CHANDIGARH UNIVERSITY
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Institute/Department: UNIVERSITY INSTITUTE OF ENGINEERING
Division: BLOCK 1
Subject Name: DATA STRUCTURES
Subject Code: CST-231

Assignment No.: 2
Max. Marks: 12

Date of Allotment:25 SEP, 2019
Last date of Submission: 22 OCT, 2019

Course Outcomes:

CO Number	Title	Level
CO1	To understand the use of operators in expressions and their precedence in expressions.	Remember
CO2	To learn situation based sorting methods and advanced methods like quick sort and merge sort.	Understand
CO3	To use the storage of data as linked list and performing traversals of linked list	Understand
CO4	To solve push and pop operations in data structure like stack and queue.	Understand
CO5	Compute postfix infix notations for given expressions.	Understand
CO6	To compute real life problems like tower of Hanoi.	Understand

Set 1

Sr. No.	Question	CO Number
1	Assume that the operators +, -, × are left associative and ^ is right associative. The order of precedence (from highest to lowest) is ^, * , +, -. The postfix expression corresponding to the infix expression a + b / c - d ^ e ^ f is.	CO1

2	What are the time complexities of finding 8th element from beginning and 8th element from end in a singly linked list? Let n be the number of nodes in linked list, you may assume that n > 8.	CO2
3	Consider the quick sort algorithm. Suppose there is a procedure for finding the pivot element which splits the list into two sub-lists each of which contains at least one-fifth of the elements. Calculate the number of comparisons required to sort n elements?	CO3
4	Consider three pegs A, B, C and four disks of different sizes. Initially, the four disks are stacked on peg A, in order of decreasing size. The task is to move all the disks from peg A to peg C with the help of peg B. the moves are to be made under the following constraints: [i] In each step, exactly one disk is moved from one peg to another. [ii] A disk cannot be placed on another disk of smaller size. If we denote the movement of a disk from one peg to another by y → y, where y, y are A, B or C, then represent the sequence of the minimum number of moves to accomplish this as a binary tree with node labels of the form (y → y) such that the in-order traversal of the tree gives the correct sequence of the moves..	CO4
5	If there are n disks, derive the formula for the total number of moves required in terms of n	CO5

Set 2

Sr. No.	Question	CO Number
1	Suppose we have a doubly-linked list made of Nodes. Each Node contains a char and two Node * variables called Next and Back. We have a Head pointer and a Tail pointer. We would like to have a function which will remove all occurrences of a character called Target from the list. Write the algorithm for the function.	CO1
2	A Priority-Queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is given below: 10, 8, 5, 3, 2 Two new elements ”1‘ and ”7‘ are inserted in the heap in that order. The level-order traversal of the heap after the insertion of the elements is	CO2
3	Convert following expression into postfix notation(A+B)∗(C∗D-E)∗F/G	CO3
4	Arrange the following numbers in increasing order using quick sort 44,33,11,55,77,90,40,60,99,22,88,66	CO4

Set 3

Sr. No.	Question	CO Number
1	Consider a standard Circular Queue 'q' implementation (which has the same condition for Queue Full and Queue Empty) whose size is 11 and the elements of the queue are q[0], q[1], q[2].....,q[10]. The front and rear pointers are initialized to point at q[2] . In which position will the ninth element be added?	CO1
2	What is the postfix form of the following prefix expression -A/B*C$DE	CO2
3	Write a algorithm which gives solution to Towers of Hanoi Problem for n disks. Test the algorithm using n =3.	CO3
4	What is the output of following function for start pointing to first node of following linked list? 1->2->3->4->5->6	CO4

5	void fun(struct node* start)
	{
	if(start == NULL)
	return;
	printf("%d ", start->data);
	if(start->next != NULL)
	fun(start->next->next);
	printf("%d ", start->data);
	}
		CO5

