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Write a program to search an element using Linear Search.

**CODE-**

#include <stdio.h>

#define MAX\_l 10

int ls(int arr[])

{

    int val, flag = 0;

    printf("enter search value");

    scanf("%d", &val);

    for (int i = 0; i < MAX\_l; i++)

    {

        if (val == arr[i])

        {

            printf("%d found at %d \n", arr[i], i);

            flag += 1;

        }

    }

    if (flag <= 1)

    {

        printf("total %d results found", flag);

    }

}

int main()

{

    int arr[MAX\_l];

    printf("enter data by spaces \n");

    for (int i = 0; i < MAX\_l; i++)

    {

        scanf("%d", &arr[i]);

    }

    ls(arr);

}

1. Write a program to search an element using Binary Search

**CODE-**

    #include <stdio.h>

    #define MAX\_l 10

    int binary\_s(int arr[])

    {

        int val, flag = 0, level, f = 0, l = MAX\_l - 1;

        level = (f + l) / 2;

        printf("enter search value");

        scanf("%d", &val);

        while (f <= l)

        {

            if (arr[level] == val)

            {

                printf("%d found at %d \n", arr[level], level);

                flag += 1;

                break;

            }

            else if (arr[level] < val)

            {

                f = level + 1;

            }

            else

            {

                l = level - 1;

            }

            level = (f + l) / 2;

        }

    }

    int main()

    {

        int arr[MAX\_l];

        printf("enter data by spaces \n");

        for (int i = 0; i < MAX\_l; i++)

        {

            scanf("%d", &arr[i]);

        }

        binary\_s(arr);

    }

1. Write a program to sort the given array using Bubble Sort.

**CODE-**

#include <stdio.h>

#define max 10

int input(int arr[])

{

    for (int i = 0; i < max; i++)

    {

        scanf("%d", &arr[i]);

    }

}

int output(int arr[])

{

    for (int i = 0; i < max; i++)

    {

        printf("%d ,", arr[i]);

    }

    printf("\n");

}

int bsort(int arr[], int ord)

{

    int temp;

    for (int i = 0; i < max; i++)

    {

        for (int j = 0; j < max - i - 1; j++)

        {

            if (ord == 1)

            {

                if (arr[j] < arr[j + 1])

                {

                    temp = arr[j];

                    arr[j] = arr[j + 1];

                    arr[j + 1] = temp;

                }

            }

            else

            {

                if (arr[j] > arr[j + 1])

                {

                    temp = arr[j + 1];

                    arr[j + 1] = arr[j];

                    arr[j] = temp;

                }

            }

        }

    }

}

int main()

{

    int arr[max], ord, type, stop = 0;

    while (stop != 1)

    {

        printf("sellect \n1=>sort\n4=>exit\n");

        scanf("%d", &type);

        if (type != 4)

        {

            printf("1=>decending\n2=>assending\n");

            scanf("%d", &ord);

            printf("input arrey elements\n");

            input(arr);

            bsort(arr, ord);

            output(arr);

        }

        else

        {

            stop = 1;

            printf("adios \n");

        }

    }

}

1. Write a program to sort the given array using Selection Sort.

**CODE-**

    #include <stdio.h>

    #define max 10

    int input(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            scanf("%d", &arr[i]);

        }

    }

    int output(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            printf("%d ,", arr[i]);

        }

        printf("\n");

    }

    int sel\_sort(int arr[], int ord)

    {

        int local = 0, temp;

        for (int i = 0; i < max; i++)

        {

            local = 0;

            for (int j = 0; j < max - i; j++)

            {

                if (ord == 1)

                {

                    if (arr[local] < arr[j])

                    {

                        temp = arr[local];

                        arr[local] = arr[j];

                        arr[j] = temp;

                        local += 1;

                    }

                }

                else

                {

                    if (arr[local] > arr[j])

                    {

                        temp = arr[local];

                        arr[local] = arr[j];

                        arr[j] = temp;

                        local += 1;

                    }

                }

            }

        }

    }

    int main()

    {

        int arr[max], ord, type, stop = 0;

        while (stop != 1)

        {

            printf("sellect \n1=>sort\n4=>exit\n");

            scanf("%d", &type);

            if (type != 4)

            {

                printf("1=>decending\n2=>assending\n");

                scanf("%d", &ord);

                printf("input arrey elements\n");

                input(arr);

                sel\_sort(arr, ord);

                output(arr);

            }

            else

            {

                stop = 1;

                printf("adios \n");

            }

        }

    }

1. Write a program to sort the given array using Insertion Sort.

**CODE-**

    #include <stdio.h>

    #define max 10

    int input(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            scanf("%d", &arr[i]);

        }

    }

    int output(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            printf("%d ,", arr[i]);

        }

        printf("\n");

    }

    int ins\_sort(int arr[], int ord)

    {

        int temp, key, temp1, temp2;

        for (int i = 0; i < max; i++)

        {

            for (int j = 0; j < i; j++)

            {

                if (ord == 1)

                {

                    if (arr[i] > arr[j])

                    {

                        temp = arr[i];

                        temp1 = arr[j];

                        for (int k = j; k < i; k++)

                        {

                            temp2 = arr[k + 1];

                            arr[k + 1] = temp1;

                            temp1 = temp2;

                        }

                        arr[j] = temp;

                    }

                }

                else

                {

                    if (arr[i] < arr[j])

                    {

                        temp = arr[i];

                        temp1 = arr[j];

                        for (int k = j; k < i; k++)

                        {

                            temp2 = arr[k + 1];

                            arr[k + 1] = temp1;

                            temp1 = temp2;

                        }

                        arr[j] = temp;

                    }

                }

            }

        }

    }

    int main()

    {

        int arr[max], ord, type, stop = 0;

        while (stop != 1)

        {

            printf("sellect \n1=>sort\n4=>exit\n");

            scanf("%d", &type);

            if (type != 4)

            {

                printf("1=>decending\n2=>assending\n");

                scanf("%d", &ord);

                printf("input arrey elements\n");

                input(arr);

                ins\_sort(arr, ord);

                output(arr);

            }

            else

            {

                stop = 1;

                printf("adios \n");

