

The LNM Institute of Information Technology, Jaipur
Data Structures and Algorithms – February, 2018

Name: _____

Roll No: 17UC5097
 Total Marks: 60

Duration: 90 minutes

Instructions:

- Write all the answers in the answer booklet.
- No doubts will be entertained at the exam hall. Make and state assumptions if and when required.
- There are no negative marks.

Part I: Multiple Choice Questions

[1 mark each]

1. _____ is not the component of data structure. A) Operations B) Storage Structures C) Algorithms D) None of above	2. Suppose that the complexity of an algorithm is $O(n^2)$. Suppose that the program that uses the algorithm run in 10 seconds for a data set of size n . If the data size is doubled, how long will it take (approximately) to run the program? A) 10 seconds B) 100 seconds C) 6-7 minutes D) None of the Above
3. _____ is very useful in situation when data have to be stored and then retrieved in reverse order. A) Stack B) Queue C) List D) Link list	4. If the array 6, 2, 7, 13, 5, 4 is added to a stack, in the order given, which number will be the first number to be removed from the stack? A) 6 B) 2 C) 5 D) 4
5. Which data structure allows inserting and deleting data elements at the same place? A) Stacks B) Queues C) DeQueues D) Trees	6. Which of the following strings contains balanced braces? A) ab{cde{fg}hi{jkl} B) ab{cde{fghi}j}kl} C) {abc{de}{fg}hij}kl D) {ab{cde{fgh}ijkl}
7. What is the worst case complexity of Linear search in which search start at the beginning of the list and check every element in the list. Assume that the input size is n . A) $O(n^2)$ B) $O(\log n)$ C) $O(k)$ D) $O(n)$	8. What is the value of the following postfix expression: 5 2 - 8 4 + *? A) -9 B) 28 C) 35 D) 36
9. What is the notation used to represent the best case complexity? A) $O()$ B) $o()$ C) $\Omega()$ D) $\gamma()$	10. A stack is initially empty, then the following commands are performed: push 5, push 7, pop, push 10, push 5, pop which of the following is the correct stack after those commands (assume the top of the stack is on the left)? A) 5 10 7 5 B) 5 10 C) 7 5 D) 10 5
11. Which of the following problems can be solved using stacks? A) tower of hanoi B) handling recursive function calls C) both A and B D) none of the above	12. Given the following poorly written code sequence: headPtr = new Node<std::string>(); headPtr = nullptr; What is the result? A) headPtr points to the new node B) Access the new node by use of headPtr C) The new node is inaccessible D) The program crashes

<p>13. Which of the following data structures is best suitable for implementing an online shopping cart?</p> <p>A) list B) stack C) queue D) tree</p>	<p>14. Which of the following is the postfix form of the infix expression: $(a + b) * c / d$</p> <p>A) $a b + c * d /$ B) $a b * c / d +$ C) $a + b * c / d$ D) $a b + c d * /$</p>
<p>15. Which of the following statement is true?</p> <p>i) Using singly linked lists and circular list, it is not possible to traverse the list backwards. ii) To find the predecessor, it is required to traverse the list from the first node in case of singly linked list.</p> <p>A) i-only B) ii-only C) Both i and ii D) None of both</p>	<p>16. If a stack is used by an algorithm to check for balanced braces, which of the following is true of a balanced braces string once the end of the string is reached?</p> <p>A) the stack is empty B) the stack has one "{" C) the stack has one "}" D) the stack has one "{" and one "}"</p>
<p>17. Arrays are best data structures for</p> <p>A) Relatively permanent collections of data. B) the size of the structure and the data in the structure are constantly changing C) both of above situation D) none of the above</p>	<p>18. Finding the max element in an unordered stack would require</p> <p>A) $O(1)$ operations B) $O(\log n)$ operations C) $O(n)$ operations. D) None of the above</p>
<p>19. What is the minimum number of links required in a node to implement a tree using linked list?</p> <p>A) 0 B) 1 C) 2 D) It is not possible to implement tree using linked list</p>	<p>20. The runtime of an algorithm depends on</p> <p>A) Data size B) Processor speed C) Language D) RAM E) All of the above</p>

[10 marks each]

Part II: Descriptive Type Questions

21. We need to detect whether everyone who had entered a room have gone out or not. Assume that the room has only one door and there is a sensor S1 that returns 1 when a person goes into the room and S2 that returns 1 when a person goes out of the room. Write an algorithm to solve this problem. What data structure will you use for this purpose?
Break up of marks: Detecting the appropriate data structure (2), Correctness (4), Completeness (4)
22. We need to make a token system for managing the bus services at our institute. As per this system, each student who reach the gate should be given a token and the student should be allowed to get into the bus according to the order in which the token was given. Write an algorithm to solve this problem. What data structure will you use for this purpose? **Break up of marks:** Detecting the appropriate data structure (2), Correctness (4), Completeness (4)
23. Assume that LL is a DOUBLY linked list with the head node and at least one other internal node M which is not the last node. Write few lines of code to accomplish the following. You may assume that each node has a next pointer and prev pointer. You may NOT swap data to accomplish any of the following operations. You are encouraged to draw pictures to justify your code. Note that for each operation, you need to manipulate at least two pointers, next and prev.
- Delete the head node.
 - Insert a node P immediately after M
 - Swap head and the node M
24. Consider the following recursive method.
- ```
int exam(int a, int b){
 if (a%b == 0)
 return b;
 else
 return exam(b, a%b);
}
```
- What is the output given by exam(17, 3)?
  - What is the output given by exam(3, 9)?
  - Explain briefly the purpose of the exam function.