Set 4

Sr. No.	Question	CO Number
1	A priority queue is implemented as a max-heap. Initially, it has five elements. The level-order traversal of the heap is as follows: 20, 18, 15, 13, 12 Two new elements ‘10’ and ‘17’ are inserted in the heap in that order. Find out he level-order traversal of the heap after the insertion of the element	CO1
2	The postfix form of A*B+C/D is:	CO2
3	Let P be a singly linked list. Let Q be the pointer to an intermediate node x in the list. Determine the worst-case time complexity of the best known algorithm to delete the node x from the list?	CO3
4	Write a algorithm which gives solution to Towers of Hanoi Problem for n disks. Test the algorithm using n =5.	CO4

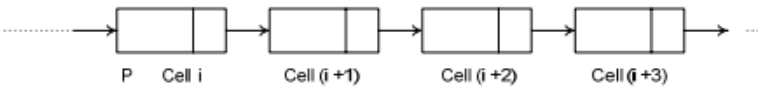
Set 5

Sr. No.	Question	CO Number
1	The five items: A ,B,C,D, and E are pushed in a stack, one after the other starting from A. The stack is popped four times and each element is inserted in a queue. Then two elements are deleted from the queue and pushed back on the stack. Now one item is popped from the stack. The popped item is	CO4
2	N items are stored in a sorted doubly linked list. For a delete operation, a pointer is provided to the record to be deleted. For a decrease-key operation, a pointer is provided to the record on which the operation is to be performed. An algorithm performs the following operations on the list in this order: Θ(N) delete, O(log N) insert, O(log N) find, and Θ(N) decrease-key. Determine the time complexity of all these operations put together	CO2
3	Suppose a Queue is maintained by circular array queue with N=12 memory cells. Find the number of elements in queue if Front=4 and Rear=8.	CO3
4	Compute the postfix equivalent of the following infix arithmetic expression where a+b/c+d*e↑f; where ↑ represents exponentiation. Assume normal operator precedence.	CO4

Set 6

Sr. No.	Question	CO Number
1	Following sequence of operations is performed on a stack push(1),push(2),pop, push(1),push(2)pop ,pop ,pop, push(2),pop. Find The sequence of popped out values .	CO4
2	Consider a singly linked list having n nodes. The data items d1, d2, …., dn are stored in the n nodes. Let Y be a pointer to the jth node ($1 \leq j \leq n$) in which dj is stored. A new data item d stored in a node with address Y is to be inserted. Give an algorithm to insert d into the list to obtain a list having items d1, d2, ……, dj-1, d, dj, …..dn in that order without using the header.	CO3
3	Arrange the following numbers in increasing order using quick sort 54,23,61,45,67,90,40,60,88,44	CO2
4	Suppose a Queue is maintained by circular array queue with N=12 memory cells. Find the number of elements in queue if Front=10 and Rear=3.	CO4

Set 7

Sr. No.	Question	CO Number
1	If the sequence of operations- pop, push (1), push (2), pop, pop, pop, push (2), pop, are performed on a stack, find the sequence of popped out values.	CO4
2	A queue Q containing n items and an empty stack S are given. It is required to transfer all the items from the queue to the stack, so that the item at the front of the queue is on the top of the stack, and the order of all the other items is preserved. Show this how this can be done in O(n) time using only a constant amount of additional storage. Note that the only operations which can be performed on the queue and stack are Delete, Insert, Push and Pop. Do not assume any implementation of the queue or stack.	CO2
3	Arrange the following numbers in increasing order using quick sort 34,45,12,67,89,56,99	CO3
4	Let p be a pointer as shown in the figure in a singly linked list.  What do the following assignment statements achieve? q: = p→ next p → next: = q→ next q → next: = (q → next) → next (p → next) →next: = q Write a constant time algorithm to insert a node with data D just before the node with address p of a singly linked list.	CO3
5	If the sequence of operations- pop, push (1), push (2), pop, pop, pop, push (2), pop, are performed on a stack, find the sequence of popped out values.	CO5

Set 8

Sr. No.	Question	CO Number
1	The postfix equivalent of the prefix * + a b - c d is	CO5
2	Circularly linked list is used to represent a Queue. A single variable p is used to access the Queue. To which node should p point such that both the operations en Queue and de Queue can be performed in constant time?	CO3

