CSA0609- DAA LAB PROGRAMS

1. Write a c-program to print Fibonacci series using recursion.

Code:

```
#include<stdio.h>
int fib(int n){
   if(n==0){
        return 0;
        }
        else if(n==1){

                return 1;
        }
        else{
                return (fib(n-1)+fib(n-2));
        }
}
int main(){
        int num;
        printf("enter num:");
        scanf("%d",&num);
        printf("fibonacci series: \n ");
        for(int i=0;i<num;i++){
                printf("%d ",fib(i));
        }
        return 0;
}
```

Output:

```
enter num:8
fibonacci series:
 0 1 1 2 3 5 8 13
--------------------------------
Process exited after 1.859 seconds with return value 0
Press any key to continue . . .
```

2. Write a c-program to check the given number is Armstrong or not using recursion.

Code:

```
#include <stdio.h>
#include <math.h>
int countDigits(int n) {
    if (n == 0)
        return 0;
    return 1 + countDigits(n / 10);
}
int isArmstrongRec(int n, int numDigits) {
    if (n == 0)
        return 0;
    int digit = n % 10;
    return pow(digit, numDigits) + isArmstrongRec(n / 10, numDigits);
}
int isArmstrong(int n) {
    int numDigits = countDigits(n);
    return (n == isArmstrongRec(n, numDigits));
}
int main() {
    int num;
    printf("Enter a number: ");
    scanf("%d", &num);
    printf("digits:",countDigits(num));
    if (isArmstrong(num))
        printf("%d is an Armstrong number.\n", num);
    else
        printf("%d is not an Armstrong number.\n", num);

    return 0;
}
```

Output:

```
Enter a number: 153
digits:153 is an Armstrong number.

--------------------------------
Process exited after 6.825 seconds with return value 0
Press any key to continue . . .
```

3. Write a c-program to find GCD of two numbers.

Code:

```
#include <stdio.h>
int gcd(int a, int b) {
    if (b == 0)
        return a;
    return gcd(b, a % b);
}
int main() {
    int num1, num2;
    printf("Enter two numbers: ");
    scanf("%d %d", &num1, &num2);
    int result = gcd(num1, num2);
    printf("GCD of %d and %d is: %d\n", num1, num2, result);
    return 0;
}
```

Output:

```
Enter two numbers: 48 18
GCD of 48 and 18 is: 6

--------------------------------
Process exited after 13.14 seconds with return value 0
Press any key to continue . . .
```

4. Write a c-program to find largest element in the array.

Code:

```
#include<stdio.h>
int main(){
    int n;
    printf("enter size: ");
    scanf("%d",&n);
    int arr[n];
    for(int i=0;i<n;i++){
        scanf("%d",&arr[i]);
    }
    int max=arr[0];
    for(int i=0;i<n;i++){
        if(arr[i]>max){
            max=arr[i];
        }
    }
    printf("Largest number is : %d",max);
}
```

Output:

```
enter size: 5
12 34 23 567 43
Largest number is : 567
--------------------------------
Process exited after 34.35 seconds with return value 0
Press any key to continue . . .
```

5. Write a c-program to find factorial of given number.

Code:

```
#include <stdio.h>
int fact(int n){
    if(n==0||n==1){
        return 1;
    }
    return n*fact(n-1);
}
int main(){
    printf("enter Number: ");
    int num;
    scanf("%d",&num);
    printf("Factorial is: %d",fact(num));
}
```

Output:

```
enter Number: 5
Factorial is: 120
--------------------------------
Process exited after 8.956 seconds with return value 0
Press any key to continue . . .
```

6. Write a c-program to check the given number is prime or not.

Code:

```
#include <stdio.h>
int isprime(int a,int i){
    if (a<=2){
        return(a==2)? 1:0;
    }
    if(a%i==0){
        return 0;
    }
    if(i*i>a){
        return 1;
    }
    return (isprime(a,i+1));
}

int main(){
    printf("Enter a number: ");
    int num;
    scanf("%d",&num);
    if(isprime(num,2)){
        printf("Prime number!");
    }
    else{
        printf("Not prime number");
    }
}
```

Output:

```
Enter a number: 17
Prime number!
--------------------------------
Process exited after 6.574 seconds with return value 0
Press any key to continue . . .
```

7. Write a c-program to sort the list using selection sort.

Code:

```
#include <stdio.h>
void selectionSort(int arr[], int n) {
    int i, j, minIndex, temp;

    for (i = 0; i < n-1; i++) {
        minIndex = i;
        for (j = i+1; j < n; j++) {
            if (arr[j] < arr[minIndex]) {
                minIndex = j;
            }
        }
        if (minIndex != i) {
            temp = arr[i];
            arr[i] = arr[minIndex];
            arr[minIndex] = temp;
        }
    }
}

int main() {
    int n, i;
    printf("Enter the number of elements in the array: ");
    scanf("%d", &n);

    int arr[n];
    printf("Enter the elements of the array:\n");
    for (i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }
    selectionSort(arr, n);
```

```
    printf("Sorted array: ");
    for (i = 0; i < n; i++) {
        printf("%d ", arr[i]);
    }
    printf("\n");
    return 0;
}
```

Output:

```
Enter the number of elements in the array: 5
Enter the elements of the array:
12 32 123 45 654
Sorted array: 12 32 45 123 654

--------------------------------
Process exited after 12.99 seconds with return value 0
Press any key to continue . . .
```

8. Write a c-program to sort the array using bubble sort.

Code:

```
#include <stdio.h>
void bubbleSort(int arr[], int n) {
    int i, j, temp;

    for (i = 0; i < n-1; i++) {

        for (j = 0; j < n-i-1; j++) {
            if (arr[j] > arr[j+1]) {
                temp = arr[j];
                arr[j] = arr[j+1];
                arr[j+1] = temp;
            }
        }
    }
```

```
}

int main() {
    int n, i;
    printf("Enter the number of elements in the array: ");
    scanf("%d", &n);

    int arr[n];

    printf("Enter the elements of the array:\n");
    for (i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }
    bubbleSort(arr, n);
    printf("Sorted array: ");
    for (i = 0; i < n; i++) {
        printf("%d ", arr[i]);
    }
    printf("\n");

    return 0;
}
```

Output:

```
Enter the number of elements in the array: 5
Enter the elements of the array:
13 21 54 23 12
Sorted array: 12 13 21 23 54

--------------------------------
Process exited after 14.83 seconds with return value 0
Press any key to continue . . .
```