            }

        }

    }

1. Write a program to sort the given array using QuickSort

**CODE-**

    #include <stdio.h>

    #define max 10

    int input(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            scanf("%d", &arr[i]);

        }

    }

    int output(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            printf("%d ,", arr[i]);

        }

        printf("\n");

    }

    void swap(int \*x, int \*y) {

        int Temp;

        Temp = \*x;

        \*x = \*y;

        \*y = Temp;

    }

    void quick\_sort(int a[], int first, int last) {

        int pivot, i, j;

        if(first < last) {

            pivot = first;

            i = first;

            j = last;

            while (i < j) {

                while(a[i] <= a[pivot] && i < last)

                    i++;

                while(a[j] > a[pivot])

                    j--;

                if(i < j) {

                    swap(&a[i], &a[j]);

                }

            }

            swap(&a[pivot], &a[j]);

            quick\_sort(a, first, j - 1);

            quick\_sort(a, j + 1, last);

        }

    }

    int main()

    {

        int arr[max], type, stop = 0;

        while (stop != 1)

        {

            printf("sellect \n1=>sort\n4=>exit\n");

            scanf("%d", &type);

            if (type != 4)

            {

                printf("input arrey elements\n");

                input(arr);

                quick\_sort(arr,0,max-1);

                output(arr);

            }

            else

            {

                stop = 1;

                printf("adios \n");

            }

        }

    }

1. Write a program to sort the given array using MergeSort.

**CODE-**

    #include <stdio.h>

    #define max 10

    int input(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            scanf("%d", &arr[i]);

        }

    }

    int output(int arr[])

    {

        for (int i = 0; i < max; i++)

        {

            printf("%d ,", arr[i]);

        }

        printf("\n");

    }

    void merge\_sort(int i, int j, int a[], int aux[])

    {

        if (j <= i)

        {

            return;

        }

        int mid = (i + j) / 2;

        merge\_sort(i, mid, a, aux);

        merge\_sort(mid + 1, j, a, aux);

        int pointer\_left = i;

        int pointer\_right = mid + 1;

        int k;

        for (k = i; k <= j; k++)

        {

            if (pointer\_left == mid + 1)

            {

                aux[k] = a[pointer\_right];

                pointer\_right++;

            }

            else if (pointer\_right == j + 1)

            {

                aux[k] = a[pointer\_left];

                pointer\_left++;

            }

            else if (a[pointer\_left] < a[pointer\_right])

            {

                aux[k] = a[pointer\_left];

                pointer\_left++;

            }

            else

            {

                aux[k] = a[pointer\_right];

                pointer\_right++;

            }

        }

        for (k = i; k <= j; k++)

        {

            a[k] = aux[k];

        }

    }

    int main()

    {

        int arr[max],temp[max], type, stop = 0;

        while (stop != 1)

        {

            printf("sellect \n1=>sort\n4=>exit\n");

            scanf("%d", &type);

            if (type != 4)

            {

                printf("input arrey elements\n");

                input(arr);

                merge\_sort(0, max - 1,arr,temp);

                output(arr);

            }

            else

            {

                stop = 1;

                printf("adios \n");

            }

        }

    }

1. Write a program to insert a new element in the given unsorted array at kth position.

**CODE-**

    #include <stdio.h>

    #define MAX\_l 10

    int main()

    {

        int arr[MAX\_l], element, pos;

        printf("enter data by spaces \n");

        for (int i = 0; i < MAX\_l; i++)

        {

            scanf("%d", &arr[i]);

        }

        printf("element to be inserted \n");

        scanf("%d", &element);

        printf("pos of element \n");

        scanf("%d", &pos);

        for (int i = MAX\_l; i > pos; i--)

        {

            arr[i] = arr[i - 1];

        }

        arr[pos] = element;

        printf("final array \n");

        for (int i = 0; i < MAX\_l; i++)

        {

            printf("%d, ", arr[i]);

        }

    }

1. Write a program to delete an element from given sorted array.

**CODE-**

    #include <stdio.h>

    #define MAX\_l 10

    int main()

    {

        int arr[MAX\_l], element;

        printf("enter data by spaces \n");

        for (int i = 0; i < MAX\_l; i++)

        {

            scanf("%d", &arr[i]);

        }

        printf("element to be deleted \n");

        scanf("%d", &element);

        for (int i = 0; i < MAX\_l; i++)

        {

            if (element == arr[i])

            {

                for (int j = i; j <MAX\_l; j++)

                {

                    arr[j] = arr[j+1];

                }

            }

        }

        arr[MAX\_l-1] = 0;

        printf("final array \n");

        for (int i = 0; i < MAX\_l; i++)

        {

            printf("%d ", arr[i]);

        }

    }

1. Write a program to merge to given sorted arrays.

**CODE-**

    #include <stdio.h>

    int main()

    {

        int arr1\_s, arr2\_s, arr3\_s;

        printf("\nEnter the size of first array ");

        scanf("%d", &arr1\_s);

        printf("\nEnter the size of second array ");

        scanf("%d", &arr2\_s);

        arr3\_s = arr1\_s + arr2\_s;

        printf("\nEnter the sorted array elements");

        int a[arr1\_s], b[arr2\_s], c[arr3\_s];

        for (int i = 0; i < arr1\_s; i++)

        {   scanf("%d", &a[i]);

            c[i] = a[i];}

        int k = arr1\_s;

        printf("\nEnter the sorted array elements");

        for (int i = 0; i < arr2\_s; i++)

        {   scanf("%d", &b[i]);

            c[k] = b[i];

            k++;}

        for (int i = 0; i < arr3\_s; i++)

        {

int temp;

            for (int j = i + 1; j < arr3\_s; j++)

            {

                if (c[i] < c[j])

                {   temp = c[i];

                    c[i] = c[j];

                    c[j] = temp;}}}

        for (int i = 0; i < arr3\_s; i++)

        {

            printf(" %d ", c[i]);

        }

        return 0;

    }

1. Write a program to implement Stack using array, also show overflow and underflow in respective push and pop operations.

