Rajalakshmi Engineering College

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_PAH

Attempt : 1
Total Mark : 50
Marks Obtained : 50

Section 1 : Coding

1.   Problem Statement

Riya is developing a contact management system where recently added contacts should appear first. She decides to use a doubly linked list to store contact IDs in the order they are added. Initially, new contacts are inserted at the front of the list. However, sometimes she needs to insert a new contact at a specific position in the list based on priority.

Help Riya implement this system by performing the following operations:

Insert contact IDs at the front of the list as they are added.Insert a new contact at a given position in the list.

Input Format

The first line of input consists of an integer N, representing the initial size of the linked list.

The second line consists of N space-separated integers, representing the values of the linked list to be inserted at the front.

The third line consists of an integer position, representing the position at which the new value should be inserted (position starts from 1).

The fourth line consists of integer data, representing the new value to be inserted.

Output Format

The first line of output prints the original list after inserting initial elements to the front.

The second line prints the updated linked list after inserting the element at the specified position.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
10 20 30 40
3
25
Output: 40 30 20 10
40 30 25 20 10

Answer

```c
// You are using GCC
#include <stdio.h>
#include <stdlib.h>


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

```c
void insert_front(struct Node** head, int data) {
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));
    new_node->data = data;
    new_node->prev = NULL;
    new_node->next = *head;
    if (*head != NULL) {
        (*head)->prev = new_node;
    }
    *head = new_node;
}


void insert_at_position(struct Node** head, int position, int data) {
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));
    new_node->data = data;
    if (position == 1) {
        new_node->prev = NULL;
        new_node->next = *head;
        if (*head != NULL) {
            (*head)->prev = new_node;
        }
        *head = new_node;
        return;
    }

    struct Node* current = *head;
    for (int i = 1; i < position - 1; i++) {
        if (current == NULL) return;
        current = current->next;
    }

    new_node->next = current->next;
    if (current->next != NULL) {
        current->next->prev = new_node;
    }
    current->next = new_node;
    new_node->prev = current;
}


void print_list(struct Node* head) {
```

```c
    struct Node* current = head;
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    printf("\n");
}

int main() {
    int N, position, data;
    struct Node* head = NULL;


    scanf("%d", &N);
    for (int i = 0; i < N; i++) {
        scanf("%d", &data);
        insert_front(&head, data);
    }


    print_list(head);


    scanf("%d", &position);
    scanf("%d", &data);


    insert_at_position(&head, position, data);


    print_list(head);

    return 0;
}
```

Status : Correct   *Marks : 10/10*

2. Problem Statement

Bala is a student learning about the doubly linked list and its functionalities. He came across a problem where he wanted to create a

doubly linked list by appending elements to the front of the list.

After populating the list, he wanted to delete the node at the given position from the beginning. Write a suitable code to help Bala.

Input Format

The first line contains an integer N, the number of elements in the doubly linked list.

The second line contains N integers separated by a space, the data values of the nodes in the doubly linked list.

The third line contains an integer X, the position of the node to be deleted from the doubly linked list.

Output Format

The first line of output displays the original elements of the doubly linked list, separated by a space.

The second line prints the updated list after deleting the node at the given position X from the beginning.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 20 30 40 50
2
Output: 50 40 30 20 10
50 30 20 10

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>


struct Node {
```

```c
    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;
}


void insertFront(struct Node** head, int data) {
    struct Node* newNode = createNode(data);
    newNode->next = *head;
    if (*head != NULL) {
        (*head)->prev = newNode;
    }
    *head = newNode;
}


void deleteNodeAtPosition(struct Node** head, int position) {
    if (*head == NULL) {
        return;
    }

    struct Node* temp = *head;


    if (position == 1) {
        *head = temp->next;
        if (*head != NULL) {
            (*head)->prev = NULL;
        }
        free(temp);
        return;
    }
```

```c
    int i;
    for (i = 1; temp != NULL && i < position; i++) {
        temp = temp->next;
    }


    if (temp == NULL) {
        return;
    }


    if (temp->next != NULL) {
        temp->next->prev = temp->prev;
    }
    if (temp->prev != NULL) {
        temp->prev->next = temp->next;
    }

    free(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, X;


    scanf("%d", &N);


    struct Node* head = NULL;
    for (int i = 0; i < N; i++) {
        int data;
```

```
    scanf("%d", &data);
    insertFront(&head, data);
}


scanf("%d", &X);


printList(head);


deleteNodeAtPosition(&head, X);

// Output the updated list
printList(head);

return 0;
}
```