9. Write a c-program to find time complexity for matrix multiplication.

Code:

```
#include <stdio.h>
void multiplyMatrices(int mat1[][10], int mat2[][10], int res[][10], int r1, int c1, int c2) {
    int i, j, k;
    for (i = 0; i < r1; i++) {
        for (j = 0; j < c2; j++) {
            res[i][j] = 0;
        }
    }
    int operationCount = 0;
    for (i = 0; i < r1; i++){
        for (j = 0; j < c2; j++) {
            for (k = 0; k < c1; k++) {
                res[i][j] += mat1[i][k] * mat2[k][j];
                operationCount++;
            }
        }
    }
    printf("Number of operations performed (Time Complexity): %d\n", operationCount);
}

int main() {
    int r1, c1, r2, c2;
    printf("Enter rows and columns for the first matrix: ");
    scanf("%d %d", &r1, &c1);
    printf("Enter rows and columns for the second matrix: ");
    scanf("%d %d", &r2, &c2);
    if (c1 != r2) {
        printf("Matrix multiplication not possible.\n");
        return 0;
    }
```

```
    int mat1[10][10], mat2[10][10], res[10][10];
    printf("Enter elements of the first matrix:\n");
    for (int i = 0; i < r1; i++) {
        for (int j = 0; j < c1; j++) {
            scanf("%d", &mat1[i][j]);
        }
    }
    printf("Enter elements of the second matrix:\n");
    for (int i = 0; i < r2; i++) {
        for (int j = 0; j < c2; j++) {
            scanf("%d", &mat2[i][j]);
        }
    }
    multiplyMatrices(mat1, mat2, res, r1, c1, c2);

    printf("Resultant Matrix:\n");
    for (int i = 0; i < r1; i++) {
        for (int j = 0; j < c2; j++) {
            printf("%d ", res[i][j]);
        }
        printf("\n");
    }

    return 0;
}
```

Output:

```
Enter rows and columns for the first matrix: 3
3
Enter rows and columns for the second matrix: 3 3
Enter elements of the first matrix:
2 2 2
2 2 2
2 2 2
Enter elements of the second matrix:
2 2 2
2 2 2
2 2 2
Number of operations performed (Time Complexity): 27
Resultant Matrix:
12 12 12
12 12 12
12 12 12

--------------------------------
Process exited after 79.69 seconds with return value 0
Press any key to continue . . .
```

10. Write a c-program to check given number is palindrome or not.

Code:

```
#include <stdio.h>
#include <string.h>
int palindrome(char s[],int st,int en){
   if(st>=en){
      return 1;
   }
   if(s[st]!=s[en]){
      return 0;
   }
   return (palindrome(s,st+1,en-1));
}
int main(){
   char s[20];
```

```
    printf("enter a string: ");
    scanf("%s",s);
    int n;
    n=strlen(s);
    int end=n-1;
    if(palindrome(s,0,end)){
        printf("Palindrome!!");
    }
    else{
        printf("Not palindrome");
    }

}
```

Output:

```
enter a string: 12321
Palindrome!!
--------------------------------
Process exited after 4.284 seconds with return value 0
Press any key to continue . . .
```

11. Write a c-program to copy one string to another.

Code:

```
#include<stdio.h>
void copystring(const char *source ,char *destination){
    int i;
    for(int i=0;source[i]!= '\0';i++){
            destination[i]=source[i];
    }
    destination[i]='\0';
}
int main(){
    char source[]="hello world";
```

```
    char destination[1000];
    copystring(source,destination);
    printf("source string : %s\n",source);
    printf("copied string : %s",destination);
    return 0;
}
```

Output:

```
source string : hello world
copied string : hello world
--------------------------------
Process exited after 10.08 seconds with return value 0
Press any key to continue . . .
```

12. Write a c-program to perform binary search.

Code:

```
#include<stdio.h>
void sorted(int array[], int n){
    for(int i=0;i<n-1;i++){
            for(int j=0;j<n-i-1;j++){
                    if(array[j]>array[j+1]){
                            int temp=array[j];
                            array[j]=array[j+1];
                            array[j+1]=temp;
                    }
            }
    }
    for(int i=0;i<n;i++){
            printf(" %d",array[i]);
    }
    printf("]");
}
int binarysearch(int array[], int n,int target){
```

```
    int low=0,high=n-1;
    while(low<=high){
    int mid=(low+high)/2;
    if(array[mid]==target){
            return mid;
       }
    else if(array[mid]>target){
            high=mid-1;
    }
    else{
            low=mid+1;
            }
   }
   return -1;
}
int main(){
            int n,target;
            printf("enter no of elements in array:");
            scanf("%d",&n);
            int array[n],i,j;
            printf("enter elements in array:");
            for(i=0;i<n;i++){
                    scanf("%d",&array[i]);
            }
            printf("input array=[");
            for(i=0;i<n;i++){
                    printf(" %d",array[i]);
    }
    printf("]");
    printf("\nenter target element:");
    scanf("%d",&target);
    printf("sorted array:[");
```

```
        sorted(array,n);
        int result=binarysearch(array,n,target);
        printf("\n%d is found at index %d",target,result);
        return 0;
}
```

Output:

```
enter no of elements in array:7
enter elements in array:23 45 76 23 8 34 29
input array=[ 23 45 76 23 8 34 29]
enter target element:34
sorted array:[ 8 23 23 29 34 45 76]
34 is found at index 4
--------------------------------
Process exited after 30.96 seconds with return value 0
Press any key to continue . . .
```

13. Write a c-program to print reverse of a string.

Code:

```
#include<stdio.h>
#include<string.h>
void reversestring(char s[]){
    int len=strlen(s);
    int start=0,end=len-1;
    while(start<end){
        int temp=s[start];
        s[start]=s[end];
        s[end]=temp;
        start++;
        end--;
    }
}
int main(){
    char s[100];
```

```
    printf("enter a string:");
    scanf("%s",&s);
    reversestring(s);
    printf("reversed string: %s",s);

}
```

Output:

```
enter a string:pradeep
reversed string: peedarp
--------------------------------
Process exited after 4.653 seconds with return value 0
Press any key to continue . . .
```

14. Write a c-program to print Fibonacci series using recursion.

Code:

```
#include<stdio.h>
void stringlen(char s[]){
    int i,count=0;
    for(i=0;s[i]!='\0';i++){
            if(s[i]!='\n'){
                    count++;
            }
    }
    printf("length of string %s is %d",s,count);
}
int main(){
    char str[100];
    printf("enter the string:");
    scanf("%s",&str);
    stringlen(str);
    return 0;
}
```

Output:

```
enter the string:saveetha
length of string saveetha is 8
--------------------------------
Process exited after 16.48 seconds with return value 0
Press any key to continue . . .
```

