Rajalakshmi Engineering College

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 20

Section 1 : MCQ

1. How do you reverse a doubly linked list?

Answer

By swapping the next and previous pointers of each node

Status : Correct ***Marks : 1/1***

2. Which of the following information is stored in a doubly-linked list's nodes?

Answer

All of the mentioned options

Status : Correct ***Marks : 1/1***

3. Consider the provided pseudo code. How can you initialize an empty two-way linked list?

Define Structure Node
  data: Integer
  prev: Pointer to Node
  next: Pointer to Node
End Define

Define Structure TwoWayLinkedList
  head: Pointer to Node
  tail: Pointer to Node
End Define

Answer

struct TwoWayLinkedList* list = malloc(sizeof(struct TwoWayLinkedList)); list->head = NULL; list->tail = NULL;

Status : Correct ***Marks : 1/1***

4. How many pointers does a node in a doubly linked list have?

Answer

2

Status : Correct ***Marks : 1/1***

5. How do you delete a node from the middle of a doubly linked list?

Answer

All of the mentioned options

Status : Correct ***Marks : 1/1***

6. What will be the output of the following code?

#include <stdio.h>
#include <stdlib.h>

```
struct Node {
    int data;
    struct Node* next;
    struct Node* prev;
};

int main() {
    struct Node* head = NULL;
    struct Node* temp = (struct Node*)malloc(sizeof(struct Node));
    temp->data = 2;
    temp->next = NULL;
    temp->prev = NULL;
    head = temp;
    printf("%d\n", head->data);
    free(temp);
    return 0;
}
```

Answer

2

Status : Correct ***Marks : 1/1***

7. What is the main advantage of a two-way linked list over a one-way linked list?

Answer

Two-way linked lists allow for traversal in both directions.

Status : Correct ***Marks : 1/1***

8. What is a memory-efficient double-linked list?

Answer

A doubly linked list that uses bitwise AND operator for storing addresses

Status : Correct ***Marks : 1/1***

9. Which code snippet correctly deletes a node with a given value from a doubly linked list?

```
void deleteNode(Node** head_ref, Node* del_node) {
   if (*head_ref == NULL || del_node == NULL) {
      return;
   }
   if (*head_ref == del_node) {
      *head_ref = del_node->next;
   }
   if (del_node->next != NULL) {
      del_node->next->prev = del_node->prev;
   }
   if (del_node->prev != NULL) {
      del_node->prev->next = del_node->next;
   }
   free(del_node);
}
```

Answer

Deletes the first occurrence of a given data value in a doubly linked list.

Status : Correct ***Marks : 1/1***

10. Where Fwd and Bwd represent forward and backward links to the adjacent elements of the list. Which of the following segments of code deletes the node pointed to by X from the doubly linked list, if it is assumed that X points to neither the first nor the last node of the list?

A doubly linked list is declared as

```
struct Node {
      int Value;
      struct Node *Fwd;
      struct Node *Bwd;
);
```

Answer

X->Bwd->Fwd = X->Fwd; X->Fwd->Bwd = X->Bwd;

Status : Correct **Marks : 1/1**

11. Which of the following statements correctly creates a new node for a doubly linked list?

Answer

struct Node* newNode = (struct Node*) malloc(sizeof(struct Node));

Status : Correct **Marks : 1/1**

12. What does the following code snippet do?

```
struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
newNode->data = value;
newNode->next = NULL;
newNode->prev = NULL;
```

Answer

Creates a new node and initializes its data to 'value'

Status : Correct **Marks : 1/1**

13. What will be the effect of setting the prev pointer of a node to NULL in a doubly linked list?

Answer

The node will become the new head

Status : Correct **Marks : 1/1**

14. Which pointer helps in traversing a doubly linked list in reverse order?

Answer

prev

Status : Correct **Marks : 1/1**

15. What will be the output of the following program?

```
#include <stdio.h>
#include <stdlib.h>

struct Node {
    int data;
    struct Node* next;
    struct Node* prev;
};

int main() {
    struct Node* head = NULL;
    struct Node* tail = NULL;
    for (int i = 0; i < 5; i++) {
        struct Node* temp = (struct Node*)malloc(sizeof(struct Node));
        temp->data = i + 1;
        temp->prev = tail;
        temp->next = NULL;
        if (tail != NULL) {
            tail->next = temp;
        } else {
            head = temp;
        }
        tail = temp;
    }
    struct Node* current = head;
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    return 0;
}
```