3	Explain with an example the difference between input restricted dequeue and output restricted de queue.	CO4
4	Discuss and explain the complexity 1)to convert infix to prefix 2) to convert infix to postfix 3)convert infix to prefix using stack ?	CO1

Set 9

Sr. No.	Question	CO Number
1	The postfix expression for the infix expression	CO1
2	A + B* (C+D) / F + D*E is	CO2
3	Write the algorithm and discuss the complexity of inserting the elements and displaying the items from a circular queue.	CO3
4	Consider a singly linked list having n nodes. The data items d1, d2, …., dn are stored in the n nodes. Let Y be a pointer to the jth node ($1 \leq j \leq n$) in which dj is stored. A new data item d stored in a node with address Y is to be inserted. Give an algorithm to insert d into the list to obtain a list having items d1, d2, ……, dj-1, d, dj, …..dn in that order without using the header.	CO4
5	Write a algorithm which gives solution to Towers of Hanoi Problem for n disks. Test the algorithm using n =4.	CO5

Set 10

Sr. No.	Question	CO Number
1	An item that is read as input can be either pushed to a stack and later popped and printed, or printed directly. What will be the output if the input is the sequence of items 1, 2, 3, 4, 5?	CO1
2	The following postfix expression with single digit operands is evaluated using a stack: 8 2 3 ^ / 2 3 * + 5 1 * - Note that ^ is the exponentiation operator. The top two elements of the stack after the first *is evaluated are:	CO2
3	Explain the merging of two sorted linked with the help of algorithm. Take a suitable example of two sorted linked lists and merge them to illustrate your answer.	CO3
4	Suppose a Queue is maintained by circular array queue with N=12 memory cells. Find the number of elements in queue if Front=5 and Rear=6.	CO4

Set 11

Sr. No.	Question	CO Number
1	Suppose I want to store data (not in order) and I want to be able to insert items as fast as possible. What data structure should I use? (Think about fixed-size arrays, dynamic arrays, and linked lists.) If I must store them in order, does the answer change?	CO1
2	Compute the postfix equivalent of the following infix arithmetic expression where a+b*c+d*e↑f; where ↑ represents exponentiation. Assume normal operator precedence.	CO2
3	Write a algorithm which gives solution to Towers of Hanoi Problem for n disks. Test the algorithm using n =6.	CO3

4	Suppose you are given an implementation of a queue of integers. The operations that can be performed on the queue are:
	isEmpty(Q) – returns true if the queue is empty, false otherwise.
	delete(Q) – deletes the element at the front of the queue and returns its value.
	insert(Q, i) – inserts the integer i at the rear of the queue.
	Consider the following function:
	void f(queue Q) {
	inti;
	if(!isEmpty (Q)) {
	i = delete(Q);
	f(Q) insert(Q, i); }
	}
	What operation is performed by the above function f?
		CO4

Set 12

Sr. No.	Question	CO Number
1	What are the basic operations we can do with a queue? Suppose we implement a queue as a linked list with head and tail pointers. Write the algorithm for the push and pop operations.	CO4
2	Let S be a stack of size $n \geq 1$. Starting with the empty stack, suppose we Push the first n natural numbers in sequence, and then perform n Pop operations. Assume that Push and POP operations take X seconds each, and Y seconds elapse between the end of one such stack operation and the start of the next operation. For $m \geq 1$, define the stack-life of m as the time elapsed from the end of Push(m) to the start of the Pop operation that removes m from S. The average stack-life of an element of this stack is	CO2

3	N items are stored in a sorted doubly linked list. For a delete operation, a pointer is provided to the record to be deleted. For a decrease-key operation, a pointer is provided to the record on which the operation is to be performed. An algorithm performs the following operations on the list in this order: Θ(N) delete, O(logN) insert, O(logN) find, and Θ(N) decrease-key. What is the time complexity of all these operations put together?	CO3
4	The postfix expression for the infix expression P + Q* (R-S) / T + S is	CO1