Status : Correct   *Marks : 10/10*

3. Problem Statement

Tom is a software developer working on a project where he has to check if a doubly linked list is a palindrome. He needs to write a program to solve this problem. Write a program to help Tom check if a given doubly linked list is a palindrome or not.

Input Format

The first line consists of an integer N, representing the number of elements in the linked list.

The second line consists of N space-separated integers representing the linked list elements.

Output Format

The first line displays the space-separated integers, representing the doubly linked list.

The second line displays one of the following:

1. If the doubly linked list is a palindrome, print "The doubly linked list is a palindrome".
2. If the doubly linked list is not a palindrome, print "The doubly linked list is not a palindrome".

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 5
1 2 3 2 1
Output: 1 2 3 2 1
The doubly linked list is a palindrome

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.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 = newNode->prev = NULL;
    return newNode;
}


void insertAtEnd(struct Node** head, int data) {
    struct Node* newNode = createNode(data);
    if (*head == NULL) {
        *head = newNode;
```

```c
        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 isPalindrome(struct Node* head) {
    struct Node* left = head;
    struct Node* right = head;


    while (right != NULL && right->next != NULL) {
        right = right->next;
    }


    while (left != right && left->prev != right) {
        if (left->data != right->data) {
            return 0;
        }
        left = left->next;
        right = right->prev;
    }
    return 1;
}

int main() {
```

```c
    int N;
    scanf("%d", &N);

    struct Node* head = NULL;


    for (int i = 0; i < N; i++) {
        int data;
        scanf("%d", &data);
        insertAtEnd(&head, data);
    }


    printList(head);


    if (isPalindrome(head)) {
        printf("The doubly linked list is a palindrome\n");
    } else {
        printf("The doubly linked list is not a palindrome\n");
    }

    return 0;
}
```

Status : Correct   *Marks : 10/10*

4.   Problem Statement

Rohan is a software developer who is working on an application that
processes data stored in a Doubly Linked List. He needs to implement a
feature that finds and prints the middle element(s) of the list. If the list
contains an odd number of elements, the middle element should be
printed. If the list contains an even number of elements, the two middle
elements should be printed.

Help Rohan by writing a program that reads a list of numbers, prints the
list, and then prints the middle element(s) based on the number of
elements in the list.

Input Format

The first line of the input consists of an integer n the number of elements in the doubly linked list.

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

Output Format

The first line prints the elements of the list separated by space. (There is an extra space at the end of this line.)

The second line prints the middle element(s) based on the number of elements.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
20 52 40 16 18
Output: 20 52 40 16 18
40

Answer

```c
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

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

typedef struct DoublyLinkedList {
    Node* head;
    Node* tail;
    int size;
} DoublyLinkedList;
```

```c
// Function to create a new node
Node* createNode(int data) {
    Node* newNode = (Node*)malloc(sizeof(Node));
    newNode->data = data;
    newNode->next = NULL;
    newNode->prev = NULL;
    return newNode;
}

// Function to initialize a doubly linked list
void initList(DoublyLinkedList* list) {
    list->head = NULL;
    list->tail = NULL;
    list->size = 0;
}

// Function to append an element to the doubly linked list
void append(DoublyLinkedList* list, int data) {
    Node* newNode = createNode(data);
    if (list->head == NULL) {
        list->head = newNode;
        list->tail = newNode;
    } else {
        list->tail->next = newNode;
        newNode->prev = list->tail;
        list->tail = newNode;
    }
    list->size++;
}