Answer

1 2 3 4 5

Status : Correct ***Marks : 1/1***

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

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

```
Procedure fun(head_ref: Pointer to Pointer of node)
   temp = NULL
   current = *head_ref

   While current is not NULL
      temp = current->prev
      current->prev = current->next
      current->next = temp
      current = current->prev
   End While

   If temp is not NULL
      *head_ref = temp->prev
   End If
End Procedure
```

Answer

6 <--> 5 <--> 4 <--> 3 <--> 2 <--> 1.

Status : Correct ***Marks : 1/1***

17. Which of the following is true about the last node in a doubly linked list?

Answer

Its next pointer is NULL

Status : Correct ***Marks : 1/1***

18. What happens if we insert a node at the beginning of a doubly linked

list?

Answer

The previous pointer of the new node is NULL

Status : Correct ***Marks : 1/1***

19. Which of the following is false about a doubly linked list?

Answer

Implementing a doubly linked list is easier than singly linked list

Status : Correct ***Marks : 1/1***

20. What is the correct way to add a node at the beginning of a doubly linked list?

Answer

void addFirst(int data){ Node* newNode = new Node(data); newNode->next = head; if (head != NULL) { head->prev = newNode; } head = newNode; }

Status : Correct ***Marks : 1/1***

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Your task is to create a program to manage a playlist of items. Each item is represented as a character, and you need to implement the following operations on the playlist.

Here are the main functionalities of the program:

Insert Item: The program should allow users to add items to the front and end of the playlist. Items are represented as characters.Display Playlist: The program should display the playlist containing the items that were added.

To implement this program, a doubly linked list data structure should be used, where each node contains an item character.

Input Format

The input consists of a sequence of space-separated characters, representing the items to be inserted into the doubly linked list.

The input is terminated by entering - (hyphen).

Output Format

The first line of output prints "Forward Playlist: " followed by the linked list after inserting the items at the end.

The second line prints "Backward Playlist: " followed by the linked list after inserting the items at the front.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: a b c -
Output: Forward Playlist: a b c
Backward Playlist: c b a

Answer

```
#include <stdio.h>
#include <stdlib.h>

struct Node {
    char item;
    struct Node* next;
    struct Node* prev;
};

// You are using GCC
void insertAtEnd(struct Node** head, char item) {
    struct Node *newnode=(struct Node*)malloc(sizeof(struct Node));
    newnode->item=item;
    newnode->next=NULL;
    newnode->prev=NULL;
    if(*head==NULL){
        *head=newnode;
    }
    else{
```

```
        struct Node *temp=*head;
        while(temp->next!=NULL){
            temp=temp->next;
        }
        temp->next=newnode;
        newnode->prev=temp;
    }
}
void displayForward(struct Node* head) {
    struct Node *temp=head;
    while(temp!=NULL){
        printf("%c ",temp->item);
        temp=temp->next;
    }
    printf("\n");
}

void displayBackward(struct Node* tail) {
    struct Node *temp=tail;
    while(temp!=NULL){
        printf("%c ",temp->item);
        temp=temp->prev;
    }
}

void freePlaylist(struct Node* head) {
    free(head);
}
int main() {
    struct Node* playlist = NULL;
    char item;

    while (1) {
        scanf(" %c", &item);
        if (item == '-') {
            break;
        }
        insertAtEnd(&playlist, item);
    }

    struct Node* tail = playlist;
    while (tail->next != NULL) {
```

```
        tail = tail->next;
    }

    printf("Forward Playlist: ");
    displayForward(playlist);

    printf("Backward Playlist: ");
    displayBackward(tail);

    freePlaylist(playlist);

    return 0;
}
```

Status : Correct ***Marks : 10/10***

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Moniksha, a chess coach organizing a tournament, needs a program to manage participant IDs efficiently. The program maintains a doubly linked list of IDs and offers two functions: Append to add IDs as students register, and Print Maximum ID to identify the highest ID for administrative tasks.

