



UNIVERSITY OF RUHUNA

Faculty of Engineering

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Module No: EE4303 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 0.4 marks.

1. What is the run time complexity of the function $30n^2 + 10n^2 \log(n) + 100 \log(n) + n + 4$ using Θ (big-theta) asymptotic notation?
 - (a) $\Theta(\log(n))$
 - (b) $\Theta(n^2)$
 - (c) $\Theta(n^2 \log(n))$
 - (d) none of the above
2. What is the Θ (big-theta) asymptotic complexity for *selection sort* algorithm for sequence of nearly sorted numbers.
 - (a) $\Theta(n \log(n))$
 - (b) $\Theta(n^2)$
 - (c) $\Theta(n)$
 - (d) $\Theta(n^3)$
3. What is the Θ (big-theta) asymptotic complexity for merging two already sorted arrays.
 - (a) $\Theta(n \log(n))$
 - (b) $\Theta(n^2)$
 - (c) $\Theta(n)$
 - (d) $\Theta(n^3)$
4. Two main measures for the efficiency of an algorithm are
 - (a) Processor and memory
 - (b) Time and space
 - (c) Complexity and capacity
 - (d) Data and space
5. Which algorithm is having highest space complexity?
 - (a) Merge sort
 - (b) Insertion Sort
 - (c) Quick sort
 - (d) Bubble sort
6. What is the Θ (big-theta) asymptotic complexity for *selection sort* algorithm for sequence of number sorted in descending order.
 - (a) $\Theta(n^2)$
 - (b) $\Theta(n \log(n))$
 - (c) $\Theta(n)$
 - (d) $\Theta(2n)$

7. If algorithm A has running time $5n^2 + n + 4$ and algorithm B has running time $20n^2 + n \log(n) + 100n$, then
- both have the same asymptotic time complexity.
 - A has larger asymptotic time complexity.
 - B has larger asymptotic time complexity.
 - no comparison can be made.
8. Which of the following cases does not exist in complexity theory?
- Best case
 - Worst case
 - Average case
 - Null case
9. The slowest sorting algorithm out of following to sort a almost sorted array is
- Merge sort
 - Insertion Sort
 - Quick sort
 - All have same asymptotic complexity.
10. The time factor, when determining the efficiency of an algorithm is measured by counting
- microseconds
 - the number of key operations
 - the number of statements
 - the kilobytes of algorithm
11. A linear list in which each node has a pointer that points to the successor node is called
- Singly Linked List
 - Doubly Linked List
 - Array List
 - Graph
12. The term "push" and "pop" is related to
- arrays
 - lists
 - stacks
 - all of above
13. Which of the below algorithms is not based on divide and conquer approach?
- Insertion Sort
 - Merge Sort
 - Shell Sort
 - Heap Sort
14. LinkedList is better than Array data structures,
- if number of data is fixed.
 - if the size of data structure is constantly changing.
 - for both of the above situations.
 - for none of the above situations.
15. Finding the n-th element of a set of numbers
- is slower if it was stored in an array than in a Linked List.
 - is faster if it was stored in an array than in a Linked List.
 - is slower if it was stored in an array than in a Tree.
 - takes the same amount of time across all data structures.
16. 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
- not accessible.
  - full.
  - invalid.
  - empty.
17. Doubly Linked List performs traverse in
- forward direction.
  - backward direction.
  - both forward and backward directions.
  - circular direction.

18. 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.
19. Which linear data structure allows deleting and inserting data elements only from front?
- (a) Stacks
  - (b) Queues
  - (c) Doubly LinkedLists
  - (d) Binary search tree
20. 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
21. 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)  $\Theta(n \cdot \log(n))$
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. To represent hierarchical relationship between elements, which data structure is suitable?
- (a) Stacks
  - (b) Tree
  - (c) Doubly LinkedLists
  - (d) All of the above
24. Which of the following data structures is Non-linear type ?
- (a) Strings
  - (b) Lists
  - (c) Stacks
  - (d) None of the above
25. Which of the following data structures are indexed structures?
- (a) linear arrays
  - (b) linked lists
  - (c) both of above
  - (d) none of above
26. 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
27. 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)  $(rear \% 1) + CAPACITY$
28. The data structure required for Breadth First Traversal on a graph is
- (a) queue
  - (b) stack
  - (c) tree
  - (d) array

29. 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.
30. Stack can be implemented by using
- (a) Tree or a LinkedList.
  - (b) Array or a LinkedList.
  - (c) Queue or a Tree.
  - (d) Array or a Tree.
31. Key value pairs is usually seen in
- (a) Hash tables
  - (b) Heaps
  - (c) Both (a) and (b)
  - (d) Skip list
32. Breadth First Search is used in
- (a) Binary trees
  - (b) Stacks
  - (c) Graphs
  - (d) Both (a) and (c) above
33. Which of the following data structures is linear type?
- (a) String
  - (b) Linked List
  - (c) Stack
  - (d) Graph
34. 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.
35. The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the height of the binary search tree (the height is the maximum distance of a leaf node from the root)?
- (a) 2
  - (b) 3
  - (c) 4
  - (d) 6
36. 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.
37. The pre-order and post order traversal of a Binary Tree generates the same output. The tree can have maximum of
- (a) three nodes.
  - (b) two nodes.
  - (c) one node.
  - (d) any number of nodes.
38. What data structure would you most likely to see in a nonrecursive implementation of a recursive algorithm?
- (a) Stack
  - (b) Linked list
  - (c) Queue
  - (d) Trees
39. Postorder 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

40. What are the number of nodes of left and right subtree of the binary tree if the data is inserted in the following order: 45, 15, 8, 5, 6, 5, 65, 47, 12, 18, 10, 73, 50, 16, 61.
- 7 and 6
  - 6 and 7
  - 8 and 5
  - 5 and 8
41. The worst case time complexity of AVL tree is better in comparison to binary search tree, only for
- Search and Insert Operations.
  - Search and Delete Operations.
  - Insert and Delete Operations.
  - Search, Insert and Delete Operations.
42. The number of different Binary Search Trees with 3 nodes having unique key values are
- 3.
  - 4.
  - 5.
  - 6.
43. What is the maximum possible number of nodes in a binary tree at level 6?
- 32
  - 64
  - 126
  - Non of these
44. 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?
- as left child of 23
  - as right child of 4
  - as right child of 1
  - none of the above is true.
45. Suppose T is a binary tree with 14 nodes. What is the minimum possible depth of T?
- 2
  - 3
  - 4
  - 5
46. An algorithm to search a node in a binary tree has worst case complexity of
- $\Theta(n)$
  - $\Theta(1)$
  - $\Theta(\log n)$
  - $\Theta(n \log n)$
47. The size of adjacency matrix which can be used to represent graph with 25 nodes is
- 5 x 5
  - 25 x 25
  - 625 x 625
  - 125 x 125
48. An adjacency matrix representation of a graph cannot contain information of
- nodes
  - edges
  - direction of edges
  - parallel edges
49. 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?
- Breadth first search
  - Depth first search
  - A cycle-finding algorithm
  - A shortest-path algorithm
50. In a graph, when does Dijkstra's algorithm stop?
- When the shortest path to the destination vertex is found
  - When all the vertices in the graph are included to the path
  - When the vertices together form a cycle
  - When the minimum spanning tree is constructed

