Rajalakshmi Engineering College

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_PAH_modified

Attempt : 1
Total Mark : 5
Marks Obtained : 3.8

Section 1 : Coding

1. Problem Statement

Write a program to manage a singly linked list. The program should allow users to perform various operations on the linked list, such as inserting elements at the beginning or end, deleting elements from the beginning or end, inserting before or after a specific value, and deleting elements before or after a specific value. After each operation, the updated linked list should be displayed.

Input Format

The first line contains an integer choice, representing the operation to perform:

- For choice 1 to create the linked list. The next lines contain space-separated integers, with -1 indicating the end of input.
- For choice 2 to display the linked list.
- For choice 3 to insert a node at the beginning. The next line contains an integer

data representing the value to insert.
- For choice 4 to insert a node at the end. The next line contains an integer data representing the value to insert.
- For choice 5 to insert a node before a specific value. The next line contains two integers: value (existing node value) and data (value to insert).
- For choice 6 to insert a node after a specific value. The next line contains two integers: value (existing node value) and data (value to insert).
- For choice 7 to delete a node from the beginning.
- For choice 8 to delete a node from the end.
- For choice 9 to delete a node before a specific value. The next line contains an integer value representing the node before which deletion occurs.
- For choice 10 to delete a node after a specific value. The next line contains an integer value representing the node after which deletion occurs.
- For choice 11 to exit the program.

Output Format

For choice 1, print "LINKED LIST CREATED".

For choice 2, print the linked list as space-separated integers on a single line. If the list is empty, print "The list is empty".

For choice 3, 4, 5, and 6, print the updated linked list with a message indicating the insertion operation.

For choice 7, 8, 9, and 10, print the updated linked list with a message indicating the deletion operation.

For any operation that is not possible print an appropriate error message such as "Value not found in the list".

For choice 11 terminate the program.

For any invalid option, print "Invalid option! Please try again".

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 1
5

3
7
-1
2
11
Output: LINKED LIST CREATED
5 3 7

Answer

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

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

struct Node *head = NULL;

// Function to create the linked list
void createList() {
    int data;
    struct Node *newNode, *temp;
    while (scanf("%d", &data) && data != -1) {
        newNode = (struct Node *)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;
        if (!head) {
            head = newNode;
        } else {
            temp = head;
            while (temp->next)
                temp = temp->next;
            temp->next = newNode;
        }
    }
    printf("LINKED LIST CREATED \n");
}

// Function to display the list
void display() {
    if (!head) {
```

```c
        printf("The list is empty ");
        return;
    }
    struct Node *temp = head;
    while (temp) {
        printf("%d ", temp->data);
        temp = temp->next;
    }
}

// Insert at beginning
void insertAtBeginning(int data) {
    struct Node *newNode = (struct Node *)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = head;
    head = newNode;
    printf("\nThe linked list after insertion at the beginning is:\n");
    display();
}

// Insert at end
void insertAtEnd(int data) {
    struct Node *newNode = (struct Node *)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = NULL;

    if (!head) {
        head = newNode;
    } else {
        struct Node *temp = head;
        while (temp->next)
            temp = temp->next;
        temp->next = newNode;
    }
    printf("\nThe linked list after insertion at the end is:\n");
    display();
}

// Insert before a value
void insertBefore(int value, int data) {
    if (!head) {
        printf("Value not found in the list ");
```

```c
        return;
    }
    struct Node *newNode = (struct Node *)malloc(sizeof(struct Node));
    newNode->data = data;

    if (head->data == value) {
        newNode->next = head;
        head = newNode;
        printf("\nThe linked list after insertion before a value is:\n");
        display();
        return;
    }

    struct Node *temp = head;
    while (temp->next && temp->next->data != value)
        temp = temp->next;

    if (!temp->next) {
        printf("Value not found in the list ");
        return;
    }

    newNode->next = temp->next;
    temp->next = newNode;
    printf("\nThe linked list after insertion before a value is:\n");
    display();
}

// Insert after a value
void insertAfter(int value, int data) {
    struct Node *temp = head;
    while (temp && temp->data != value)
        temp = temp->next;

    if (!temp) {
        printf("Value not found in the list ");
        return;
    }

    struct Node *newNode = (struct Node *)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = temp->next;
```