**CODE-**

    #include <stdio.h>

    #define size 50

    int push(int stack[], int top)

    {

        if ((top + 1) > size)

        {

            printf("overflow\n");

            return (50);

        }

        else

        {

            printf("enter element \n");

            int inp;

            scanf("%d", &inp);

            stack[top++] = inp;

            return top;

        }

    }

    int pop(int top, int bottom)

    {

        if ((top - 1) < 0)

        {

            printf("under flow\n");

            return (0);

        }

        else

        {

            printf("popped last element\n");

            return (--top);

        }

    }

    int disp(int stack[], int top, int bottom)

    {

        for (int i = bottom; i < top; i++)

        {

            printf("%d ", stack[i]);

        }

        printf("\n");

    }

    int main()

    {

        int stack[size], top, bottom = 0, inp, stop = 0;

        while (stop != 1)

        {

            printf("enter your choice \n1: push\n2: pop\n3: disp\n0: exit\n");

            scanf("%d", &inp);

            switch (inp)

            {

            case 1:

                top = push(stack, top);

                break;

            case 2:

                top = pop(top, bottom);

                break;

            case 3:

                disp(stack, top, bottom);

                break;

            case 0:

                stop = 1;

                printf("adios\n");

                break;

            default:

                break;

            }

        }

    }

1. Write a program to implement Queue using array, which shows insertion and deletion operations.

**CODE-**

    #include <stdio.h>

    #define max\_l 3

    struct node

    {

        int value;

    };

    int push(int \*f, int \*r, struct node arr[])

    {

        int val;

        if (\*r == \*f && \*r >= max\_l)

        {

            \*f = 0;

            \*r = 0;

        }

        if (\*r >= max\_l)

        {

            printf("over flow\n");

            return 0;

        }

        else

        {

            printf("enter the value ");

            scanf("%d", &val);

            arr[(\*r)++].value = val;

        }

    }

    int pop(int \*f, int \*r, struct node arr[])

    {

        int val;

        if (\*f == \*r)

        {

            printf("under flow\n");

            return 0;

        }

        else

        {

            printf("popped %d\n", arr[(\*f)++].value);

        }

    }

    int display(int f, int r, struct node arr[])

    {

        int val;

        if (f == r)

        {

            printf("under flow \n");

            return 0;

        }

        printf("elements are:\n");

        for (int i = f; i <= r - 1; i++)

        {

            printf("%d\n", arr[i].value);

        }

    }

    int main()

    {

        struct node queue[max\_l];

        int stop = 0, temp, choice, front = 0, rear = 0;

        while (stop != 1)

        {

            printf("\n1: push\n2: pop\n3: display\n4: exit\n");

            scanf("%d", &choice);

            switch (choice)

            {

            case 1:

                push(&front, &rear, queue);

                break;

            case 2:

                pop(&front, &rear, queue);

                break;

            case 3:

                display(front, rear, queue);

                break;

            case 4:

                stop = 1;

                break;

            default:

                printf("enter the correct value");

                break;

            }

        }

        return 0;

    }

1. Write a program to implement Circular Queue using array, which shows insertion and deletion operations.

**CODE-**

    #include <stdio.h>

    #define max 5

    int enqueue(int queue[], int \*front, int \*rear)

    {   int inp;

        scanf("%d", &inp);

        if ((\*front == \*rear + 1) || (\*front == 0 && \*rear == max - 1))

        {

            printf("\noverflow");

        }

        else

        {

            if (\*front == -1)

            {

                \*front = 0;

            }

            \*rear = (\*rear + 1) % max;

            queue[\*rear] = inp;

        }

        printf("\nrear %d", \*rear);

        printf(" front %d", \*front);}

    int dequeue(int queue[], int \*front, int \*rear)

    {

        if (\*front == -1)

        {

            printf("\nunder flow");

        }

        else

        {

            if (\*front == \*rear)

            {

                \*front = -1;

                \*rear = -1;

            }

            else

            {

                \*front = (\*front + 1) % max;

            }

        }

        printf("\nrear %d", \*rear);

        printf(" front %d", \*front);}

    int display(int queue[], int front, int rear)

    {   int i;

        if (front == -1)

        {

            printf("\nunder flow");

        }

        else

        {

            for (i = front; i != rear; i = (i + 1) % max)

            {

                printf("%d ", queue[i]);

            }

            printf("%d ", queue[i]);}}

    int main()

    {   int queue[5], front, rear, stop = 0, inp;

        front = -1;

        rear = front;

        while (stop != 1)

        {

            scanf("%d", &inp);

            switch (inp)

            {

            case 1:

                enqueue(queue, &front, &rear);

                break;

            case 2:

                dequeue(queue, &front, &rear);

                break;

            case 3:

                display(queue, front, rear);

                break;

            case 4:

                stop = 1;

                break;

            default:

                break;

            }}}

1. Write a program to implement Linear Linked List, showing all the operations, like creation, display, insertion, deletion and searching.

**CODE-**

    #include <stdio.h>

    #include <stdlib.h>

    struct node

    {

        int val;

        struct node \*next;

    } \*head = NULL;

    int insertion(int data)

    {

        struct node \*ptr = head;

        struct node \*temp = (struct node \*)malloc(sizeof(struct node));

        temp->val = data;

        temp->next = NULL;

        if (head == NULL)

        {

            head = temp;

        }

        else

        {

            while (ptr->next != NULL)

            {

                ptr = ptr->next;

            }

            ptr->next = temp;

        }

        return 0;

    }

    void deletion()

    {

        struct node \*ptr = head, \*prev;

        while (ptr->next != NULL)

        {

            prev = ptr;

            ptr = ptr->next;

        }

        prev->next = NULL;

    }

    void traverse()

    {

        struct node \*ptr = head;

        while (ptr->next != NULL)

        {

            printf("%d,", ptr->val);

            ptr = ptr->next;

        }

        printf("%d\n", ptr->val);

    }

    void search(int data)

    {

        int flag=0;

        struct node \*ptr = head;

        while (ptr->next != NULL)

        {

            if (ptr->val == data)

            {

                printf("element found\n");

                flag=1;

                break;

            }

            ptr = ptr->next;