15. Write a c-program to perform Strassen matrix multiplication.

Code:

```
#include <stdio.h>
#include <stdlib.h>
#define MAX 4
void add(int A[MAX][MAX], int B[MAX][MAX], int C[MAX][MAX], int size) {
    for (int i = 0; i < size; i++) {
        for (int j = 0; j < size; j++) {
            C[i][j] = A[i][j] + B[i][j];
        }
    }
}
void subtract(int A[MAX][MAX], int B[MAX][MAX], int C[MAX][MAX], int size) {
    for (int i = 0; i < size; i++) {
        for (int j = 0; j < size; j++) {
            C[i][j] = A[i][j] - B[i][j];
        }
    }
}
void strassen(int A[MAX][MAX], int B[MAX][MAX], int C[MAX][MAX], int size) {
    if (size == 1) {
        C[0][0] = A[0][0] * B[0][0];
        return;
    }

    int newSize = size / 2;
```

```
    int A11[MAX][MAX], A12[MAX][MAX], A21[MAX][MAX], A22[MAX][MAX];
    int B11[MAX][MAX], B12[MAX][MAX], B21[MAX][MAX], B22[MAX][MAX];
    int C11[MAX][MAX], C12[MAX][MAX], C21[MAX][MAX], C22[MAX][MAX];
    int M1[MAX][MAX], M2[MAX][MAX], M3[MAX][MAX], M4[MAX][MAX],
M5[MAX][MAX], M6[MAX][MAX], M7[MAX][MAX];
    int temp1[MAX][MAX], temp2[MAX][MAX];
    for (int i = 0; i < newSize; i++) {
        for (int j = 0; j < newSize; j++) {
            A11[i][j] = A[i][j];
            A12[i][j] = A[i][j + newSize];
            A21[i][j] = A[i + newSize][j];
            A22[i][j] = A[i + newSize][j + newSize]
            B11[i][j] = B[i][j];
            B12[i][j] = B[i][j + newSize];
            B21[i][j] = B[i + newSize][j];
            B22[i][j] = B[i + newSize][j + newSize];
        }
    }
    add(A11, A22, temp1, newSize);
    add(B11, B22, temp2, newSize);
    strassen(temp1, temp2, M1, newSize);

    add(A21, A22, temp1, newSize);
    strassen(temp1, B11, M2, newSize);

    subtract(B12, B22, temp2, newSize);
    strassen(A11, temp2, M3, newSize);

    subtract(B21, B11, temp2, newSize);
    strassen(A22, temp2, M4, newSize);

    add(A11, A12, temp1, newSize);
```

```
    strassen(temp1, B22, M5, newSize);

    subtract(A21, A11, temp1, newSize);
    add(B11, B12, temp2, newSize);
    strassen(temp1, temp2, M6, newSize);

    subtract(A12, A22, temp1, newSize);
    add(B21, B22, temp2, newSize);
    strassen(temp1, temp2, M7, newSize);

    add(M1, M4, temp1, newSize);
    subtract(temp1, M5, temp2, newSize);
    add(temp2, M7, C11, newSize);

    add(M3, M5, C12, newSize);

    add(M2, M4, C21, newSize);

    add(M1, M3, temp1, newSize);
    subtract(temp1, M2, temp2, newSize);
    add(temp2, M6, C22, newSize);

    for (int i = 0; i < newSize; i++) {
        for (int j = 0; j < newSize; j++) {
            C[i][j] = C11[i][j];
            C[i][j + newSize] = C12[i][j];
            C[i + newSize][j] = C21[i][j];
            C[i + newSize][j + newSize] = C22[i][j];
        }
    }
}
void inputMatrix(int A[MAX][MAX], int size) {
```

```
    printf("Enter elements of the matrix:\n");
    for (int i = 0; i < size; i++) {
        for (int j = 0; j < size; j++) {
            scanf("%d", &A[i][j]);
        }
    }
}
void displayMatrix(int A[MAX][MAX], int size) {
    printf("Result matrix:\n");
    for (int i = 0; i < size; i++) {
        for (int j = 0; j < size; j++) {
            printf("%d ", A[i][j]);
        }
        printf("\n");
    }
}
int main() {
    int size = MAX;
    int A[MAX][MAX], B[MAX][MAX], C[MAX][MAX];
    inputMatrix(A, size);
    inputMatrix(B, size);
    strassen(A, B, C, size);
    displayMatrix(C, size);
    return 0;
}
```

Output:

```
Enter elements of the matrix:
2 2 2 2
2 2 2 2
2 2 2 2
2 2 2 2
Enter elements of the matrix:
2 2 2 2
2 2 2 2
2 2 2 2
2 2 2 2
Result matrix:
16 16 16 16
16 16 16 16
16 16 16 16
16 16 16 16

--------------------------------
Process exited after 23.04 seconds with return value 0
Press any key to continue . . .
```

16. Write a c-program to perform merge sort.

Code:

```
#include <stdio.h>
void merge(int arr[], int left, int mid, int right) {
    int n1 = mid - left + 1;
    int n2 = right - mid;
    int L[n1], R[n2];
    for (int i = 0; i < n1; i++) {
        L[i] = arr[left + i];
    }
    for (int j = 0; j < n2; j++) {
        R[j] = arr[mid + 1 + j];
    }
    int i = 0, j = 0, k = left;
    while (i < n1 && j < n2) {
```

```
        if (L[i] <= R[j]) {
            arr[k] = L[i];
            i++;
        } else {
            arr[k] = R[j];
            j++;
        }
        k++;
    }
    while (i < n1) {
        arr[k] = L[i];
        i++;
        k++;
    }
    while (j < n2) {
        arr[k] = R[j];
        j++;
        k++;
    }
}
void mergeSort(int arr[], int left, int right) {
    if (left < right) {
        int mid = left + (right - left) / 2;
        mergeSort(arr, left, mid);
        mergeSort(arr, mid + 1, right);
        merge(arr, left, mid, right);
    }
}
void printArray(int arr[], int size) {
    for (int i = 0; i < size; i++) {
        printf("%d ", arr[i]);
    }
```

```
    printf("\n");
}
int main() {
    int arrSize;
    printf("Enter the number of elements: ");
    scanf("%d", &arrSize);
    int arr[arrSize];
    printf("Enter the elements of the array:\n");
    for (int i = 0; i < arrSize; i++) {
        scanf("%d", &arr[i]);
    }
    printf("Original array: \n");
    printArray(arr, arrSize);
    mergeSort(arr, 0, arrSize - 1);
    printf("Sorted array: \n");
    printArray(arr, arrSize);
    return 0;
}
```