```c
    temp->next = newNode;

    printf("\nThe linked list after insertion after a value is:\n");
    display();
}

// Delete from beginning
void deleteFromBeginning() {
    if (!head) {
        printf("The list is empty ");
        return;
    }
    struct Node *temp = head;
    head = head->next;
    free(temp);
    printf("\nThe linked list after deletion from the beginning is:\n");
    display();
}

// Delete from end
void deleteFromEnd() {
    if (!head) {
        printf("The list is empty ");
        return;
    }
    if (!head->next) {
        free(head);
        head = NULL;
    } else {
        struct Node *temp = head;
        while (temp->next->next)
            temp = temp->next;
        free(temp->next);
        temp->next = NULL;
    }
    printf("\nThe linked list after deletion from the end is:\n");
    display();
}

// Delete before a value
void deleteBefore(int value) {
    if (!head || head->data == value) {
```

```c
        printf("Value not found in the list ");
        return;
    }

    struct Node *temp = head, *prev = NULL, *pprev = NULL;

    if (head->next && head->next->data == value) {
        temp = head;
        head = head->next;
        free(temp);
        printf("\nThe linked list after deletion before a value is:\n");
        display();
        return;
    }

    while (temp->next && temp->next->data != value) {
        pprev = prev;
        prev = temp;
        temp = temp->next;
    }

    if (!temp->next) {
        printf("Value not found in the list ");
        return;
    }

    if (!pprev) {
        head = temp->next;
        free(temp);
    } else {
        pprev->next = temp->next;
        free(prev);
    }

    printf("\nThe linked list after deletion before a value is:\n");
    display();
}

// Delete after a value
void deleteAfter(int value) {
    struct Node *temp = head;
    while (temp && temp->data != value)
```

```c
        temp = temp->next;

    if (!temp || !temp->next) {
        printf("Value not found in the list ");
        return;
    }

    struct Node *toDelete = temp->next;
    temp->next = toDelete->next;
    free(toDelete);

    printf("\nThe linked list after deletion after a value is:\n");
    display();
}

int main() {
    int choice;
    while (scanf("%d", &choice)) {
        if (choice == 1) {
            createList();
        } else if (choice == 2) {
            display();
        } else if (choice == 3) {
            int data;
            scanf("%d", &data);
            insertAtBeginning(data);
        } else if (choice == 4) {
            int data;
            scanf("%d", &data);
            insertAtEnd(data);
        } else if (choice == 5) {
            int value, data;
            scanf("%d %d", &value, &data);
            insertBefore(value, data);
        } else if (choice == 6) {
            int value, data;
            scanf("%d %d", &value, &data);
            insertAfter(value, data);
        } else if (choice == 7) {
            deleteFromBeginning();
        } else if (choice == 8) {
            deleteFromEnd();
```

