statements.
  - (d) the kilobytes of algorithm.
3. What will be the  $\Theta$  (big-theta) asymptotic complexity to find the average of  $n$  elements in an array?
  - (a)  $\Theta(n^2)$
  - (b)  $\Theta(n \log(n))$
  - (c)  $\Theta(n)$
  - (d)  $\Theta(2n)$
4. What is the  $\Theta$  (big-theta) asymptotic complexity for a *quick sort* algorithm for sequence of number sorted in decreasing order.
  - (a)  $\Theta(n \log(n))$
  - (b)  $\Theta(n^2)$
  - (c)  $\Theta(n)$
  - (d)  $\Theta(n^3)$
5. What is the time, space complexity of following code:
 

```

int a = 0, b = 0;
for (i = 0; i < N; i++) {
    a = a + rand();
}
for (j = 0; j < M; j++) {
    b = b + rand();
}
      
```

  - (a)  $O(N * M)$  time and  $O(1)$  space
  - (b)  $O(N + M)$  time and  $O(N + M)$  space
  - (c)  $O(N + M)$  time and  $O(1)$  space
  - (d)  $O(N * M)$  time and  $O(N + M)$  space
6. What is the time complexity of the following code:

```

int a = 0;
for (i = 0; i < N; i++) {
    for (j = N; j > i; j--) {
        a = a + i + j;
    }
}

```

- (a)  $\Theta(n \log(n))$   
 (b)  $\Theta(n^2)$   
 (c)  $\Theta(n)$   
 (d)  $\Theta(n^3)$
7. What is the time complexity of the following code:

```

int i, j, k = 0;
for (i = n / 2; i <= n; i++) {
    for (j = 2; j <= n; j = j * 2) {
        k = k + n / 2;
    }
}

```

- (a)  $\Theta(n \log(n))$   
 (b)  $\Theta(n^2)$   
 (c)  $\Theta(n)$   
 (d)  $\Theta(n^3)$
8. What does it mean when we say that an algorithm X is asymptotically more efficient than Y?
- (a) X will always be a better choice for small inputs.  
 (b) X will always be a better choice for large inputs.  
 (c) Y will always be a better choice for small inputs.  
 (d) X will always be a better choice for all inputs.
9. An algorithm to search a node in a binary tree has worst case complexity of
- (a)  $\Theta(n)$ .  
 (b)  $\Theta(1)$ .  
 (c)  $\Theta(\log n)$ .  
 (d)  $\Theta(n \log n)$ .

10. What is the  $\Theta$  (big-theta) asymptotic complexity of adding two  $N \times N$  matrices?
- (a)  $\Theta(n)$   
 (b)  $\Theta(n^2)$   
 (c)  $\Theta(n^3)$   
 (d)  $\Theta(n \log n)$
11. What is the  $\Theta$  (big-theta) asymptotic complexity for *merge sort* algorithm?
- (a)  $\Theta(n \log(n))$   
 (b)  $\Theta(n^2)$   
 (c)  $\Theta(n)$   
 (d)  $\Theta(n^3)$

12. If the sequence of operations  
 push(4); push(2); pop(); push(1);  
 push(4); pop(); push(5);

are performed on a Stack, what will be the output of next three pop() operations?

- (a) 5, 4, 2  
 (b) 4, 2, 1  
 (c) 1, 4, 5  
 (d) 5, 1, 4.
13. Post-order traversal of a given binary search tree, T produces the following sequence of keys 10, 9, 23, 22, 27, 25, 15, 50, 95, 60, 40, 29. Which one of the following sequences of keys can be the result of an in-order traversal of the Tree T?
- (a) 9, 10, 15, 22, 23, 25, 27, 29, 40, 50, 60, 95  
 (b) 9, 10, 15, 22, 40, 50, 60, 95, 23, 25, 27, 29  
 (c) 29, 15, 9, 10, 25, 22, 23, 27, 40, 60, 50, 95  
 (d) 95, 50, 60, 40, 27, 23, 22, 25, 10, 9, 15, 29
14. You insert the following number sequence to an empty binary search tree.

30, 45, 22, 1, 40, 23, 4, 56

Now you want to insert number 20. Where will it be inserted?