Output:

```
Enter the number of elements: 5
Enter the elements of the array:
34 56 43 12 4
Original array:
34 56 43 12 4
Sorted array:
4 12 34 43 56

--------------------------------
Process exited after 12.14 seconds with return value 0
Press any key to continue . . .
```

17. Write a c-program to find max and min in the given list using divide and conquer.

Code:

```
#include <stdio.h>
void findMaxMin(int arr[], int low, int high, int *max, int *min) {
    if (low == high) {
        *max = arr[low];
        *min = arr[low];
    }
    else if (high == low + 1) {
        if (arr[low] > arr[high]) {
            *max = arr[low];
            *min = arr[high];
        } else {
            *max = arr[high];
            *min = arr[low];
        }
    }
    else {
        int mid = (low + high) / 2;
        int max1, min1, max2, min2;
                findMaxMin(arr, low, mid, &max1, &min1);
                findMaxMin(arr, mid + 1, high, &max2, &min2);
                *max = (max1 > max2) ? max1 : max2;
        *min = (min1 < min2) ? min1 : min2;
    }
}
int main() {
    int n,arr[n],max, min;
    printf("enter the number of elements in array:");
    scanf("%d",&n);
    printf("enter the elements of the array:\n");
    for(int i=0;i<n;i++){
```

```
    scanf("%d",&arr[i]);
    }
    findMaxMin(arr, 0, n - 1, &max, &min);
    printf("Maximum value in the list: %d\n", max);
    printf("Minimum value in the list: %d\n", min);
    return 0;
}
```

Output:

```
Enter the number of elements in the array: 6
Enter the elements of the array:
12 35 23 5 6 32
Minimum element: 5
Maximum element: 35

--------------------------------
Process exited after 23.97 seconds with return value 0
Press any key to continue . . .
```

18. Write a c-program to print prime numbers from 1-100.

Code:

```
#include <stdio.h>
#include <stdbool.h>
bool isPrime(int num) {
    if (num <= 1) {
        return false;
    }
    for (int i = 2; i * i <= num; i++) {
        if (num % i == 0) {
            return false;
        }
    }
    return true;
}
```

```
int main() {
    printf("Prime numbers between 1 and 100 are:\n");
    for (int i = 1; i <= 100; i++) {
        if (isPrime(i)) {
            printf("%d ", i);
        }
    }
    return 0;
}
```

Output:

```
Prime numbers between 1 and 100 are:
2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83 89 97
--------------------------------
Process exited after 2.296 seconds with return value 0
Press any key to continue . . .
```

19. Write a c-program to perform knapsack problem using greedy techniques.

Code:

```
#include <stdio.h>
#include <stdlib.h>
struct Item {
    int value;
    int weight;
    float ratio;
};
int compare(const void *a, const void *b) {
    float ratio1 = ((struct Item*)a)->ratio;
    float ratio2 = ((struct Item*)b)->ratio;
    return (ratio2 - ratio1 > 0) - (ratio2 - ratio1 < 0);
}
float knapsack(struct Item items[], int n, int capacity) {
    qsort(items, n, sizeof(struct Item), compare);
    float totalValue = 0.0;
```

```
    int remainingCapacity = capacity;
    for (int i = 0; i < n; i++) {
        if (items[i].weight <= remainingCapacity) {
            remainingCapacity -= items[i].weight;
            totalValue += items[i].value;
        } else {
            totalValue += items[i].value * ((float)remainingCapacity / items[i].weight);
            break;
        }
    }
    return totalValue;
}
int main() {
    int n, capacity;
    printf("Enter the number of items: ");
    scanf("%d", &n);
    printf("Enter the capacity of the knapsack: ");
    scanf("%d", &capacity);
    struct Item items[n];
    printf("Enter the value and weight for each item:\n");
    for (int i = 0; i < n; i++) {
        scanf("%d %d", &items[i].value, &items[i].weight);
        items[i].ratio = (float)items[i].value / items[i].weight;
    }
        float maxValue = knapsack(items, n, capacity);
        printf("Maximum value that can be obtained: %.2f\n", maxValue);
    return 0;
}
```

Output:

```
Enter the number of items: 4
Enter the capacity of the knapsack: 100
Enter the value and weight for each item:
60 40
70 50
100 30
90 30
Maximum value that can be obtained: 250.00

--------------------------------
Process exited after 72.91 seconds with return value 0
Press any key to continue . . .
```

20. Write a c-program to perform MST using greedy techniques(prims).

Code:

```
#include <stdio.h>
#include <limits.h>
#include <stdbool.h>
#define V 5
int minKey(int key[], bool mstSet[]) {
   int min = INT_MAX, min_index;
   for (int v = 0; v < V; v++)
      if (mstSet[v] == false && key[v] < min) {
         min = key[v];
         min_index = v;
      }
   return min_index;
}
void printMST(int parent[], int graph[V][V]) {
   printf("Edge \tWeight\n");
   for (int i = 1; i < V; i++)
      printf("%d - %d \t%d \n", parent[i], i, graph[i][parent[i]]);
}
void primMST(int graph[V][V]) {
```

```
    int parent[V];
    int key[V];
    bool mstSet[V];
    for (int i = 0; i < V; i++) {
        key[i] = INT_MAX;
        mstSet[i] = false;
    }
    key[0] = 0;
    parent[0] = -1;
    for (int count = 0; count < V - 1; count++) {
        int u = minKey(key, mstSet);
        mstSet[u] = true;
        for (int v = 0; v < V; v++)
            if (graph[u][v] && mstSet[v] == false && graph[u][v] < key[v]) {
                parent[v] = u;
                key[v] = graph[u][v];
            }
    }
    printMST(parent, graph);
}
int main() {
    int graph[V][V] = {
        {0, 2, 0, 6, 0},
        {2, 0, 3, 8, 5},
        {0, 3, 0, 0, 7},
        {6, 8, 0, 0, 9},
        {0, 5, 7, 9, 0}
    };
    primMST(graph);
    return 0;
}
```

Output:

```
Edge    Weight
0 - 1   2
1 - 2   3
0 - 3   6
1 - 4   5

--------------------------------
Process exited after 1.239 seconds with return value 0
Press any key to continue . . .
```