```
        } else if (choice == 9) {
            int value;
            scanf("%d", &value);
            deleteBefore(value);
        } else if (choice == 10) {
            int value;
            scanf("%d", &value);
            deleteAfter(value);
        } else if (choice == 11) {
            break;
        } else {
            printf("\nInvalid option! Please try again ");
        }
    }
    return 0;
}
```

Status : Partially correct   *Marks : 0.4/1*

2. Problem Statement

Emily is developing a program to manage a singly linked list. The program
should allow users to perform various operations on the linked list, such as
inserting elements at the beginning or end, deleting elements from the
beginning or end, inserting before or after a specific value, and deleting
elements before or after a specific value. After each operation, the updated
linked list should be displayed.

Your task is to help Emily in implementing the same.

Input Format

The first line contains an integer choice, representing the operation to perform:

- For choice 1 to create the linked list. The next lines contain space-separated
integers, with -1 indicating the end of input.
- For choice 2 to display the linked list.
- For choice 3 to insert a node at the beginning. The next line contains an integer
data representing the value to insert.
- For choice 4 to insert a node at the end. The next line contains an integer data

representing the value to insert.
- For choice 5 to insert a node before a specific value. The next line contains two integers: value (existing node value) and data (value to insert).
- For choice 6 to insert a node after a specific value. The next line contains two integers: value (existing node value) and data (value to insert).
- For choice 7 to delete a node from the beginning.
- For choice 8 to delete a node from the end.
- For choice 9 to delete a node before a specific value. The next line contains an integer value representing the node before which deletion occurs.
- For choice 10 to delete a node after a specific value. The next line contains an integer value representing the node after which deletion occurs.
- For choice 11 to exit the program.

Output Format

For choice 1, print "LINKED LIST CREATED".

For choice 2, print the linked list as space-separated integers on a single line. If the list is empty, print "The list is empty".

For choice 3, 4, 5, and 6, print the updated linked list with a message indicating the insertion operation.

For choice 7, 8, 9, and 10, print the updated linked list with a message indicating the deletion operation.

For any operation that is not possible print an appropriate error message such as "Value not found in the list".

For choice 11 terminate the program.

For any invalid option, print "Invalid option! Please try again".

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 1
5
3
7

-1
2
11
Output: LINKED LIST CREATED
5 3 7

Answer

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

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

struct Node* head = NULL;

void createList() {
    int value;
    struct Node *newNode, *temp;
    while (1) {
        scanf("%d", &value);
        if (value == -1) break;
        newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = value;
        newNode->next = NULL;
        if (head == NULL)
            head = newNode;
        else {
            temp = head;
            while (temp->next != NULL)
                temp = temp->next;
            temp->next = newNode;
        }
    }
    printf("LINKED LIST CREATED\n");
}

void displayList() {
    struct Node* temp = head;
    if (temp == NULL) {
        printf("The list is empty\n");
```

```c
        return;
    }
    while (temp != NULL) {
        printf("%d ", temp->data);
        temp = temp->next;
    }
    printf("\n");
}

void insertAtBeginning(int value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = value;
    newNode->next = head;
    head = newNode;
    printf("The linked list after insertion at the beginning is: \n");
    displayList();
}

void insertAtEnd(int value) {
    struct Node *newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = value;
    newNode->next = NULL;
    if (head == NULL) {
        head = newNode;
    } else {
        struct Node* temp = head;
        while (temp->next != NULL)
            temp = temp->next;
        temp->next = newNode;
    }
    printf("The linked list after insertion at the end is: \n");
    displayList();
}

void insertBefore(int target, int value) {
    struct Node *newNode, *temp = head, *prev = NULL;
    newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = value;

    if (head == NULL) {
        printf("Value not found in the list\n");
        return;
```

```c
        }

        if (head->data == target) {
            newNode->next = head;
            head = newNode;
            printf("The linked list after insertion before a value is: \n");
            displayList();
            return;
        }

        while (temp != NULL && temp->data != target) {
            prev = temp;
            temp = temp->next;
        }

        if (temp == NULL) {
            printf("Value not found in the list\n");
            return;
        }

        newNode->next = temp;
        prev->next = newNode;
        printf("The linked list after insertion before a value is: \n");
        displayList();
    }

    void insertAfter(int target, int value) {
        struct Node* temp = head;
        while (temp != NULL && temp->data != target)
            temp = temp->next;

        if (temp == NULL) {
            printf("Value not found in the list\n");
            return;
        }

        struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = value;
        newNode->next = temp->next;
        temp->next = newNode;

        printf("The linked list after insertion after a value is: \n");
```

```c
    displayList();
}

void deleteFromBeginning() {
    if (head == NULL) return;
    struct Node* temp = head;
    head = head->next;
    free(temp);
    printf("The linked list after deletion from the beginning is: \n");
    displayList();
}

void deleteFromEnd() {
    if (head == NULL) return;
    struct Node* temp = head, *prev = NULL;
    if (head->next == NULL) {
        free(head);
        head = NULL;
    } else {
        while (temp->next != NULL) {
            prev = temp;
            temp = temp->next;
        }
        prev->next = NULL;
        free(temp);
    }
    printf("The linked list after deletion from the end is: \n");
    displayList();
}

void deleteBefore(int target) {
    if (head == NULL || head->next == NULL || head->data == target) {
        printf("Value not found in the list\n");
        return;
    }

    struct Node *temp = head, *prev = NULL, *prevPrev = NULL;

    while (temp != NULL && temp->next != NULL && temp->next->data != target) {
        prevPrev = prev;
        prev = temp;
        temp = temp->next;
```

```c
    }

    if (temp->next == NULL) {
        printf("Value not found in the list\n");
        return;
    }

    if (temp == head) {
        head = temp->next;
        free(temp);
    } else {
        prevPrev->next = temp->next;
        free(temp);
    }
    printf("The linked list after deletion before a value is: \n");
    displayList();
}

void deleteAfter(int target) {
    struct Node* temp = head;
    while (temp != NULL && temp->data != target)
        temp = temp->next;

    if (temp == NULL || temp->next == NULL) {
        printf("Value not found in the list\n");
        return;
    }

    struct Node* toDelete = temp->next;
    temp->next = toDelete->next;
    free(toDelete);

    printf("The linked list after deletion after a value is: \n");
    displayList();
}

int main() {
    int choice, val1, val2;

    while (scanf("%d", &choice)) {
        switch (choice) {
            case 1:
```

```c
            createList();
            break;
        case 2:
            displayList();
            break;
        case 3:
            scanf("%d", &val1);
            insertAtBeginning(val1);
            break;
        case 4:
            scanf("%d", &val1);
            insertAtEnd(val1);
            break;
        case 5:
            scanf("%d %d", &val1, &val2);
            insertBefore(val1, val2);
            break;
        case 6:
            scanf("%d %d", &val1, &val2);
            insertAfter(val1, val2);
            break;
        case 7:
            deleteFromBeginning();
            break;
        case 8:
            deleteFromEnd();
            break;
        case 9:
            scanf("%d", &val1);
            deleteBefore(val1);
            break;
        case 10:
            scanf("%d", &val1);
            deleteAfter(val1);
            break;
        case 11:
            return 0;
        default:
            printf("Invalid option! Please try again\n");
    }
}
return 0;
```

