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


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

struct Node *first, *last;

void insert_node()
{
	struct Node *nn, *temp, *temp2;
	int ch, sele;

	nn = (struct Node *) malloc(sizeof(struct Node) );
	printf("Enter element for New Node : ");
	scanf("%d", &nn->ele);

	if(first == NULL)
	{
		nn->next = NULL;
		nn->prev = NULL;
		first = nn;
		last = nn;
		printf("List Created..\n");
	}
	else
	{
		// means list is already created.
		printf("Where you want to place this new node? \n");
		printf("1 - At First Position\n");
		printf("2 - At Last Position\n");
		printf("3 - At Specific Position\n");
		printf("Provide your choice : ");
		scanf("%d", &ch);

		switch(ch)
```

```
		{
			case 1: // insert nn at first position
				nn->prev = NULL;
				nn->next = first;
				first->prev = nn;
				first = nn;
				printf("New Node is inserted at first position\n");
				break;
			case 2: // insert nn at last position
				nn->next = NULL;
				nn->prev = last;
				last->next =nn;
				last = nn;
				printf("New Node is inserted at last position\n");
				break;
			case 3: // insert nn after specified node
				printf("Enter element of that node, after which you want to place
NN : ");
				scanf("%d", &sele);
				temp = first;
				while(temp->ele != sele && temp!=NULL)
				{
					temp = temp->next;
				}

				if(temp==NULL)
				{
					printf("No such node found.\n");
				}
				else
				{
					// means selected node found.
					// "temp" points to selected node.
					if(temp==last)
					{
					  // means selected node is last node
					  nn->next = NULL;
					  nn->prev = last;
					  last->next = nn;
					  last = nn;
					  printf("NN inserted after specified Node.\n");
					}
					else
```

```
                                        {
                                          // means selected node is other than last node
                                          temp2 = temp->next;
                                          nn->prev = temp;
                                          nn->next = temp2;
                                          temp->next = nn;
                                          temp2->prev = nn;
                                          printf("NN inserted after specified Node.\n");
                                        } // end of inner else
                                    } //end of innter else
                                    break;
                        } //end of switch-case
                } //end of outer else
} //end of insert_node()

void remove_node()
{
        int ch, sele;
        struct Node *temp, *temp2, *temp3;

        if(first == NULL)
        {
                printf("List Underflow. Yet Not created.\n");
        }
        else
        {
                // means list is already created...
                if(first == last)
                {
                        // means there is only one node.
                        temp = first;
                        first = NULL;
                        last = NULL;
                        free(temp);
                        printf("There was only one node. It is not removed.\n");
                }
                else
                {
                  // means there are multiple nodes.
                  printf("Which node you want to remove : \n");
                  printf("1 - Remove First Node\n");
                  printf("2 - Remove Last Node\n");
                  printf("3 - Remove Specific Node\n");
```

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printf("Provide your choice : ");
scanf("%d", &ch);
switch(ch)
{
  case 1: // remove first node
        temp = first;
        first = first->next;
        first->prev = NULL;
        free(temp);
        printf("First Node is Removed.\n");
        break;
  case 2: // remove last node
        temp = last;
        last = last->prev;
        last->next = NULL;
        free(temp);
        printf("Last Node is Removed.\n");
        break;
  case 3: // remove specific node
        printf("Enter element of that node, which you want to Remove : ");
        scanf("%d", &sele);

        temp = first;
        while(temp->ele != sele && temp!=NULL)
        {
                temp = temp->next;
        }

        if(temp==NULL)
        {
                printf("No such node found.\n");
        }
        else
        {
          // means selected node found. "temp" points to it.
          if(temp==first)
          {
            // means selected node "temp" is first node
            temp = first;
            first = first->next;
            first->prev = NULL;
            free(temp);
            printf("Specified Node is Removed.\n");
```

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                        }
                        else if(temp == last)
                        {
                          // means selected node "temp" is last node
                          temp = last;
                          last = last->prev;
                          last -> next = NULL;
                          free(temp);
                          printf("Specified Node is Removed.\n");
                        }
                        else
                        {
                          // means selected node is in-between
                          temp2 = temp->prev;
                          temp3 = temp->next;
                          temp2->next = temp3;
                          temp3->prev = temp2;
                          free(temp);
                          printf("Specified Node is Removed.\n");
                        }
                       }
                       break;
                  } //end of swith-case
                } //end of inner else
        } //end of outer else
} //end of remove_node()

void display_list()
{
        struct Node *temp;
        if(first == NULL)
        {
          printf("List is yet not created. Nothing to display.\n");
        }
        else
        {
          printf("List Contains\n");
          temp = first;
          while(temp!=NULL)
          {
                printf("%d\t", temp->ele);
                temp = temp->next;
          }
```

```
        }
} //end of display_list()

void main()
{
        int ch;
        clrscr();
        first = NULL;
        last = NULL;

        while(1)
        {
                getch();
                clrscr();
                printf("Select operation\n");
                printf("1 - Insert Node\n");
                printf("2 - Remove Node\n");
                printf("3 - Display List\n");
                printf("4 - EXIT\n");
                printf("Provide your choice : ");
                scanf("%d", &ch);

                switch(ch)
                {
                        case 1: insert_node();
                                break;
                        case 2: remove_node();
                                break;
                        case 3: display_list();
                                break;
                        case 4: exit(0);
                } //end of switch-case
        } //end of while

        getch();

}
```