JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -2 EXAMINATION- MAY-2023

COURSE CODE(CREDITS): 18B11CI211(4)   MAX. MARKS: 25

COURSE NAME: Data Structure and Algorithms   MAX. TIME 1.5 Hours

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*Note: All questions are compulsory. Marks are indicated against each question in square brackets. **Attempt all parts of a question consecutively.***

Q1.   **[CO4] [1+2=3]**

Suppose there is a task to implement the functionality of a playlist in a music playing application. A number of songs can be added to the playlist and they are played in the same sequence as they are added to the playlist. Suppose a user adds song_1, song_2, song_3 to a playlist one by one, then song_1 will be played first, then song_2 and finally song_3. Answer the following questions in context to the above problem:

- Which data structure is the appropriate choice for implementing the playlist in the music playing app?
- Write an algorithm to add and play songs from the playlist using appropriate data structure.

Q2.   **[CO4] [4]**

Consider the following function that takes reference to head of a Doubly Linked List as parameter. Assume that a node of doubly linked list has previous pointer as *prev* and next pointer as *next*.

```
void fun(struct node **head_ref)
{
struct node *temp = NULL;
struct node *current = *head_ref;
while (current != NULL)
    {
temp = current->prev;
current->prev = current->next;
current->next = temp;
current = current->prev;
    }
if(temp != NULL )
        *head_ref = temp->prev;
}
```

Assume that reference of head of following doubly linked list is passed to above function. 1 <--> 2 <--> 3 <--> 4 <--> 5 <-->6. What should be the modified linked list after the function call?

Q3. [CO4] [3]
Consider the following double-ended queue represented by a circular array with *FRONT*= 1 and *REAR* = 5.

	A	B	C	D	E	

Perform the following operations based on the above double-ended queue.
   a. Add F on the left
   b. Add G on the right
   c. Add H on the right
   d. Delete two letters from left
   e. Add I on the right
   f. Add J on the left

Q4. [CO4] [3]
Consider the following pseudo-code of a function that takes a pointer to Queue as an argument. The function uses a Stack S to do the processing. What does this function do? Justify your answer.

```
void fun(Queue *Q)
{
Stack S;                          // Creates an empty stack
while (!isEmpty(Q))               //Run while Q is not empty
    {
        push(&S, deQueue(Q));     //delete an item from Q and push it into S
    }
while (!isEmpty(&S))              //Run while S is not empty
    {
        enQueue(Q, pop(&S));      //Pop an item from S and insert it into Q
    }
}
```

Q5. [CO4] [3+3=6]
   a) Use the stack application to convert the following expression into prefix and postfix notations. Write all the steps in a tabular form. Symbol ^ used in the expression represents the power.
$$(A+B^C)*D+E^5$$
   b) Write the algorithm to check if the following brackets are balanced or not (using stack).
$$(\,)\,((\,)\,[(\,)]\,)$$

Q6. [CO4] [3+3=6]

   a) Prove that maximum number of nodes in a binary tree is $2^{h+1} - 1$, where h is the height of a binary tree and root is at level '0'. Show all the steps.
   b) Design the Proper binary tree, Complete binary tree and Perfect binary tree using the following keys: **3, 6, 7, 8, 9, 11, 2, 1, 8, 12, 20, 23, 25.**