21. Write a c-program to find out optimal binary search tree Using Dynamic programming.

Code:

```
#include<stdio.h>
void sorted(int array[], int n){
    for(int i=0;i<n-1;i++){
        for(int j=0;j<n-i-1;j++){
            if(array[j]>array[j+1]){
                int temp=array[j];
                array[j]=array[j+1];
                array[j+1]=temp;
            }
        }
    }
    for(int i=0;i<n;i++){
        printf(" %d",array[i]);
    }
    printf("]");
}
int binarysearch(int array[], int n,int target){
    int low=0,high=n-1;
    while(low<=high){
    int mid=(low+high)/2;
```

```
    if(array[mid]==target){
            return mid;
       }
    else if(array[mid]>target){
            high=mid-1;
    }
    else{
            low=mid+1;
            }
   }
   return -1;
}
int main(){
            int n,target;
            printf("enter no of elements in array:");
            scanf("%d",&n);
            int array[n],i,j;
            printf("enter elements in array:");
            for(i=0;i<n;i++){
                    scanf("%d",&array[i]);
            }
            printf("input array=[");
            for(i=0;i<n;i++){
                    printf(" %d",array[i]);
    }
    printf("]");
    printf("\nenter target element:");
    scanf("%d",&target);
    printf("sorted array:[");
            sorted(array,n);
            int result=binarysearch(array,n,target);
            printf("\n%d is found at index %d",target,result);
```

```
    return 0;
}
```

Output:

```
Optimal Binary Search Tree Cost Table:
          0     1     2     3
0  0.10  0.40  1.10  1.70
1  0.00  0.20  0.80  1.40
2  0.00  0.00  0.40  1.00
3  0.00  0.00  0.00  0.30

Optimal cost of constructing BST: 1.70

--------------------------------
Process exited after 0.6563 seconds with return value 0
Press any key to continue . . .
```

22. Write a c-program to perform Binomial coefficient of a given number using dynamic programming.

Code:

```
#include <stdio.h>
int binomialCoeff(int n, int k) {
    int C[n + 1][k + 1];
    for (int i = 0; i <= n; i++) {
        for (int j = 0; j <= k && j <= i; j++) {
            if (j == 0 || j == i) {
                C[i][j] = 1;
            } else {
                C[i][j] = C[i - 1][j - 1] + C[i - 1][j];
            }
        }
    }
    return C[n][k];
}
int main() {
    int n, k;
```

```
    printf("Enter n and k for C(n, k): ");
    scanf("%d %d", &n, &k);
    printf("Binomial Coefficient C(%d, %d) is %d\n", n, k, binomialCoeff(n, k));
    return 0;
}
```

Output:

```
Enter n and k for C(n, k): 5 3
Binomial Coefficient C(5, 3) is 10

--------------------------------
Process exited after 2.474 seconds with return value 0
Press any key to continue . . .
```

23. Write a c-program to find the reverse of a given number.

Code:

```
#include <stdio.h>
int reverseNumber(int num) {
    int reversed = 0;
    while (num != 0) {
        int digit = num % 10;
        reversed = reversed * 10 + digit;
        num /= 10;
    }
    return reversed;
}
int main() {
    int num;
    printf("Enter a number: ");
    scanf("%d", &num);

    int reversed = reverseNumber(num);
    printf("Reversed number: %d\n", reversed);
```

```
    return 0;
}
```

Output:

```
Enter a number: 123
Reversed number: 321

--------------------------------
Process exited after 3.454 seconds with return value 0
Press any key to continue . . .
```

24. Write a c-program to find a perfect number.

Code:

```
#include <stdio.h>
int isPerfectNumber(int num) {
    int sum = 0;
    for (int i = 1; i <= num / 2; i++) {
        if (num % i == 0) {
            sum += i;
        }
    }
    if (sum == num) {
        return 1;
    } else {
        return 0;
    }
}
int main() {
    int num;
    printf("Enter a number: ");
    scanf("%d", &num);
    if (isPerfectNumber(num)) {
        printf("%d is a perfect number.\n", num);
    } else {
```

```
        printf("%d is not a perfect number.\n", num);
    }
    return 0;
}
```

Output:

```
Enter a number: 28
28 is a perfect number.

--------------------------------
Process exited after 1.465 seconds with return value 0
Press any key to continue . . .
```

25. Write a c-program to perform TSP using dynamic programming.

Code:

```
#include <stdio.h>
#include <limits.h>
#define MAX 16
#define INF INT_MAX
int dist[MAX][MAX];
int dp[1 << MAX][MAX];
int tsp(int n, int mask, int pos) {
    if (mask == (1 << n) - 1) {
        return dist[pos][0];
    }
    if (dp[mask][pos] != -1) {
        return dp[mask][pos];
    }
    int ans = INF;
    for (int city = 0; city < n; city++) {
        if ((mask & (1 << city)) == 0) {
            int newAns = dist[pos][city] + tsp(n, mask | (1 << city), city);
            ans = (ans < newAns) ? ans : newAns;
        }
```

```
    }
    return dp[mask][pos] = ans;
}
int main() {
    int n;
    printf("Enter the number of cities: ");
    scanf("%d", &n);
    printf("Enter the distance matrix (adjacency matrix):\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &dist[i][j]);
        }
    }
    for (int i = 0; i < (1 << n); i++) {
        for (int j = 0; j < n; j++) {
            dp[i][j] = -1;
        }
    }
    int result = tsp(n, 1, 0);
    printf("The minimum cost to visit all cities and return to the starting city is: %d\n",
result);
    return 0;
}
```

Output:

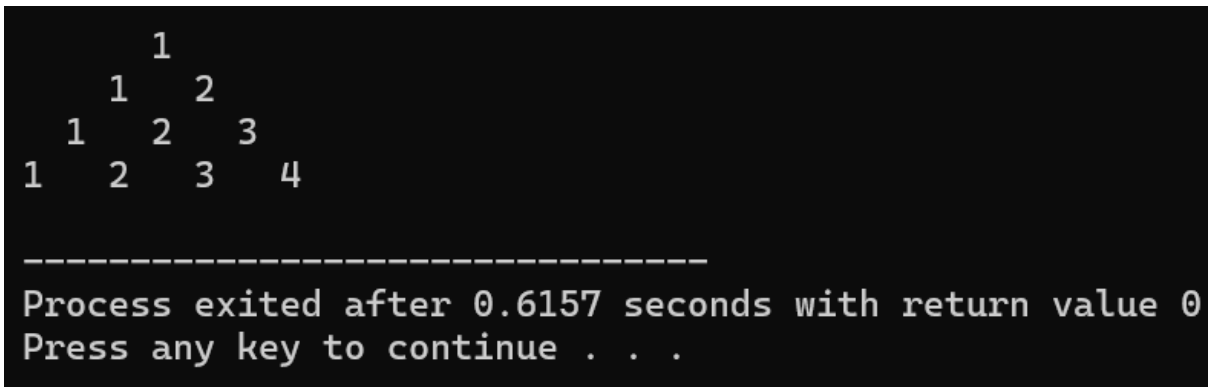
```
Enter the number of cities: 3
Enter the distance matrix (adjacency matrix):
3 4 5
3 4 5
6 5 4
The minimum cost to visit all cities and return to the starting city is: 13

--------------------------------
Process exited after 10.18 seconds with return value 0
Press any key to continue . . .
```