This tool streamlines tournament organization, allowing Moniksha to focus on coaching her students effectively.

Input Format

The first line consists of an integer n, representing the number of participant IDs to be added.

The second line consists of n space-separated integers representing the participant IDs.

Output Format

The output displays a single integer, representing the maximum participant ID.

If the list is empty, the output prints "Empty list!".

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 3
163 137 155
Output: 163

Answer

```
#include <stdio.h>
#include <stdlib.h>
typedef struct myNode {
   int val;
   struct myNode*next;
   struct myNode*prev;
}
Node;
void append(Node**head, int val) {
   Node*tmp=(Node*)malloc(sizeof(Node));
   tmp->val=val;
   tmp->prev=NULL;
   tmp->next=NULL;
   if (*head==NULL){
      *head=tmp;
   } else{
      Node*curr=*head;
      while(curr->next!=NULL) {
         curr=curr->next;
      }
      curr->next =tmp;
      tmp->prev=curr;
   }
}
void printMax(Node*head) {
```

```
    if (head==NULL) {
        printf("Empty list!");
        return;
    }
    Node*curr=head;
    int max=curr->val;
    while(curr->next!=NULL) {
        curr=curr->next;
        max=curr->val > max ? curr -> val : max;
    }
    printf("%d", max);
}
int main(void) {
    int num_of_nodes,i;
    scanf("%d",&num_of_nodes);
    Node*myList=NULL;
    for (i=0;i<num_of_nodes;i++){
        int val;
        scanf("%d",&val);
        append(&myList, val);
    }
    printMax(myList);
    return 0;
}
```

Status : Correct **Marks : 10/10**

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Bob is tasked with developing a company's employee record management system. The system needs to maintain a list of employee records using a doubly linked list. Each employee is represented by a unique integer ID.

Help Bob to complete a program that adds employee records at the front, traverses the list, and prints the same for each addition of employees to the list.

Input Format

The first line of input consists of an integer N, representing the number of employees.

The second line consists of N space-separated integers, representing the employee IDs.

Output Format

For each employee ID, the program prints "Node Inserted" followed by the current state of the doubly linked list in the next line, with the data values of each node separated by spaces.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
101 102 103 104
Output: Node Inserted
101
Node Inserted
102 101
Node Inserted
103 102 101
Node Inserted
104 103 102 101

Answer

```
#include <iostream>
using namespace std;

struct node {
    int info;
    struct node* prev, * next;
};

struct node* start = NULL;

// You are using GCC
void traverse() {
    struct node* temp=start;
    while(temp!=NULL){
        printf("%d ",temp->info);
        temp=temp->next;
    }
    printf("\n");
}
```

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```
void insertAtFront(int data) {
    struct node *temp=(struct node*)malloc(sizeof(struct node));
    temp->info=data;
    temp->prev=NULL;
    temp->next=start;
    if(start!=NULL){
        start->prev=temp;
    }
    start=temp;
    printf("Node Inserted\n");
}

int main() {
    int n, data;
    cin >> n;
    for (int i = 0; i < n; ++i) {
        cin >> data;
        insertAtFront(data);
        traverse();
    }
    return 0;
}
```

Status : Correct ***Marks : 10/10***

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Ravi is developing a student registration system for a college. To efficiently store and manage the student IDs, he decides to implement a doubly linked list where each node represents a student's ID.

In this system, each student's ID is stored sequentially, and the system needs to display all registered student IDs in the order they were entered.

Implement a program that creates a doubly linked list, inserts student IDs, and displays them in the same order.

Input Format

The first line contains an integer N the number of student IDs.

The second line contains N space-separated integers representing the student IDs.

Output Format

The output should display the single line containing N space-separated integers representing the student IDs stored in the doubly linked list.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 20 30 40 50
Output: 10 20 30 40 50

Answer

