



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 40 multiple choice questions.
- Answer all questions. Each question has only one answer.
- Read the question and all answers before making the choice.
- 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. What is the run time complexity of the function $3n^3 + 110n^2 + 100 \log(n) + n + 4$ using Θ (big-theta) asymptotic notation?
 - (a) $\Theta(n^3)$
 - (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 *quick sort* algorithm for sequence of number sorted in descending order.
 - (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 *insertion sort* algorithm for sequence of number sorted in descending order.
 - (a) $\Theta(n \log(n))$
 - (b) $\Theta(n^2)$
 - (c) $\Theta(n)$

- (d) $\Theta(n^3)$
4. 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
5. 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) $\Theta(2n)$
6. If algorithm A has running time $5n^2 + n + 4$ and algorithm B has running time $20n^2 + n \log(n) + 100n$, then
- (a) both have the same asymptotic time complexity.
 - (b) A has larger asymptotic time complexity.
 - (c) B has larger asymptotic time complexity.
 - (d) No comparison can be made.
7. Which of the following cases does not exist in complexity theory?
- (a) Best case
 - (b) Worst case
 - (c) Average case
 - (d) Null case
8. The slowest sorting algorithm out of following to sort a almost sorted array is
- (a) Merge sort
 - (b) Heap sort
 - (c) Quick sort
 - (d) All have same asymptotic complexity.
9. A linear list in which each node has a pointer that points to the successor node is called
- (a) Singly Linked List
 - (b) Doubly Linked List
 - (c) Array List

(d) Graph

10. The term "push" and "pop" is related to
 - (a) arrays
 - (b) lists
 - (c) stacks
 - (d) all of above

11. Which of the below algorithm is not based on divide and conquer approach?
 - (a) Insertion Sort
 - (b) Merge Sort
 - (c) Shell Sort
 - (d) Heap Sort

12. LinkedList is better than Array data structures
 - (a) if number of data is fixed.
 - (b) if the size of data structure is constantly changing.
 - (c) for both of the above situations.
 - (d) for none of the above situations.

13. 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.

14. Doubly Linked List performs traverse in
 - (a) forward direction.
 - (b) backward direction.
 - (c) both forward and backward directions.
 - (d) circular direction.

15. 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.
16. Which linear data structure allows deleting and inserting data elements only from front?
- (a) Stacks
 - (b) Queues
 - (c) Doubly LinkedLists
 - (d) Binary search tree
17. 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
18. To represent hierarchical relationship between elements, which data structure is suitable?
- (a) Stacks
 - (b) Tree
 - (c) Doubly LinkedLists
 - (d) All of the above
19. Which of the following data structures is Non-linear type ?
- (a) Strings
 - (b) Lists
 - (c) Stacks
 - (d) None of the above
20. What is a Collision Resolution in Hash Tables?
- (a) Linear Probing
 - (b) Double hashing
 - (c) Separate Chaining
 - (d) All of the above
21. Which of the following data structures are indexed structures?
- (a) linear arrays
 - (b) linked lists
 - (c) both of above

(d) none of above

22. 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.

23. 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.

24. Key value pairs is usually seen in

(a) Hash tables

(b) Heaps

(c) Both (a) and (b)

(d) Skip list

25. Breadth First Search is used in

(a) Binary trees

(b) Stacks

(c) Graphs

(d) Both (a) and (c) above

26. Which of the following data structures is linear type?

(a) String

(b) Linked List

(c) Stack

(d) Graph

27. Given the following input (4322, 1334, 1471, 9679, 1989, 6172, 6173, 4199) and the hash function $(2x \bmod 10)$, which of the following statements are true?

(a) 9679, 1989, 4199 hash to the same value

(b) 1471, 6172 has to the same value

- (c) All elements hash to the same value
(d) Each element hashes to a different value
28. Consider a hash table of size seven, with starting index zero, and a hash function $(3x + 4) \bmod 7$. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 3, 8, 10 is inserted into the table using Open addressing with linear probing? Note that $_$ denotes an empty location in the table.
- (a) 8, $_$, $_$, $_$, $_$, $_$, 10.
(b) 1, 10, 8, $_$, $_$, $_$, 3
(c) 1, 8, 10, $_$, $_$, $_$, 3
(d) 1, $_$, $_$, $_$, $_$, $_$, 3
29. 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.
30. 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
31. 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.
32. 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

33. 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.
34. 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
35. 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) $\Theta(n \log n)$
36. The size of adjacency matrix which can be used to represent graph with 25 nodes is
- (a) 5×5
 - (b) 25×25
 - (c) 625×625
 - (d) 125×125
37. Let G be an undirected connected graph with distinct edge weight. Let *emax* be the edge with maximum weight and *emin* 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*
38. What kind of list is best to answer questions such as "What is the item at position n?"
- (a) Singly linked lists.
 - (b) Doubly linked lists.

- (c) List implemented using array.
 - (d) AVL tree.
39. 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.
40. 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