26. Write a c-program to print the pattern for n=4.

Code:

```
#include <stdio.h>
int main() {
    int n = 4;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n - i; j++) {
            printf("  ");
        }
        for (int j = 1; j <= i; j++) {
            printf("%d   ", j);
        }
        printf("\n");
    }
    return 0;
}
```

Output:



27. Write a c-program to perform Floyd's algorithm.

Code:

```
#include <stdio.h>
#define INF 99999
void floydWarshall(int graph[5][5], int n) {
    int dist[n][n];
    for (int i = 0; i < n; i++) {
```

```
        for (int j = 0; j < n; j++) {
            dist[i][j] = graph[i][j];
        }
    }
    for (int k = 0; k < n; k++) {
        for (int i = 0; i < n; i++) {
            for (int j = 0; j < n; j++) {
                if (dist[i][j] > dist[i][k] + dist[k][j]) {
                    dist[i][j] = dist[i][k] + dist[k][j];
                }
            }
        }
    }
    printf("The shortest distances between every pair of vertices are:\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            if (dist[i][j] == INF) {
                printf("INF\t");
            } else {
                printf("%d\t", dist[i][j]);
            }
        }
        printf("\n");
    }
}
int main() {
    int n = 5;
    int graph[5][5] = {
        {0, 6,INF,INF,INF},
        {INF,0,5,INF,12},
        {11,INF,0,INF,INF},
        {INF,8,INF,0,INF},
```

```
        {INF,INF,9,10,0}
    };
    floydWarshall(graph, n);
    return 0;
}
```

Output:

```
The shortest distances between every pair of vertices are:
0       6       11      28      18
16      0       5       22      12
11      17      0       39      29
24      8       13      0       20
20      18      9       10      0

--------------------------------
Process exited after 1.373 seconds with return value 0
Press any key to continue . . .
```

28. Write a c-program to print pascals triangle.

Code:

```
#include <stdio.h>
void generatePascalTriangle(int n) {
    for (int row = 0; row < n; row++) {
        int value = 1;
        for (int space = 1; space <= n - row; space++) {
            printf("  ");
        }
        for (int column = 0; column <= row; column++) {
            printf("%4d", value);
            value = value * (row - column) / (column + 1);
        }
        printf("\n");
    }
}
int main() {
```

```
    int n;
    printf("Enter the number of rows for Pascal's Triangle: ");
    scanf("%d", &n);
    generatePascalTriangle(n);
    return 0;
}
```

Output:

```
Enter the number of rows for Pascal's Triangle: 5
            1
          1   1
        1   2   1
      1   3   3   1
    1   4   6   4   1

--------------------------------
Process exited after 2.423 seconds with return value 0
Press any key to continue . . .
```

29. Write a c-program to find sum of digits.

Code:

```
#include <stdio.h>
int sumOfDigits(int number) {
    int sum = 0;
    while (number > 0) {
        int digit = number % 10;
        sum += digit;
        number /= 10;
    }

    return sum;
}
int main() {
    int number;
```

```
    printf("Enter a number: ");
    scanf("%d", &number);

    int result = sumOfDigits(number);
    printf("The sum of the digits is: %d\n", result);
    return 0;
}
```

Output:

```
Enter a number: 1234
The sum of the digits is: 10

--------------------------------
Process exited after 2.097 seconds with return value 0
Press any key to continue . . .
```

30. Write a c-program to insert a new number in a list.

Code:

```
#include <stdio.h>
void insertNumber(int list[], int *size, int number, int position) {
    if (position < 1 || position > *size + 1) {
        printf("Invalid position!\n");
        return;
    }
    for (int i = *size; i >= position; i--) {
        list[i] = list[i - 1];
    }
    list[position - 1] = number;
    (*size)++;
}
int main() {
    int list[100], size, number, position;
    printf("Enter the number of elements in the list: ");
```

```
    scanf("%d", &size);
    printf("Enter the elements of the list:\n");
    for (int i = 0; i < size; i++) {
        scanf("%d", &list[i]);
    }
    printf("Enter the number to insert: ");
    scanf("%d", &number);
    printf("Enter the position to insert the number: ");
    scanf("%d", &position);
    insertNumber(list, &size, number, position);
    printf("List after insertion:\n");
    for (int i = 0; i < size; i++) {
        printf("%d ", list[i]);
    }
    printf("\n");
    return 0;
}
```

Output:

```
Enter the number of elements in the list: 5
Enter the elements of the list:
2 34 54 23 4
Enter the number to insert: 78
Enter the position to insert the number: 3
List after insertion:
2 34 78 54 23 4

--------------------------------
Process exited after 20.92 seconds with return value 0
Press any key to continue . . .
```

31. Write a c-program to perform Sum of subsets using backtracking.

Code:

```
#include <stdio.h>
int n, target;
int set[100], subset[100];
void sumOfSubsets(int index, int curr_sum, int start) {
    if (curr_sum == target) {
        printf("{ ");
        for (int i = 0; i < index; i++) {
            printf("%d ", subset[i]);
        }
        printf("}\n");
        return;
    }
    for (int i = start; i < n; i++) {
        if (curr_sum + set[i] <= target) {
            subset[index] = set[i];
            sumOfSubsets(index + 1, curr_sum + set[i], i + 1);
        }
    }
}
int main() {
    printf("Enter the number of elements in the set: ");
    scanf("%d", &n);
    printf("Enter the elements of the set: ");
    for (int i = 0; i < n; i++) {
        scanf("%d", &set[i]);
    }
    printf("Enter the target sum: ");
    scanf("%d", &target);
    printf("Subsets that sum to %d are:\n", target);
    sumOfSubsets(0, 0, 0);
```

```
    return 0;
}
```

Output:

```
Enter the number of elements in the set: 5
Enter the elements of the set: 23 4 5 2 1
Enter the target sum: 7
Subsets that sum to 7 are:
{ 4 2 1 }
{ 5 2 }

--------------------------------
Process exited after 14.14 seconds with return value 0
Press any key to continue . . .
```