```
#include <stdio.h>
#include <stdlib.h>
struct node {
   int num;
   struct node*preptr;
   struct node*nextptr;
}*stnode,*ennode;
void DlListcreation(int n);
void displayDlList();
int main()
{
   int n;
   stnode=NULL;
   ennode=NULL;
   scanf("%d",&n);
   DlListcreation(n);
   displayDlList();
   return 0;
}
void DlListcreation(int n)
{
   int i,num;
   struct node *fnNode;
   if(n>=1)
```

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```
    {
      stnode=(struct node
      *)malloc(sizeof(struct node));

      if(stnode!=NULL)
      {
         scanf("%d",&num);

         stnode->num=num;
         stnode->preptr=NULL;
         stnode->nextptr=NULL;
         ennode=stnode;
         for(i=2;i<=n;i++)
         {
            fnNode=(struct node *)malloc(sizeof(struct node));
            if(fnNode!=NULL)
            {

               scanf("%d",&num);
               fnNode->num=num;
               fnNode->preptr=ennode;
               fnNode->nextptr=NULL;
               ennode->nextptr=fnNode;
               ennode=fnNode;
            }

         }
      }

   }
}
void displayDlList()
{
   struct node*tmp;
   int n=1;
   if(stnode==NULL)
   {
      printf("No data found in the List yet.");
   }
   else
   {
      tmp=stnode;
```

```
        while(tmp != NULL)
        {
            printf("%d ",tmp->num);
            n++;
            tmp = tmp->nextptr;
        }
    }
}
```

Status : Correct ***Marks : 10/10***

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Ashwin is tasked with developing a simple application to manage a list of items in a shop inventory using a doubly linked list. Each item in the inventory has a unique identification number. The application should allow users to perform the following operations:

Create a List of Items: Initialize the inventory with a given number of items. Each item will be assigned a unique number provided by the user and insert the elements at end of the list.

Delete an Item: Remove an item from the inventory at a specific position.

Display the Inventory: Show the list of items before and after deletion.

If the position provided for deletion is invalid (e.g., out of range), it should

display an error message.

Input Format

The first line contains an integer n, representing the number of items to be initially entered into the inventory.

The second line contains n integers, each representing the unique identification number of an item separated by spaces.

The third line contains an integer p, representing the position of the item to be deleted from the inventory.

Output Format

The first line of output prints "Data entered in the list:" followed by the data values of each node in the doubly linked list before deletion.

If p is an invalid position, the output prints "Invalid position. Try again."

If p is a valid position, the output prints "After deletion the new list:" followed by the data values of each node in the doubly linked list after deletion.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 4
1 2 3 4
5
Output: Data entered in the list:
node 1 : 1
node 2 : 2
node 3 : 3
node 4 : 4
Invalid position. Try again.

Answer

```
void DlListcreation(int n) {
    int i, num;
```

```
    struct node *fnNode;
    if (n >= 1) {
        stnode = (struct node *)malloc(sizeof(struct node));
        printf("Data entered in the list:\n");
        scanf("%d", &num);
        stnode->num = num;
        stnode->preptr = NULL;
        stnode->nextptr = NULL;
        ennode = stnode;
        printf(" node 1 : %d\n", num);
        for (i = 2; i <= n; i++) {
            fnNode = (struct node *)malloc(sizeof(struct node));
            scanf("%d", &num);
            fnNode->num = num;
            fnNode->preptr = ennode;
            fnNode->nextptr = NULL;
            ennode->nextptr = fnNode;
            ennode = fnNode;
            printf(" node %d : %d\n", i, num);
        }
    }
}
void DlListDeleteAnyNode(int pos) {
    int i;
    struct node *tmp;
    tmp = stnode;
    for (i = 1; i < pos && tmp != NULL; i++) {
        tmp = tmp->nextptr;
    }
    if (tmp != NULL) {
        if (tmp->preptr != NULL)
            tmp->preptr->nextptr = tmp->nextptr;
        else
            stnode = tmp->nextptr;

        if (tmp->nextptr != NULL)
            tmp->nextptr->preptr = tmp->preptr;
        else
            ennode = tmp->preptr;

        free(tmp);
    }
```