- (a) as left child of 23  
 (b) as right child of 4  
 (c) as right child of 1  
 (d) none of the above is true.

15. The size of an adjacency matrix which can be used to represent graph  $a$  with 25 nodes is
- (a)  $5 \times 5$ .
  - (b)  $25 \times 25$ .
  - (c)  $625 \times 625$ .
  - (d)  $125 \times 125$ .
16. An adjacency matrix representation of a graph cannot contain information of :
- (a) nodes
  - (b) edges
  - (c) direction of edges
  - (d) parallel edges
17. Let  $G$  be an undirected connected graph with distinct edge weight. Let  $emax$  be the edge with maximum weight and  $emin$  be the edge with minimum weight. Which of the following statements is false?
- (a) Every minimum spanning tree of  $G$  must contain  $emin$ .
  - (b) If  $emax$  is in a minimum spanning tree, then its removal must disconnect  $G$ .
  - (c)  $G$  has a unique minimum spanning tree.
  - (d) No minimum spanning tree contains  $emax$ .
18. In a graph, when does Dijkstra's algorithm stop?
- (a) When the shortest path to the destination vertex is found.
  - (b) When all the vertices in the graph are included to the path.
  - (c) When the vertices together form a cycle.
  - (d) When the minimum spanning tree is constructed.
19. What is not true about a binary search tree?
- (a) Any node contains maximum two children.
  - (b) Left sub tree contains values less than the parent.
  - (c) Values can be duplicated.
  - (d) Child nodes can be assigned to null.
20. The best data structure to check whether an arithmetic expression has balanced parentheses is a
- (a) Queue.
  - (b) Stack.
  - (c) Hash table.
  - (d) Binary search tree.
21. Suppose you have a directed graph representing all the flights that an airline flies. What algorithm might be used to find the best sequence of connections from one city to another?
- (a) Breadth first search.
  - (b) Depth first search.
  - (c) A cycle-finding algorithm.
  - (d) A shortest-path algorithm.
22. The worst case occur in sequential search algorithm, when
- (a) Item is somewhere in the middle of the array.
  - (b) Item is not in the array at all.
  - (c) Item is the last element in the array.
  - (d) Item is the last element in the array or is not there at all.
23. Merge sort uses which of the following technique to implement sorting?
- (a) backtracking
  - (b) greedy algorithm
  - (c) divide and conquer
  - (d) dynamic programming
24. How many sub arrays does the quick sort algorithm divide the entire array into?
- (a) one
  - (b) two
  - (c) three
  - (d) four
25. Apply Quick sort algorithm on a number sequence 7 11 14 6 9 4 3 12. What is the sequence after first phase, pivot is first element?

- (a) 6 4 3 7 11 9 14 12  
(b) 6 3 4 7 9 14 11 12  
(c) 7 6 14 11 9 4 3 12  
(d) 7 6 4 3 9 14 11 12
26. Consider the Quick sort algorithm which sorts elements in ascending order using the first element as pivot. Then, which of the following input sequence will require a maximum number of comparisons when this algorithm is applied on it?
- (a) 22 25 56 67 89  
(b) 52 25 76 67 89  
(c) 22 25 76 67 50  
(d) 52 25 89 67 76
27. A machine needs a minimum of 200 sec to sort 1000 elements by Quick sort. The minimum time needed to sort 200 elements will be approximately
- (a) 60.2 sec.  
(b) 45.54 sec.  
(c) 31.11 sec.  
(d) 20 sec.
28. Which one of the following sorting algorithm is best suited to sort an array of 10 million random numbers?
- (a) Bubble sort  
(b) Insertion sort  
(c) Merge sort  
(d) Quick sort
29. In a max-heap, element with the greatest key is always in the
- (a) Leaf node.  
(b) First node of left sub tree.  
(c) root node.  
(d) First node of right sub tree.
30. Heap can be used as
- (a) a priority queue.  
(b) a stack.  
(c) a decreasing order array.  
(d) a normal Array.
31. Which one of the following array elements represents a binary min heap?
- (a) 12 10 8 25 14 17  
(b) 8 10 12 25 14 17  
(c) 25 17 14 12 10 8  
(d) 14 17 25 10 12 8
32. LinkedList data structure class has two pointers to keep the first and last places of the list ( Head and Tail ). When the reference
- ```
Tail = null;
```
- the LinkedList is
- (a) not accessible.  
(b) full.  
(c) invalid.  
(d) empty.
33. Doubly Linked List performs traverse in
- (a) forward direction.  
(b) backward direction.  
(c) both forward and backward directions.  
(d) circular direction.
34. Which element has the highest priority when removing from the Queue?
- (a) First inserted element of the Queue.  
(b) Element with minimum value.  
(c) Element with maximum value.  
(d) Last inserted element of the Queue.
35. Which linear data structure allows deleting and inserting data elements only from front?
- (a) Stacks  
(b) Queues  
(c) Doubly LinkedLists  
(d) Binary search tree
36. Which of the following data structures is Non-linear type ?
- (a) Strings  
(b) Lists