32. Write a c-program to perform Graph colouring using backtracking.

Code:

```
#include <stdio.h>
#include <stdbool.h>
#define MAX 10
int V;
int graph[MAX][MAX];
int colors[MAX];
bool isSafe(int v, int c) {
    for (int i = 0; i < V; i++) {
        if (graph[v][i] && colors[i] == c) {
            return false;
        }
    }
    return true;
}
bool graphColoringUtil(int v, int m) {
    if (v == V) {
        return true;
    }
```

```
    for (int c = 1; c <= m; c++) {
        if (isSafe(v, c)) {
            colors[v] = c;
            if (graphColoringUtil(v + 1, m)) {
                return true;
            }
            colors[v] = 0;
        }
    }
    return false;
}
bool graphColoring(int m) {
    for (int i = 0; i < V; i++) {
        colors[i] = 0;
    }
    if (!graphColoringUtil(0, m)) {
        printf("Solution does not exist.\n");
        return false;
    }
    printf("Solution Exists: Following are the assigned colors:\n");
    for (int i = 0; i < V; i++) {
        printf("Vertex %d -> Color %d\n", i, colors[i]);
    }
    return true;
}
int main() {
    int m;
    printf("Enter the number of vertices in the graph: ");
    scanf("%d", &V);
    printf("Enter the adjacency matrix of the graph:\n");
    for (int i = 0; i < V; i++) {
        for (int j = 0; j < V; j++) {
```

```
            scanf("%d", &graph[i][j]);
        }
    }
    printf("Enter the maximum number of colors: ");
    scanf("%d", &m);
    graphColoring(m);
    return 0;
}
```

Output:

```
Enter the number of vertices in the graph: 4
Enter the adjacency matrix of the graph:
0 2 0 2
2 0 2 0
0 2 0 2
2 0 2 0
Enter the maximum number of colors: 3
Solution Exists: Following are the assigned colors:
Vertex 0 -> Color 1
Vertex 1 -> Color 2
Vertex 2 -> Color 1
Vertex 3 -> Color 2

--------------------------------
Process exited after 82.19 seconds with return value 0
Press any key to continue . . .
```

33. Write a c-program to compute container loading problem.

Code:

```
#include <stdio.h>
int totalWeight = 0;
void swap(int *a, int *b) {
    int temp = *a;
    *a = *b;
    *b = temp;
}
```

```
void heapify(int arr[], int n, int i) {
    int largest = i;
    int left = 2 * i + 1;
    int right = 2 * i + 2;
    if (left < n && arr[left] > arr[largest]) {
        largest = left;
    }
    if (right < n && arr[right] > arr[largest]) {
        largest = right;
    }
    if (largest != i) {
        swap(&arr[i], &arr[largest]);
        heapify(arr, n, largest);
    }
}
void heapSort(int arr[], int n) {
    for (int i = n / 2 - 1; i >= 0; i--) {
        heapify(arr, n, i);
    }
    for (int i = n - 1; i > 0; i--) {
        swap(&arr[0], &arr[i]);
        heapify(arr, i, 0);
    }
}
int main() {
    int n;
    int capacity;
    printf("Enter the number of items: ");
    scanf("%d", &n);
    int weights[n];
    int excludedWeights[100];
    int excludedCount = 0;
```

```
    printf("Enter the weights of the items:\n");
    for (int i = 0; i < n; i++) {
        scanf("%d", &weights[i]);
    }
    printf("Enter the capacity of the container: ");
    scanf("%d", &capacity);
    heapSort(weights, n);
    for (int i = 0; i < n; i++) {
        if (totalWeight + weights[i] <= capacity) {
            totalWeight += weights[i];
        } else {
            excludedWeights[excludedCount++] = weights[i];
        }
    }
    int remainingWeight = capacity - totalWeight;
    printf("Remaining weight in the container: %d\n", remainingWeight);
    printf("Excluded items (weights): ");
    for (int i = 0; i < excludedCount; i++) {
        printf("%d ", excludedWeights[i]);
    }
    printf("\n");
    return 0;
}
```

Output:

```
Enter the number of items: 8
Enter the weights of the items:
50 100 30 80 90 200 160 20
Enter the capacity of the container: 400
Remaining weight in the container: 30
Excluded items (weights): 160 200

--------------------------------
Process exited after 29.07 seconds with return value 0
Press any key to continue . . .
```

34. Write a c-program to generate the list of all factor for n value using recursion.

Code:

```
#include <stdio.h>
void findFactors(int n, int i) {
    if (i > n) {
        return;
    }
    if (n % i == 0) {
        printf("%d ", i);
    }
    findFactors(n, i + 1);
}
int main() {
    int n;
    printf("Enter a number: ");
    scanf("%d", &n);
    printf("Factors of %d are: ", n);
    findFactors(n, 1);
    printf("\n");
    return 0;
}
```

Output:

```
Enter a number: 6
Factors of 6 are: 1 2 3 6

--------------------------------
Process exited after 3.82 seconds with return value 0
Press any key to continue . . .
```

35. Write a c-program to perform assignment problem using branch and bound.

Code:

```
#include <stdio.h>
#include <limits.h>
#include <stdbool.h>
#define N 4
typedef struct Node {
   int cost;
   int lowerBound;
   int jobAssignment[N];
   bool assigned[N];
   int level;
} Node;
int calculateLowerBound(int costMatrix[N][N], bool assigned[N], int level) {
   int lowerBound = 0;

   for (int i = level; i< N; i++) {
      int minCost = INT_MAX;
      for (int j = 0; j < N; j++) {
         if (!assigned[j] &&costMatrix[i][j] <minCost) {
minCost = costMatrix[i][j];
         }
      }
lowerBound += minCost;
   }
   return lowerBound;
}
void branchAndBound(int costMatrix[N][N]) {
   int minCost = INT_MAX;
   Node bestNode;
   Node root;
root.cost = 0;
```

```
root.level = 0;
   for (int i = 0; i< N; i++) {
root.assigned[i] = false;
root.jobAssignment[i] = -1;
   }
root.lowerBound = calculateLowerBound(costMatrix, root.assigned, root.level);
   Node queue[N * N];
   int queueSize = 0;
   queue[queueSize++] = root;
   while (queueSize> 0) {
      Node currentNode = queue[--queueSize];
      if (currentNode.lowerBound>= minCost) continue;
      if (currentNode.level == N) {
         if (currentNode.cost<minCost) {
minCost = currentNode.cost;
bestNode = currentNode;
         }
         continue;
      }
      for (int job = 0; job < N; job++) {
         if (!currentNode.assigned[job]) {
            Node newNode = currentNode;
newNode.level++;
newNode.jobAssignment[currentNode.level - 1] = job;
newNode.cost += costMatrix[currentNode.level - 1][job];
newNode.assigned[job] = true;
newNode.lowerBound = newNode.cost + calculateLowerBound(costMatrix,
newNode.assigned, newNode.level);
            if (newNode.lowerBound<minCost) {
               queue[queueSize++] = newNode;
            }
         }
```

```
        }
    }
printf("Minimum cost: %d\n", minCost);
printf("Job assignments:\n");
    for (int i = 0; i< N; i++) {
printf("Person %d -> Job %d\n", i, bestNode.jobAssignment[i]);
    }
}
int main() {
    int costMatrix[N][N] = {
        {9, 2, 7, 8},
        {6, 4, 3, 7},
        {5, 8, 1, 8},
        {7, 6, 9, 4}
    };
branchAndBound(costMatrix);
    return 0;
}
```

