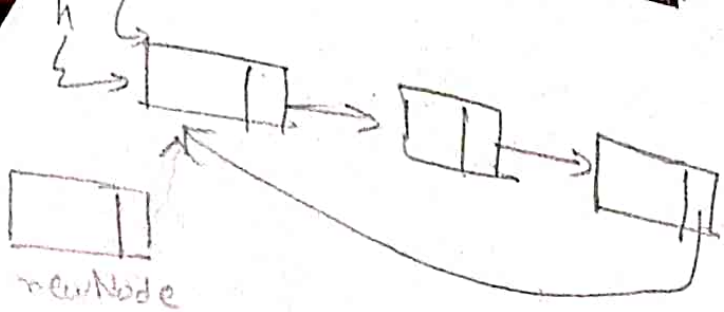


ptr2 = h
newNode->next = ptr
while (ptr->next != head)
ptr2 = ptr2->next
h = ptr1
ptr2->next = h

O(1)
O(log log n)
O(log n)
O(n)
O(n log n)
O(n²)
O(2ⁿ)
O(n!)

Indian Association for the Cultivation of Science

(Deemed to be University under the *de novo* category)

Integrated Bachelor's – Master's program

MID-Semester Examination-2023 (Autumn Semester)

Subject: Data Structures & Algorithms ***Subject Code(s): MCS 2101B***

Full marks: 25 ***Time allotted: 2 hrs***

Instruction: Answer Q1 and any three questions from the rest.

Best of luck for your exam!

Q1. Answer the following questions with correct explanation. {5 ×2 Marks}

i) Is it possible to add a node at the beginning of a circular singly linked list in O(1)? Will inclusion of a tail pointer make any difference?

ii) Is deque (deck) a LIFO or a FIFO?

iii) Why should we use a doubly linked list to implement a deque, instead of a singly linked list?

iv) What will be the time complexity of an algorithm to input an integer and output its binary equivalent?

v) Given, $T(n) = 2^{8log_2 n} + 26n^{104} + 7(log_2 n)^n$, what is the worst-case time complexity?

Q2. Define Big-Oh (O), Big-Omega (Ω) and Big-Theta (Θ). Explain the terms with the help of a plot with n (size of the input) in the X-axis and T (time taken) in the Y-axis. {5 Marks}

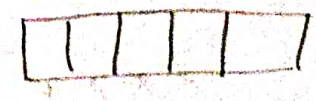
Q3. Explain the triple representation of a sparse matrix with an example. What would be the constraints to represent a sparse matrix into its triple representation such that, it would lead to memory efficiency? {5 Marks}

Q4. Write a C function or a pseudo-code for the function to delete a node from a singly linked list located before a node with a key value, which has been provided as an input to the function. NB: Assume that the main function exists, the linked list is not empty, and the nodes have unique values. **{5 Marks}**

Q5. Write a C program or a pseudo-code to implement a stack with a 1-D array of a given length. Make sure that every ADT function inherent to stack is performed in $O(1)$. NB: Do not use any global variable. **{5 Marks}**

Q6. Write a C program or a pseudo-code to implement a queue with a singly linked list. Make sure that every ADT function inherent to queue is performed in $O(1)$. NB: Do not use any global variable. **{5 Marks}**

int stack_arr[5];



push