        }

        if (flag ==0)

        {

            printf("element not found\n");

        }

    }

    int main()

    {

        int stop = 0, choice, val;

        while (stop != 1)

        {

            printf("enter your choice");

            scanf("%d", &choice);

            switch (choice)

            {

            case 1:

                scanf("%d", &val);

                insertion(val);

                break;

            case 2:

                deletion();

                break;

            case 3:

                traverse();

                break;

            case 4:

                scanf("%d", &val);

                search(val);

                break;

            case 5:

                stop = 1;

                break;

            default:

                break;

            }

        }

    }

1. Write a program to implement Stack, using Linked List. Implement Push, Pop and display operations.

**CODE-**

    #include <stdio.h>

    #include <stdlib.h>

    struct node

    {

        int val;

        struct node \*next;

    } \*head = NULL;

    int push(int data)

    {

        struct node \*ptr = head;

        struct node \*temp = (struct node \*)malloc(sizeof(struct node));

        temp->val = data;

        temp->next = NULL;

        if (head == NULL)

        {

            head = temp;

        }

        else

        {

            while (ptr->next != NULL)

            {

                ptr = ptr->next;

            }

            ptr->next = temp;

        }

        return 0;

    }

    void pop()

    {

        struct node \*ptr = head, \*prev;

        while (ptr->next != NULL)

        {

            prev = ptr;

            ptr = ptr->next;

        }

        prev->next = NULL;

    }

    void display()

    {

        struct node \*ptr = head;

        while (ptr->next != NULL)

        {

            printf("%d,", ptr->val);

            ptr = ptr->next;

        }

        printf("%d\n", ptr->val);

    }

    int main()

    {

        int stop = 0, choice, val;

        while (stop != 1)

        {

            printf("enter your choice");

            scanf("%d", &choice);

            switch (choice)

            {

            case 1:

                scanf("%d", &val);

                push(val);

                break;

            case 2:

                pop();

                break;

            case 3:

                display();

                break;

            case 4:

                stop = 1;

                break;

            default:

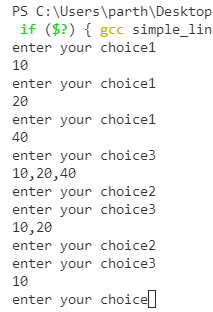
                break;

            }

        }

    }

**OUTPUT**



1. Write a program to implement Queue, using Linked List. Implement Insertion, deletion and display operations.

**CODE-**

    #include <stdio.h>

    #include <stdlib.h>

    struct node

    {

        int val;

        struct node \*next;

    } \*head = NULL, \*rear = NULL;

    void push()

    {

        int value;

        printf("enter the value ");

        scanf("%d", &value);

        struct node \*temp = (struct node \*)malloc(sizeof(struct node));

        temp->next = NULL;

        temp->val = value;

        if (head == NULL && rear == NULL)

        {

            head = temp;

            rear = temp;

        }

        else

        {

            rear->next = temp;

            rear = temp;

        }}

    void pop()

    {

        int value;

        if (head == NULL || rear == NULL)

        {

            printf("empty queue");

        }

        else

        {

            printf("removing %d", head->val);

            head = head->next;

        }}

    void disp()

    {

        struct node \*temp = head;

        if (temp == NULL)

        {

            printf("empty queue");

        }

        else

        {   while (temp->next != NULL)

            {

                printf("%d ", temp->val);

                temp = temp->next;

            }

            printf("%d\n", temp->val);

        }}

    int main()

    {

        int stop = 0, choice;

        printf("\nenter your choice ");

        scanf("%d", &choice);

        while (!stop)

        {

            switch (choice)

            {

            case 1:

                push();

                break;

            case 2:

                pop();

                break;

            case 3:

                disp();

                break;

            case 4:

                stop = 1;

                break;

            default:

                break;}

            printf("\nenter your choice ");

            scanf("%d", &choice);

        }}

1. Write a program to count the number of times an item is present in a linked list.

**CODE-**

    #include <stdio.h>

    #include <stdlib.h>

    struct node

    {

        int val;

        struct node \*next;

    } \*head = NULL;

    int insertion(int data)

    {

        struct node \*ptr = head;

        struct node \*temp = (struct node \*)malloc(sizeof(struct node));

        temp->val = data;

        temp->next = NULL;

        if (head == NULL)

        {

            head = temp;

        }

        else

        {

            while (ptr->next != NULL)

            {

                ptr = ptr->next;

            }

            ptr->next = temp;

        }

        return 0;

    }

    int deletion()

    {

        struct node \*ptr = head, \*prev;

        if (head == NULL)

        {

            printf("underflow");

            return 0;

        }

        if (head->next == NULL)

        {

            head = NULL;

        }

        else

        {

            while (ptr->next != NULL)

            {

                prev = ptr;

                ptr = ptr->next;

            }

            prev->next = NULL;

        }

        return 0;

    }

    void traverse()

    {

        struct node \*ptr = head;

        while (ptr->next != NULL)

        {

            printf("%d,", ptr->val);

            ptr = ptr->next;

        }

        printf("%d\n", ptr->val);

    }

    int count()

    {

        int no = 0;

        struct node \*ptr = head;

        if (head != NULL)

        {

            while (ptr->next != NULL)

            {

                ptr = ptr->next;

                no++;

            }

            no++;

        }

        return no;

    }

    int main()

    {

        int stop = 0, choice, val;

        while (stop != 1)

        {

            printf("enter your choice");

            scanf("%d", &choice);

            switch (choice)

            {

            case 1:

                scanf("%d", &val);

                insertion(val);

                break;

            case 2:

                deletion();

                break;

            case 3:

                traverse();

                break;

            case 4:

                printf("number of elements are %d \n", count());

                break;

            case 5:

                stop = 1;

                break;

            default:

                break;

            }

        }

    }

1. Write a program to increment the data part of every node present in a linked list by 10. Display the data both before incrimination and after.