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```
}
void displayDlList(int a) {
    struct node *tmp;
    int nodeNo = 1;
    if (a == 1)
        return;
    printf("\n After deletion the new list:\n");
    tmp = stnode;
    while (tmp != NULL) {
        printf(" node %d : %d\n", nodeNo, tmp->num);
        nodeNo++;
        tmp = tmp->nextptr;
    }
}
```

Status : Correct **Marks : 10/10**

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_CY

Attempt : 1
Total Mark : 30
Marks Obtained : 30

Section 1 : Coding

1. Problem Statement

Vanessa is learning about the doubly linked list data structure and is eager to play around with it. She decides to find out how the elements are inserted at the beginning and end of the list.

Help her implement a program for the same.

Input Format

The first line of input contains an integer N, representing the size of the doubly linked list.

The next line contains N space-separated integers, each representing the values to be inserted into the doubly linked list.

Output Format

The first line of output prints the integers, after inserting them at the beginning, separated by space.

The second line prints the integers, after inserting at the end, separated by space.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
1 2 3 4 5
Output: 5 4 3 2 1
1 2 3 4 5

Answer

```
#include <stdio.h>
#include <stdlib.h>
struct Node {
    int data;
    struct Node* prev;
    struct Node* next;
};
void insertAtBeginning(struct Node** head, int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->prev = NULL;
    newNode->next = *head;
    if (*head != NULL)
        (*head)->prev = newNode;
    *head = newNode;
}
void insertAtEnd(struct Node** head, int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = NULL;
    if (*head == NULL) {
        newNode->prev = NULL;
        *head = newNode;
        return;
```

```
    }
    struct Node* temp = *head;
    while (temp->next != NULL)
        temp = temp->next;
    temp->next = newNode;
    newNode->prev = temp;
}
void printList(struct Node* head) {
    struct Node* temp = head;
    while (temp != NULL) {
        printf("%d ", temp->data);
        temp = temp->next;
    }
    printf("\n");
}
int main() {
    int N, val;
    scanf("%d", &N);
    struct Node* headBegin = NULL;
    struct Node* headEnd = NULL;
    for (int i = 0; i < N; i++) {
        scanf("%d", &val);
        insertAtBeginning(&headBegin, val);
        insertAtEnd(&headEnd, val);
    }
    printList(headBegin);
    printList(headEnd);

    return 0;
}
```

Status : Correct **Marks : 10/10**

2. Problem Statement

You are required to implement a program that deals with a doubly linked list.

The program should allow users to perform the following operations:

Insertion at the End: Insert a node with a given integer data at the end of

the doubly linked list.Insertion at a given Position: Insert a node with a given integer data at a specified position within the doubly linked list.Display the List: Display the elements of the doubly linked list.

Input Format

The first line of input consists of an integer n, representing the number of elements to be initially inserted into the doubly linked list.

The second line consists of n space-separated integers, denoting the elements to be inserted at the end.

The third line consists of integer m, representing the new element to be inserted.

The fourth line consists of an integer p, representing the position at which the new element should be inserted (1-based indexing).

Output Format

If p is valid, display the elements of the doubly linked list after performing the insertion at the specified position.

If p is invalid, display "Invalid position" in the first line and the second line prints the original list.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 25 34 48 57
35
4

Output: 10 25 34 35 48 57

Answer

```
#include <stdio.h>
#include <stdlib.h>
struct Node {
    int data;
    struct Node* prev;
```