}

3. Problem Statement

Imagine you are managing the backend of an e-commerce platform. Customers place orders at different times, and the orders are stored in two separate linked lists. The first list holds the orders from morning, and the second list holds the orders from the evening.

Your task is to merge the two lists so that the final list holds all orders in sequence from the morning list followed by the evening orders, in the same order

Input Format

The first line contains an integer n , representing the number of orders in the morning list.

The second line contains n space-separated integers representing the morning orders.

The third line contains an integer m , representing the number of orders in the evening list.

The fourth line contains m space-separated integers representing the evening orders.

Output Format

The output should be a single line containing space-separated integers representing the merged order list, with morning orders followed by evening orders.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 3
101 102 103
2
104 105
Output: 101 102 103 104 105

Answer

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

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

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

// Function to append a node to the end of the list
void append(struct Node** head, int value) {
    struct Node* newNode = createNode(value);
    if (*head == NULL) {
        *head = newNode;
        return;
    }
    struct Node* temp = *head;
    while (temp->next != NULL)
        temp = temp->next;
    temp->next = newNode;
}

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

```c
        if (temp->next != NULL) printf(" ");
        temp = temp->next;
    }
    printf("\n");
}

int main() {
    int n, m, value;
    struct Node* morningHead = NULL;
    struct Node* eveningHead = NULL;

    // Read morning list
    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &value);
        append(&morningHead, value);
    }

    // Read evening list
    scanf("%d", &m);
    for (int i = 0; i < m; i++) {
        scanf("%d", &value);
        append(&eveningHead, value);
    }

    // Merge evening list into morning list
    if (morningHead == NULL) {
        morningHead = eveningHead;
    } else {
        struct Node* temp = morningHead;
        while (temp->next != NULL)
            temp = temp->next;
        temp->next = eveningHead;
    }

    // Print merged list
    printList(morningHead);

    return 0;
}
```

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

4. Problem Statement

Bharath is very good at numbers. As he is piled up with many works, he decides to develop programs for a few concepts to simplify his work. As a first step, he tries to arrange even and odd numbers using a linked list. He stores his values in a singly-linked list.

Now he has to write a program such that all the even numbers appear before the odd numbers. Finally, the list is printed in such a way that all even numbers come before odd numbers. Additionally, the even numbers should be in reverse order, while the odd numbers should maintain their original order.