**CODE-**

    #include <stdio.h>

    #include <stdlib.h>

    struct node

    {

        int val;

        struct node \*next;

    } \*head = NULL;

    int insertion(int data)

    {

        struct node \*ptr = head;

        struct node \*temp = (struct node \*)malloc(sizeof(struct node));

        temp->val = data;

        temp->next = NULL;

        if (head == NULL)

        {

            head = temp;

        }

        else

        {

            while (ptr->next != NULL)

            {

                ptr = ptr->next;

            }

            ptr->next = temp;

        }

        return 0;

    }

    int deletion()

    {

        struct node \*ptr = head, \*prev;

        if (head == NULL)

        {

            printf("underflow");

            return 0;

        }

        if (head->next == NULL)

        {

            head = NULL;

        }

        else

        {

            while (ptr->next != NULL)

            {

                prev = ptr;

                ptr = ptr->next;

            }

            prev->next = NULL;

        }

        return 0;

    }

    void traverse()

    {

        struct node \*ptr = head;

        while (ptr->next != NULL)

        {

            printf("%d,", ptr->val);

            ptr = ptr->next;

        }

        printf("%d\n", ptr->val);

    }

    int inc10()

    {

        struct node \*ptr = head;

        while (ptr->next != NULL)

        {

            ptr->val += 10;

            ptr = ptr->next;

        }

        ptr->val += 10;

    }

    int main()

    {

        int stop = 0, choice, val;

        while (stop != 1)

        {

            printf("\n1: push\n2: pop\n3: display\n4: increment by 10\n5: exit\n");

            printf("enter your choice");

            scanf("%d", &choice);

            switch (choice)

            {

            case 1:

                scanf("%d", &val);

                insertion(val);

                break;

            case 2:

                deletion();

                break;

            case 3:

                traverse();

                break;

            case 4:

                traverse();

                inc10();

                traverse();

                break;

            case 5:

                stop = 1;

                break;

            default:

                break;

            }

        }

    }

1. Write a program to implement Doubly Linked List, showing all the operations, like creation, display, insertion, deletion and searching.

**CODE-**

#include<stdio.h>

#include<stdlib.h>

struct node

{

    struct node \*prev;

    struct node \*next;

    int data;

};

struct node \*head;

void insertion\_beginning();

void insertion\_last();

void insertion\_specified();

void deletion\_beginning();

void deletion\_last();

void deletion\_specified();

void display();

void search();

void main ()

{

int choice =0;

    while(choice != 9)

    {

        printf("Main Menu\n");

        printf("Choose one option from the following list ...\n");

        printf("1.insert in begining\n");

        printf("2.insert at last\n");

        printf("3.insert at any location\n");

        printf("4.delete from Beginning\n");

        printf("5.delete from last\n");

        printf("6.delete specific data\n");

        printf("7.show\n");

        printf("8.exit\n");

        printf("\nEnter your choice?\n");

        scanf("\n%d",&choice);

        switch(choice)

        {

            case 1:

            insertion\_beginning();

            break;

            case 2:

                    insertion\_last();

            break;

            case 3:

            insertion\_specified();

            break;

            case 4:

            deletion\_beginning();

            break;

            case 5:

            deletion\_last();

            break;

            case 6:

            deletion\_specified();

            break;

            case 7:

            display();

            break;

            case 8:

            exit(0);

            break;

            default:

            printf("Please enter valid choice..");

        }

    }

}

void insertion\_beginning()

{

   struct node \*ptr;

   int item;

   ptr = (struct node \*)malloc(sizeof(struct node));

   if(ptr == NULL)

   {

       printf("\nOVERFLOW");

   }

   else

   {

    printf("\nEnter Item value");

    scanf("%d",&item);

   if(head==NULL)

   {

       ptr->next = NULL;

       ptr->prev=NULL;

       ptr->data=item;

       head=ptr;

   }

   else

   {

       ptr->data=item;

       ptr->prev=NULL;

       ptr->next = head;

       head->prev=ptr;

       head=ptr;

   }

   printf("\nNode inserted\n");

}

}

void insertion\_last()

{

   struct node \*ptr,\*temp;

   int item;

   ptr = (struct node \*) malloc(sizeof(struct node));

   if(ptr == NULL)

   {

       printf("\nOVERFLOW");

   }

   else

   {

       printf("\nEnter value");

       scanf("%d",&item);

        ptr->data=item;

       if(head == NULL)

       {

           ptr->next = NULL;

           ptr->prev = NULL;

           head = ptr;

       }

       else

       {

          temp = head;

          while(temp->next!=NULL)

          {

              temp = temp->next;

          }

          temp->next = ptr;

          ptr ->prev=temp;

          ptr->next = NULL;

          }

       }

     printf("\nnode inserted\n");

    }

void insertion\_specified()

{

   struct node \*ptr,\*temp;

   int item,loc,i;

   ptr = (struct node \*)malloc(sizeof(struct node));

   if(ptr == NULL)

   {

       printf("\n OVERFLOW");

   }

   else

   {

       temp=head;

       printf("Enter the location");

       scanf("%d",&loc);

       for(i=0;i<loc;i++)

       {

           temp = temp->next;

           if(temp == NULL)

           {

               printf("\n There are less than %d elements", loc);

               return;

           }

       }

       printf("Enter value");

       scanf("%d",&item);

       ptr->data = item;

       ptr->next = temp->next;

       ptr -> prev = temp;

       temp->next = ptr;

       temp->next->prev=ptr;

       printf("\nnode inserted\n");

   }

}

void deletion\_beginning()

{

    struct node \*ptr;

    if(head == NULL)

    {

        printf("\n UNDERFLOW");

    }

    else if(head->next == NULL)

    {

        head = NULL;

        free(head);

        printf("\nnode deleted\n");

    }

    else

    {

        ptr = head;

        head = head -> next;

        head -> prev = NULL;

        free(ptr);

        printf("\nnode deleted\n");

    }

}

void deletion\_last()

{

    struct node \*ptr;

    if(head == NULL)

    {

        printf("\n UNDERFLOW");

    }

    else if(head->next == NULL)

    {

        head = NULL;

        free(head);

        printf("\nnode deleted\n");

    }

    else

    {

        ptr = head;

        if(ptr->next != NULL)

        {

            ptr = ptr -> next;