// Function to print the list
void printList(DoublyLinkedList* list) {
    Node* current = list->head;
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    printf("\n");
}

// Function to find and print the middle element(s)
void findMiddle(DoublyLinkedList* list) {
```

```c
    if (list->size == 0) {
        return;
    }

    int midIndex = list->size / 2;
    Node* current = list->head;

    if (list->size % 2 == 1) {
        // Odd number of elements, single middle element
        for (int i = 0; i < midIndex; i++) {
            current = current->next;
        }
        printf("%d\n", current->data);
    } else {
        // Even number of elements, two middle elements
        for (int i = 0; i < midIndex - 1; i++) {
            current = current->next;
        }
        printf("%d %d\n", current->data, current->next->data);
    }
}

int main() {
    int n;

    // Read the number of elements in the list
    scanf("%d", &n);

    // Initialize the doubly linked list
    DoublyLinkedList list;
    initList(&list);

    // Read the elements and append to the list
    for (int i = 0; i < n; i++) {
        int data;
        scanf("%d", &data);
        append(&list, data);
    }

    // Print the list
    printList(&list);
```

```
    // Find and print the middle element(s)
    findMiddle(&list);

    return 0;
}
```

Status : Correct   *Marks : 10/10*

5. Problem Statement

Pranav wants to clockwise rotate a doubly linked list by a specified number
of positions. He needs your help to implement a program to achieve this.
Given a doubly linked list and an integer representing the number of
positions to rotate, write a program to rotate the list clockwise.

Input Format

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

The second line consists of n space-separated linked list elements.

The third line consists of an integer k, representing the number of places to
rotate the list.

Output Format

The output displays the elements of the doubly linked list after rotating it by k
positions.

Refer to the sample output for the formatting specifications.

Sample Test Case

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

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

// Definition of a doubly linked list node
struct Node {
    int data;
    struct Node* next;
    struct Node* prev;
};

// Function to create a new node
struct Node* createNode(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = newNode->prev = NULL;
    return newNode;
}

// Function to rotate the doubly linked list by k positions clockwise
void rotateClockwise(struct Node** head, int k, int n) {
    if (k == 0 || n <= 1) return;  // No rotation needed

    // Make k within the bounds of the list length
    k = k % n;
    if (k == 0) return;

    struct Node* temp = *head;
    struct Node* newHead = NULL;
    struct Node* newTail = NULL;

    // Traverse to the node which will become the new tail (n-k-1)
    for (int i = 0; i < n - k - 1; i++) {
        temp = temp->next;
    }

    // The new head will be the node after the new tail
    newHead = temp->next;

    // New tail should point to NULL
    newTail = temp;
    newTail->next = NULL;
```

```c
    // Make the original tail point to the original head (creating a circular link)
    struct Node* originalTail = newHead;
    while (originalTail->next != NULL) {
        originalTail = originalTail->next;
    }
    originalTail->next = *head;
    (*head)->prev = originalTail;

    // Set the new head of the list
    *head = newHead;
}

// Function to print the doubly linked list
void printList(struct Node* head) {
    struct Node* temp = head;
    while (temp != NULL) {
        printf("%d ", temp->data);
        temp = temp->next;
    }
    printf("\n");
}

// Main function to drive the program
int main() {
    int n, k;

    // Read the number of elements in the list
    scanf("%d", &n);

    // Create the doubly linked list
    struct Node* head = NULL;
    struct Node* tail = NULL;

    // Read elements and create the list
    for (int i = 0; i < n; i++) {
        int data;
        scanf("%d", &data);
        struct Node* newNode = createNode(data);

        if (head == NULL) {
            head = tail = newNode;
        } else {
```

```c
        tail->next = newNode;
        newNode->prev = tail;
        tail = newNode;
    }
}

    // Read the number of positions to rotate
    scanf("%d", &k);

    // Rotate the list
    rotateClockwise(&head, k, n);

    // Print the rotated list
    printList(head);

    return 0;
}
```

Status : Correct   *Marks : 10/10*