Example

Input:

6

3 1 0 4 30 12

Output:

12 30 4 0 3 1

Explanation:

Even elements: 0 4 30 12

Reversed Even elements: 12 30 4 0

Odd elements: 3 1

So the final list becomes: 12 30 4 0 3 1

Input Format

The first line consists of an integer n representing the size of the linked list.

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

Output Format

The output prints the rearranged list separated by a space.

The list is printed in such a way that all even numbers come before odd numbers and the even numbers should be in reverse order, while the odd numbers should maintain their original order.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 6
3 1 0 4 30 12
Output: 12 30 4 0 3 1

Answer

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

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

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

// Insert at head (used for reversing even numbers)
void insertAtHead(struct Node** head, int val) {
    struct Node* newNode = createNode(val);
    newNode->next = *head;
    *head = newNode;
}

// Insert at tail (used to preserve odd number order)
void insertAtTail(struct Node** head, struct Node** tail, int val) {
```

```c
        struct Node* newNode = createNode(val);
        if (*head == NULL) {
            *head = *tail = newNode;
        } else {
            (*tail)->next = newNode;
            *tail = newNode;
        }
    }

    // Print linked list
    void printList(struct Node* head) {
        while (head != NULL) {
            printf("%d", head->data);
            if (head->next != NULL) printf(" ");
            head = head->next;
        }
        printf("\n");
    }

    int main() {
        int n, val;
        scanf("%d", &n);

        struct Node* evenHead = NULL;      // Will be reversed (insert at head)
        struct Node* oddHead = NULL;       // Will keep order (insert at tail)
        struct Node* oddTail = NULL;

        for (int i = 0; i < n; i++) {
            scanf("%d", &val);
            if (val % 2 == 0) {
                insertAtHead(&evenHead, val);
            } else {
                insertAtTail(&oddHead, &oddTail, val);
            }
        }

        // Merge even and odd lists
        struct Node* temp = evenHead;
        if (evenHead == NULL) {
            printList(oddHead);
        } else {
            while (temp->next != NULL) temp = temp->next;
```

```
        temp->next = oddHead;
        printList(evenHead);
    }

    return 0;
}
```

Status : Correct   *Marks : 1/1*

5. Problem Statement

John is working on evaluating polynomials for his math project. He needs to compute the value of a polynomial at a specific point using a singly linked list representation.

Help John by writing a program that takes a polynomial and a value of x as input, and then outputs the computed value of the polynomial.

Example

Input:

2

13

12

11

1

Output:

36

Explanation:

The degree of the polynomial is 2.

Calculate the value of x2: 13 * 12 = 13.

Calculate the value of x1: 12 * 11 = 12.

Calculate the value of x0: 11 * 10 = 11.

Add the values of x2, x1 and x0 together: 13 + 12 + 11 = 36.

Input Format

The first line of input consists of the degree of the polynomial.

The second line consists of the coefficient x2.

The third line consists of the coefficient of x1.

The fourth line consists of the coefficient x0.

The fifth line consists of the value of x, at which the polynomial should be evaluated.

Output Format

The output is the integer value obtained by evaluating the polynomial at the given value of x.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 2
13
12
11
1
Output: 36

Answer

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

struct Node {
    int coeff;
```

```c
    struct Node* next;
};

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

// Append node to linked list
void append(struct Node** head, int coeff) {
    struct Node* newNode = createNode(coeff);
    if (*head == NULL) {
        *head = newNode;
    } else {
        struct Node* temp = *head;
        while (temp->next != NULL)
            temp = temp->next;
        temp->next = newNode;
    }
}

// Evaluate the polynomial
int evaluatePolynomial(struct Node* head, int degree, int x) {
    int result = 0;
    int power = degree;
    while (head != NULL) {
        result += head->coeff * pow(x, power);
        head = head->next;
        power--;
    }
    return result;
}

int main() {
    int degree, x, coeff;
    scanf("%d", &degree);

    struct Node* head = NULL;
```

```
    for (int i = 0; i <= degree; i++) {
        scanf("%d", &coeff);
        append(&head, coeff);
    }

    scanf("%d", &x);

    int result = evaluatePolynomial(head, degree, x);
    printf("%d", result);

    return 0;
}
```

Status : Correct   *Marks : 1/1*