        }

        ptr -> prev -> next = NULL;

        free(ptr);

        printf("\nnode deleted\n");

    }

}

void deletion\_specified()

{

    struct node \*ptr, \*temp;

    int val;

    printf("\n Enter the data after which the node is to be deleted : ");

    scanf("%d", &val);

    ptr = head;

    while(ptr -> data != val)

    ptr = ptr -> next;

    if(ptr -> next == NULL)

    {

        printf("\nCan't delete\n");

    }

    else if(ptr -> next -> next == NULL)

    {

        ptr ->next = NULL;

    }

    else

    {

        temp = ptr -> next;

        ptr -> next = temp -> next;

        temp -> next -> prev = ptr;

        free(temp);

        printf("\nnode deleted\n");

    }

}

void display()

{

    struct node \*ptr;

    printf("\n printing values...\n");

    ptr = head;

    while(ptr != NULL)

    {

        printf("%d\n",ptr->data);

        ptr=ptr->next;

    }

}

void search()

{

    struct node \*ptr;

    int item,i=0,flag;

    ptr = head;

    if(ptr == NULL)

    {

        printf("\nEmpty List\n");

    }

    else

    {

        printf("\nEnter item which you want to search?\n");

        scanf("%d",&item);

        while (ptr!=NULL)

        {

            if(ptr->data == item)

            {

                printf("\nitem found at location %d ",i+1);

                flag=0;

                break;

            }

            else

            {

                flag=1;

            }

            i++;

            ptr = ptr -> next;

        }

        if(flag==1)

        {

            printf("\nItem not found\n");

        }

    }

}

1. Write a program to create a Binary Search Tree and display its contents using recursive preorder, postorder and inorder traversal.

**CODE-**

#include <stdio.h>

#include <stdlib.h>

enum Traversal {PREORDER, INORDER, POSTORDER};

typedef enum Traversal Traversal;

typedef struct Node Node;

struct Node {

    int value;

    Node\* left, \*right;

};

Node\* init\_tree(int data) {

    Node\* root = (Node\*) malloc (sizeof(Node));

    root->left = root->right = NULL;

    root->value = data;

    return root;

}

Node\* create\_node(int data) {

    Node\* node = (Node\*) malloc (sizeof(Node));

    node->value = data;

    node->left = node->right = NULL;

    return node;

}

void free\_tree(Node\* root) {

    Node\* temp = root;

    if (!temp)

        return;

    free\_tree(temp->left);

    free\_tree(temp->right);

    if (!temp->left && !temp->right) {

        free(temp);

        return;

    }}

void print\_tree(Traversal traversal, Node\* root) {

    if (!root)

        return;

    switch(traversal) {

        case (PREORDER):

            printf("%d -> ", root->value);

            print\_tree(traversal, root->left);

            print\_tree(traversal, root->right);

            break;

        case (INORDER):

            print\_tree(traversal, root->left);

            printf("%d -> ", root->value);

            print\_tree(traversal, root->right);

            break;

        case (POSTORDER):

            print\_tree(traversal, root->left);

            print\_tree(traversal, root->right);

            printf("%d -> ", root->value);

            break;

    }}

int main() {

    Node\* root = init\_tree(10);

    root->left = create\_node(20);

    root->right = create\_node(30);

    root->left->left = create\_node(40);

    root->left->right = create\_node(50);

    root->right->left = create\_node(60);

    root->right->right = create\_node(70);

    printf("Preorder Traversal:\n");

    print\_tree(PREORDER, root);

    printf("\n\n");

    printf("Inorder Traversal:\n");

    print\_tree(INORDER, root);

    printf("\n\n");

    printf("Postorder Traversal:\n");

    print\_tree(POSTORDER, root);

    printf("\n\n");

    free\_tree(root);

    return 0;

}

1. Write a program to implement deletion of a node in binary search tree

**CODE-**

#include <stdio.h>

#include <stdlib.h>

struct node {

    int key;

    struct node \*left, \*right;

};

struct node\* newNode(int item)

{

    struct node\* temp

        = (struct node\*)malloc(sizeof(struct node));

    temp->key = item;

    temp->left = temp->right = NULL;

    return temp;

}

void inorder(struct node\* root)

{

    if (root != NULL) {

        inorder(root->left);

        printf("%d ", root->key);

        inorder(root->right);

    }

}

struct node\* insert(struct node\* node, int key)

{

    if (node == NULL)

        return newNode(key);

    if (key < node->key)

        node->left = insert(node->left, key);

    else

        node->right = insert(node->right, key);

    return node;

}

struct node\* minValueNode(struct node\* node)

{

    struct node\* current = node;

    while (current && current->left != NULL)

        current = current->left;

    return current;

}

struct node\* deleteNode(struct node\* root, int key)

{

    if (root == NULL)

        return root;

    if (key < root->key)

        root->left = deleteNode(root->left, key);

    else if (key > root->key)

        root->right = deleteNode(root->right, key);

    else {

        if (root->left == NULL) {

            struct node\* temp = root->right;

            free(root);

            return temp;

        }

        else if (root->right == NULL) {

            struct node\* temp = root->left;

            free(root);

            return temp;

        }

        struct node\* temp = minValueNode(root->right);

        root->key = temp->key;

        root->right = deleteNode(root->right, temp->key);

    }

    return root;

}

int main()

{

    struct node\* root = NULL;

    root = insert(root, 50);

    root = insert(root, 30);

    root = insert(root, 20);

    root = insert(root, 40);

    root = insert(root, 70);

    root = insert(root, 60);

    root = insert(root, 80);

    printf("Inorder traversal of the given tree \n");

    inorder(root);

    printf("\nDelete 20\n");

    root = deleteNode(root, 20);

    printf("Inorder traversal of the modified tree \n");

    inorder(root);

    printf("\nDelete 30\n");

    root = deleteNode(root, 30);

    printf("Inorder traversal of the modified tree \n");

    inorder(root);

    printf("\nDelete 50\n");

    root = deleteNode(root, 50);

    printf("Inorder traversal of the modified tree \n");

    inorder(root);

    return 0;

}

1. Write a program to implement Binary tree and display the contents using non-recursive preorder, postorder and inorder traversal techniques.

