

Shiv Nadar University Chennai

Mid Semester Examinations 2023-2024 Even

Question Paper

Name of the Program: Common to B.Tech. AI & DS and B.Tech. CSE (Cyber Security)		Semester: II
Course Code & Name: CS1006T DATA STRUCTURES		
Regulation 2021		
Time: 2 Hours	Answer All Questions	Maximum: 50 Marks

Q.No.	Questions	Marks	CO	KL
1	a What do you mean by an abstract data type (ADT)? How is it different from a data structure? Give examples differentiating both. How are ADT's implemented using modern programming languages?	2	CO1	KL2
	b An algorithm has a time complexity of $\theta(n)$. Will it be correct to say the algorithm can mathematically take $\Omega(n)$, $\Omega(\log n)$, and $\Omega(1)$? Defend your response mathematically.	3	CO1	KL5
2	a <pre>void fun1(struct node* head) { if(head == NULL) return; fun1(head->next); printf("%d ", head->data); }</pre> For a given singly linked list, what does the above program do and print as output? Explain with an example linked list that consists of 4 numbers.	5	CO2	KL4
	b Say you are implementing the front and back functionality of a browser using a double linked list (DLL). Say there are 50 pages currently stored in the DLL. Let the current web position be the 36th page. After inserting a new webpage, how many total number of web pages will be stored in the DLL? What is the time complexity of the mentioned operation? Explain.	5	CO2	KL4
	c <pre>void fun(struct node* head) { struct node *temp = head; while (temp->next!= NULL) {printf ("%d ", temp->data); temp= temp->next;} }</pre> Assume appropriate structure definition. For a given singly linked list, what does the above program do and print as output? What is the time complexity for the above function? Explain.	5	CO2	KL4
3	a Assume that the operators +, -, * are left-associative and ^ is right-associative. The ^ and * have the highest precedence and + and - have the next lower precedence. Parse and convert the infix expression $a - b * c + d ^ e ^ f$ to postfix expression step by step.	5	CO2	KL4

	b	Consider the balancing brackets problem. What ADT and data structure would you use to effectively implement the same? Justify. List all the boundary conditions and how will you identify them when implementing your data structure?	5	CO2	KL5
4	a	Consider a circular queue of size 5 with locations 0 to 4. If the front is at location 3 and the rear is at 4. If a new element is enqueued, at what location will rear point to and how many elements are there in the circular queue? Draw the circular queue.	2	CO2	KL3
	b	Consider a stack that supports an instruction REVERSE, which reverses the order of elements on the stack, in addition to the PUSH and POP instructions. Implement a queue using the modified stack, how many minimum numbers of operations are needed for i) ENQUEUE and ii) DEQUEUE operations. Mention the appropriate stack operation sequence under each queue operation to implement a queue using the modified stack.	5	CO2	KL4
	c	A stack contains the following characters: h,o,w,a,r,e,y,o,u,d,o,i,n,g,t,o,d,a,y. The top of the stack points to 'h'. The characters are popped one after the other from the stack. If it is an even pop number, then that character is enqueued into a queue. After popping all the elements in the stack, five dequeue operations are performed on the queue. Illustrate each operation step by step. Highlight final top value of the stack, and the final content of the queue along with the front and rear values.	3	CO2	KL4
5	a	Consider a singly linked list of n elements with a head and tail pointer. Write an algorithm (semi-formal) to swap the content of the first element with the last element. Calculate the cost function of your algorithm using the step count method. Arrive at the time complexity using the tabular method or find the tightest asymptotic upper bound for the cost function.	5	CO4	KL4
	b	What are the time complexities of finding 8th element from beginning and 8th element from ending in a doubly linked list given a head pointer? Let n be the number of nodes in the linked list, you may assume that $n > 8$. Explain the steps in both scenarios.	5	CO4	KL4

KL – Bloom's Taxonomy Levels

(KL1: Remembering, KL2: Understanding, KL3: Applying, KL4: Analyzing, KL5: Evaluating, KL6: Creating)

CO – Course Outcomes