- (c) Stacks  
(d) None of the above
37. Breadth First Search is used in
- (a) Binary trees.  
(b) Stacks.  
(c) Graphs.  
(d) Both (a) and (c) above.
38. The data structure required for Breadth First Traversal on a graph is?
- (a) Stack  
(b) Array  
(c) Queue  
(d) Tree
39. Which of the following operations is performed more efficiently by Doubly Linked List than by singly Linked List?
- (a) Deleting a node whose location is given.  
(b) Searching of an unsorted list for a given item.  
(c) Inverting a node after the node with given location.  
(d) Traversing a list to process each node.
40. The time required to delete a node  $x$  from a doubly linked list having  $n$  nodes is
- (a)  $\Theta(\log(n))$   
(b)  $\Theta(n)$   
(c)  $\Theta(q)$   
(d)  $\Theta(n \cdot \log(n))$
41. Which of the following data structures are indexed structures?
- (a) linear arrays  
(b) Linked Lists  
(c) both of above  
(d) none of above
42. A linear list of elements in which deletion can be done from one end (front) and insertion can take place only at the other end (rear) is known as a
- (a) Queue.  
(b) Stack.  
(c) Tree.  
(d) Linked List.
43. We need to implement a queue using a circular array in C++. If DATA is a circular array of CAPACITY elements, and  $rear$  is an index into that array where data is inserted, how to update  $rear$  after inserting an element to the queue?
- (a)  $(rear + 1) \% CAPACITY$   
(b)  $rear \% CAPACITY + 1$   
(c)  $rear \% (1 + CAPACITY)$   
(d)  $(rear \% 1) + CAPACITY$
44. The pre-order and post order traversal of a Binary Tree generate the same output. The tree can have maximum
- (a) Three nodes.  
(b) Two nodes.  
(c) One node.  
(d) Any number of nodes.
45. The worst case time complexity of AVL tree is better in comparison to binary search tree for
- (a) Search and Insert Operations only.  
(b) Search and Delete Operations only.  
(c) Insert and Delete Operations only.  
(d) Search, Insert and Delete Operations only.
46. The number of different Binary Search Trees with 3 nodes with unique key values are
- (a) 3.  
(b) 4.  
(c) 5.  
(d) 6.
47. Suppose T is a binary tree with 14 nodes. What is the minimum possible depth of T?
- (a) 2  
(b) 3  
(c) 4  
(d) 5

48. What is the worst case time complexity of inserting a node in a Doubly Linked List?

- (a)  $O(n \log n)$
- (b)  $O(\log n)$
- (c)  $O(n)$
- (d)  $O(1)$

49. You want to find the  $n$ th element of a set of numbers. What statement is true.

- (a) Finding the  $n$ th element is slower if it was stored in an array than a Linked List.
- (b) Finding the  $n$ th element is faster if it was stored in an array than a Linked

List.

- (c) Finding the  $n$ th element is slower if it was stored in an array than a Tree.
- (d) Finding the  $n$ th element takes the same amount of time across all data structures.

50. What is the time complexity of Heap sort algorithm?

- (a)  $O(n \log n)$
- (b)  $O(\log n)$
- (c)  $O(n)$
- (d)  $O(n^2)$