**CODE-**

#include<stdio.h>

#include<stdlib.h>

#define bool int

struct tNode

{

   int data;

   struct tNode\* left;

   struct tNode\* right;

};

struct sNode

{

  struct tNode \*t;

  struct sNode \*next;

};

void push(struct sNode\*\* top\_ref, struct tNode \*t);

struct tNode \*pop(struct sNode\*\* top\_ref);

bool isEmpty(struct sNode \*top);

void inOrder(struct tNode \*root)

{

  struct tNode \*current = root;

  struct sNode \*s = NULL;

  bool done = 0;

  while (!done)

  {

    if(current !=  NULL)

    {

      push(&s, current);

      current = current->left;

    }

    else

    {

      if (!isEmpty(s))

      {

        current = pop(&s);

        printf("%d ", current->data);

        current = current->right;

      }

      else

        done = 1;

    }

  }

}

void push(struct sNode\*\* top\_ref, struct tNode \*t)

{

  struct sNode\* new\_tNode =

            (struct sNode\*) malloc(sizeof(struct sNode));

  if(new\_tNode == NULL)

  {

     printf("Stack Overflow \n");

     getchar();

     exit(0);

  }

  /\* put in the data  \*/

  new\_tNode->t  = t;

  new\_tNode->next = (\*top\_ref);

  (\*top\_ref)    = new\_tNode;

}

bool isEmpty(struct sNode \*top)

{

   return (top == NULL)? 1 : 0;

}

struct tNode \*pop(struct sNode\*\* top\_ref)

{

  struct tNode \*res;

  struct sNode \*top;

  if(isEmpty(\*top\_ref))

  {

     printf("Stack Underflow \n");

     getchar();

     exit(0);

  }

  else

  {

     top = \*top\_ref;

     res = top->t;

     \*top\_ref = top->next;

     free(top);

     return res;

  }

}

struct tNode\* newtNode(int data)

{

  struct tNode\* tNode = (struct tNode\*)

                       malloc(sizeof(struct tNode));

  tNode->data = data;

  tNode->left = NULL;

  tNode->right = NULL;

  return(tNode);

}

int main()

{

  struct tNode \*root = newtNode(1);

  root->left        = newtNode(2);

  root->right       = newtNode(3);

  root->left->left  = newtNode(4);

  root->left->right = newtNode(5);

  inOrder(root);

  getchar();

  return 0;

}

1. Write a program to sort the given array using HeapSort.

**CODE-**

#include <stdio.h>

void main()

{

    int heap[10], no, i, j, c, root, temp;

    printf("\n Enter no of elements :");

    scanf("%d", &no);

    printf("\n Enter the nos : ");

    for (i = 0; i < no; i++)

       scanf("%d", &heap[i]);

    for (i = 1; i < no; i++)

    {

        c = i;

        do

        {

            root = (c - 1) / 2;

            if (heap[root] < heap[c])   /\* to create MAX heap array \*/

            {

                temp = heap[root];

                heap[root] = heap[c];

                heap[c] = temp;

            }

            c = root;

        } while (c != 0);

    }

    printf("Heap array : ");

    for (i = 0; i < no; i++)

        printf("%d\t ", heap[i]);

    for (j = no - 1; j >= 0; j--)

    {

        temp = heap[0];

        heap[0] = heap[j];    /\* swap max element with rightmost leaf element \*/

        heap[j] = temp;

        root = 0;

        do

        {

            c = 2 \* root + 1;    /\* left node of root element \*/

            if ((heap[c] < heap[c + 1]) && c < j-1)

                c++;

            if (heap[root]<heap[c] && c<j

            {

                temp = heap[root];

                heap[root] = heap[c];

                heap[c] = temp;

            }

            root = c;

        } while (c < j);

    }

    printf("\n The sorted array is : ");

    for (i = 0; i < no; i++)

       printf("\t %d", heap[i]);

    printf("\n Complexity : \n Best case = Avg case = Worst case = O(n logn) \n");

}

1. Write a program of Graph traversal-Depth first search and Breadth first search.

**CODE-**

#include <stdio.h>

#include <stdlib.h>

#define SIZE 40

struct queue {

  int items[SIZE];

  int front;

  int rear;

};

struct queue\* createQueue();

void enqueue(struct queue\* q, int);

int dequeue(struct queue\* q);

void display(struct queue\* q);

int isEmpty(struct queue\* q);

void printQueue(struct queue\* q);

struct node {

  int vertex;

  struct node\* next;

};

struct node\* createNode(int);

struct Graph {

  int numVertices;

  struct node\*\* adjLists;

  int\* visited;

};

void bfs(struct Graph\* graph, int startVertex) {

  struct queue\* q = createQueue();

  graph->visited[startVertex] = 1;

  enqueue(q, startVertex);

  while (!isEmpty(q)) {

    printQueue(q);

    int currentVertex = dequeue(q);

    printf("Visited %d\n", currentVertex);

    struct node\* temp = graph->adjLists[currentVertex];

    while (temp) {

      int adjVertex = temp->vertex;

      if (graph->visited[adjVertex] == 0) {

        graph->visited[adjVertex] = 1;

        enqueue(q, adjVertex);

      }

      temp = temp->next;

    }

  }

}

struct node\* createNode(int v) {

  struct node\* newNode = malloc(sizeof(struct node));

  newNode->vertex = v;

  newNode->next = NULL;

  return newNode;

}

struct Graph\* createGraph(int vertices) {

  struct Graph\* graph = malloc(sizeof(struct Graph));

  graph->numVertices = vertices;

  graph->adjLists = malloc(vertices \* sizeof(struct node\*));

  graph->visited = malloc(vertices \* sizeof(int));

  int i;

  for (i = 0; i < vertices; i++) {

    graph->adjLists[i] = NULL;

    graph->visited[i] = 0;

  }

  return graph;

}

void addEdge(struct Graph\* graph, int src, int dest) {

  struct node\* newNode = createNode(dest);

  newNode->next = graph->adjLists[src];

  graph->adjLists[src] = newNode;

  newNode = createNode(src);

  newNode->next = graph->adjLists[dest];

  graph->adjLists[dest] = newNode;