```
    struct Node* next;
};
void insertAtEnd(struct Node** head, int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = NULL;
    if (*head == NULL) {
        newNode->prev = NULL;
        *head = newNode;
        return;
    }
    struct Node* temp = *head;
    while (temp->next != NULL)
        temp = temp->next;
    temp->next = newNode;
    newNode->prev = temp;
}
int insertAtPosition(struct Node** head, int data, int pos) {
    if (pos < 1)
        return 0;
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    if (pos == 1) {
        newNode->prev = NULL;
        newNode->next = *head;
        if (*head != NULL)
            (*head)->prev = newNode;
        *head = newNode;
        return 1;
    }
    struct Node* temp = *head;
    for (int i = 1; i < pos - 1 && temp != NULL; i++)
        temp = temp->next;
    if (temp == NULL)
        return 0;
    newNode->next = temp->next;
    newNode->prev = temp;
    if (temp->next != NULL)
        temp->next->prev = newNode;
    temp->next = newNode;
    return 1;
}
```

240701339

```
void displayList(struct Node* head) {
    struct Node* temp = head;
    while (temp != NULL) {
        printf("%d ", temp->data);
        temp = temp->next;
    }
    printf("\n");
}
int main() {
    int n,val,newElement,pos;
    struct Node* head = NULL;
    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &val);
        insertAtEnd(&head, val);
    }
    scanf("%d",&newElement);
    scanf("%d", &pos);
    int success = insertAtPosition(&head, newElement, pos);
    if (!success) {
        printf("Invalid position\n");
    }
    displayList(head);
    return 0;
}
```

Status : Correct ***Marks : 10/10***

3. Problem Statement

Imagine you're managing a store's inventory list, and some products were accidentally entered multiple times. You need to remove the duplicate products from the list to ensure each product appears only once.

You have an unsorted doubly linked list of product IDs. Some of these product IDs may appear more than once, and your goal is to remove any duplicates.

Input Format

The first line of input consists of an integer n, representing the number of elements in the list.

The second line of input consists of n space-separated integers representing the list elements.

Output Format

The output prints the final after removing duplicate nodes, separated by a space.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 10
12 12 10 4 8 4 6 4 4 8

Output: 8 4 6 10 12

Answer

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>

struct Node {
    int data;
    struct Node* next;
    struct Node* prev;
};

struct Node* createNode(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = NULL;
    newNode->prev = NULL;
    return newNode;
}


struct Node* deleteNode(struct Node* head_ref, struct Node* del) {
    if (head_ref == NULL || del == NULL)
        return NULL;
```

```
    if (head_ref == del)
        head_ref = del->next;

    if (del->next != NULL)
        del->next->prev = del->prev;

    if (del->prev != NULL)
        del->prev->next = del->next;

    free(del);
    return head_ref;
}

bool exists(int* array, int size, int value) {
    for (int i = 0; i < size; i++) {
        if (array[i] == value)
            return true;
    }
    return false;
}

struct Node* removeDuplicates(struct Node* head_ref) {
    if (head_ref == NULL)
        return NULL;

    int* us = (int*)malloc(sizeof(int) * 1000);
    int us_size = 0;

    struct Node* current = head_ref;
    struct Node* next;

    while (current != NULL) {
        if (exists(us, us_size, current->data)) {
            next = current->next;
            head_ref = deleteNode(head_ref, current);
            current = next;
        } else {
            us[us_size++] = current->data;
            current = current->next;
        }
    }
```

```
    free(us);
    return head_ref;
}

struct Node* push(struct Node* head_ref, int new_data) {
    struct Node* new_node = createNode(new_data);
    new_node->next = head_ref;

    if (head_ref != NULL)
        head_ref->prev = new_node;

    head_ref = new_node;
    return head_ref;
}

void printList(struct Node* head) {
    if (head == NULL) {
        printf("Doubly Linked list empty\n");
        return;
    }

    while (head != NULL) {
        printf("%d ", head->data);
        head = head->next;
    }
}

int main() {
    struct Node* head = NULL;
    int n, i, val;
    scanf("%d", &n);

    for (i = 0; i < n; i++) {
        scanf("%d", &val);
        head = push(head, val);
    }

    head = removeDuplicates(head);
    printList(head);

    return 0;
```

240701339

}

Status : Correct *Marks : 10/10*

240701339