}

struct queue\* createQueue() {

  struct queue\* q = malloc(sizeof(struct queue));

  q->front = -1;

  q->rear = -1;

  return q;

}

int isEmpty(struct queue\* q) {

  if (q->rear == -1)

    return 1;

  else

    return 0;

}

void enqueue(struct queue\* q, int value) {

  if (q->rear == SIZE - 1)

    printf("\nQueue is Full!!");

  else {

    if (q->front == -1)

      q->front = 0;

    q->rear++;

    q->items[q->rear] = value;

  }

}

int dequeue(struct queue\* q) {

  int item;

  if (isEmpty(q)) {

    printf("Queue is empty");

    item = -1;

  } else {

    item = q->items[q->front];

    q->front++;

    if (q->front > q->rear) {

      printf("Resetting queue ");

      q->front = q->rear = -1;

    }

  }

  return item;

}

void printQueue(struct queue\* q) {

  int i = q->front;

  if (isEmpty(q)) {

    printf("Queue is empty");

  } else {

    printf("\nQueue contains \n");

    for (i = q->front; i < q->rear + 1; i++) {

      printf("%d ", q->items[i]);

    }

  }

}

int main() {

  struct Graph\* graph = createGraph(6);

  addEdge(graph, 0, 1);

  addEdge(graph, 0, 2);

  addEdge(graph, 1, 2);

  addEdge(graph, 1, 4);

  addEdge(graph, 1, 3);

  addEdge(graph, 2, 4);

  addEdge(graph, 3, 4);

  bfs(graph, 0);

  return 0;

}

1. Write a program to implement Prim’s algorithm.

**CODE-**

#include<stdio.h>

#include<stdlib.h>

#define infinity 9999

#define MAX 20

int G[MAX][MAX],spanning[MAX][MAX],n;

int prims();

int main()

{

int i,j,total\_cost;

printf("Enter no. of vertices:");

scanf("%d",&n);

printf("\nEnter the adjacency matrix:\n");

for(i=0;i<n;i++)

for(j=0;j<n;j++)

scanf("%d",&G[i][j]);

total\_cost=prims();

printf("\nspanning tree matrix:\n");

for(i=0;i<n;i++)

{

printf("\n");

for(j=0;j<n;j++)

printf("%d\t",spanning[i][j]);

}

printf("\n\nTotal cost of spanning tree=%d",total\_cost);

return 0;

}

int prims()

{

int cost[MAX][MAX];

int u,v,min\_distance,distance[MAX],from[MAX];

int visited[MAX],no\_of\_edges,i,min\_cost,j;

for(i=0;i<n;i++)

for(j=0;j<n;j++)

{

if(G[i][j]==0)

cost[i][j]=infinity;

else

cost[i][j]=G[i][j];

spanning[i][j]=0;

}

distance[0]=0;

visited[0]=1;

for(i=1;i<n;i++)

{

distance[i]=cost[0][i];

from[i]=0;

visited[i]=0;

}

min\_cost=0;

no\_of\_edges=n-1;

while(no\_of\_edges>0)

{

min\_distance=infinity;

for(i=1;i<n;i++)

if(visited[i]==0&&distance[i]<min\_distance)

{

v=i;

min\_distance=distance[i];

}

u=from[v];

spanning[u][v]=distance[v];

spanning[v][u]=distance[v];

no\_of\_edges--;

visited[v]=1;

for(i=1;i<n;i++)

if(visited[i]==0&&cost[i][v]<distance[i])

{

distance[i]=cost[i][v];

from[i]=v;

}

min\_cost=min\_cost+cost[u][v];

}

return(min\_cost);

}

1. Write a program to implement Kruskal algorithm.

**CODE-**

#include<stdio.h>

#define MAX 30

typedef struct edge

{

int u,v,w;

}edge;

typedef struct edgelist

{

edge data[MAX];

int n;

}edgelist;

edgelist elist;

int G[MAX][MAX],n;

edgelist spanlist;

void kruskal();

int find(int belongs[],int vertexno);

void union1(int belongs[],int c1,int c2);

void sort();

void print();

void main()

{

int i,j,total\_cost;

printf("\nEnter number of vertices:");

scanf("%d",&n);

printf("\nEnter the adjacency matrix:\n");

for(i=0;i<n;i++)

for(j=0;j<n;j++)

scanf("%d",&G[i][j]);

kruskal();

print();

}

void kruskal()

{

int belongs[MAX],i,j,cno1,cno2;

elist.n=0;

for(i=1;i<n;i++)

for(j=0;j<i;j++)

{

if(G[i][j]!=0)

{

elist.data[elist.n].u=i;

elist.data[elist.n].v=j;

elist.data[elist.n].w=G[i][j];

elist.n++;

}

}

sort();

for(i=0;i<n;i++)

belongs[i]=i;

spanlist.n=0;

for(i=0;i<elist.n;i++)

{

cno1=find(belongs,elist.data[i].u);

cno2=find(belongs,elist.data[i].v);

if(cno1!=cno2)

{

spanlist.data[spanlist.n]=elist.data[i];

spanlist.n=spanlist.n+1;

union1(belongs,cno1,cno2);

}}}

int find(int belongs[],int vertexno)

{

return(belongs[vertexno]);

}

void union1(int belongs[],int c1,int c2)

{

int i;

for(i=0;i<n;i++)

if(belongs[i]==c2)

belongs[i]=c1;

}

void sort()

{

int i,j;

edge temp;

for(i=1;i<elist.n;i++)

for(j=0;j<elist.n-1;j++)

if(elist.data[j].w>elist.data[j+1].w)

{

temp=elist.data[j];

elist.data[j]=elist.data[j+1];

elist.data[j+1]=temp;}}

void print()

{

int i,cost=0;

for(i=0;i<spanlist.n;i++)

{

printf("\n%d\t%d\t%d",spanlist.data[i].u,spanlist.data[i].v,spanlist.data[i].w);

cost=cost+spanlist.data[i].w;

}

printf("\n\nCost of the spanning tree=%d",cost);

}