Output:

```
Minimum cost: 10
Job assignments:
Person 0 -> Job 1
Person 1 -> Job 2
Person 2 -> Job 0
Person 3 -> Job -1

--------------------------------
Process exited after 0.04755 seconds with return value 0
Press any key to continue . . .
```

36. Write a c-program to perform linear search.

Code:

```
#include<stdio.h>
int main(){
    int n,i,target;
```

```
    printf("enter no of elements:");
    scanf("%d",&n);
    int arr[10];
    printf("enter elements:");
    for(i=0;i<n;i++){
            scanf("%d",&arr[i]);
    }
    printf("enter target to search:");
    scanf("%d",&target);
    for(i=0;i<n;i++){
            if(arr[i]==target){
                    printf("%d is found at index %d",target, i);
            }
    }
    return 0;
}
```

Output:

```
enter no of elements:5
enter elements:23 44 32 4 6
enter target to search:32
32 is found at index 2
--------------------------------
Process exited after 9.431 seconds with return value 0
Press any key to continue . . .
```

37. Write a c-program to find all Hamiltonian circuit using backtracking.

Code:

```
#include <stdio.h>
#include <stdbool.h>
#define MAX_VERTICES 10
int n, graph[MAX_VERTICES][MAX_VERTICES], path[MAX_VERTICES];
bool isSafe(int v, int pos) {
   if (graph[path[pos - 1]][v] == 0) {
      return false;
```

```
    }
    for (int i = 0; i < pos; i++) {
        if (path[i] == v) {
            return false;
        }
    }
    return true;
}
void hamiltonianCircuitUtil(int pos) {
    if (pos == n) {
        if (graph[path[pos - 1]][path[0]] == 1) {
            printf("Hamiltonian Circuit: ");
            for (int i = 0; i < n; i++) {
                printf("%d ", path[i]);
            }
            printf("%d\n", path[0]);
        }
        return;
    }
    for (int v = 1; v < n; v++) {
        if (isSafe(v, pos)) {
            path[pos] = v;
            hamiltonianCircuitUtil(pos + 1);
            path[pos] = -1;
        }
    }
}
void findHamiltonianCircuits() {
    for (int i = 0; i < n; i++) {
        path[i] = -1;
    }
    path[0] = 0;
```

```
    hamiltonianCircuitUtil(1);
}
int main() {
    printf("Enter the number of vertices: ");
    scanf("%d", &n);
    printf("Enter the adjacency matrix (0 or 1):\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &graph[i][j]);
        }
    }
    findHamiltonianCircuits();
    return 0;
}
```

Output:

```
Enter the number of vertices: 4
Enter the adjacency matrix (0 or 1):
0 1 1 0
1 0 1 1
1 1 0 1
0 1 1 0
Hamiltonian Circuit: 0 1 3 2 0
Hamiltonian Circuit: 0 2 3 1 0

--------------------------------
Process exited after 48.11 seconds with return value 0
Press any key to continue . . .
```

38. Write a c-program to perform n-queens problem using backtracking.

Code:

```
#include <stdio.h>
#include <stdbool.h>
#define MAX 10
int board[MAX][MAX], n;
void printBoard() {
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
```

```
            if (board[i][j] == 1) {
                printf("Q ");
            } else {
                printf(". ");
            }
        }
        printf("\n");
    }
    printf("\n");
}
bool isSafe(int row, int col) {
    for (int i = 0; i < col; i++) {
        if (board[row][i] == 1) {
            return false;
        }
    }
    for (int i = row, j = col; i >= 0 && j >= 0; i--, j--) {
        if (board[i][j] == 1) {
            return false;
        }
    }
    for (int i = row, j = col; i < n && j >= 0; i++, j--) {
        if (board[i][j] == 1) {
            return false;
        }
    }
    return true;
}
bool solveNQueens(int col) {
    if (col >= n) {
        return true;
    }
```

```
    for (int row = 0; row < n; row++) {
        if (isSafe(row, col)) {
            board[row][col] = 1;
            if (solveNQueens(col + 1)) {
                return true;
            }
            board[row][col] = 0;
        }
    }
    return false;
}
int main() {
    printf("Enter the number of queens (n): ");
    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            board[i][j] = 0;
        }
    }
    if (solveNQueens(0)) {
        printf("Solution to the N-Queens problem:\n");
        printBoard();
    } else {
        printf("Solution does not exist.\n");
    }
    return 0;
}
```

Output:

```
Enter the number of queens (n): 8
Solution to the N-Queens problem:
Q . . . . . . .
. . . . . . Q .
. . . . Q . . .
. . . . . . . Q
. Q . . . . . .
. . . Q . . . .
. . . . . Q . .
. . Q . . . . .


--------------------------------
Process exited after 2.06 seconds with return value 0
Press any key to continue . . .
```

39. Write a c-program to find the optimal cost by using appropriate algorithm.

Code:

```
#include <stdio.h>
#include <limits.h>
#define MAX 10
int cost[MAX][MAX], n;
void subtractRowMin() {
    for (int i = 0; i < n; i++) {
        int min = INT_MAX;
        for (int j = 0; j < n; j++) {
            if (cost[i][j] < min) {
                min = cost[i][j];
            }
        }
        for (int j = 0; j < n; j++) {
            cost[i][j] -= min;
        }
    }
```

```
}
void subtractColumnMin() {
    for (int j = 0; j < n; j++) {
        int min = INT_MAX;
        for (int i = 0; i < n; i++) {
            if (cost[i][j] < min) {
                min = cost[i][j];
            }
        }
        for (int i = 0; i < n; i++) {
            cost[i][j] -= min;
        }
    }
}
void printMatrix() {
    printf("Cost Matrix after Reduction:\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            printf("%d ", cost[i][j]);
        }
        printf("\n");
    }
}
int main() {
    printf("Enter the number of workers/tasks (n): ");
    scanf("%d", &n);
    printf("Enter the cost matrix (n x n):\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &cost[i][j]);
        }
    }
```

```
    subtractRowMin();
    subtractColumnMin();
    printMatrix();
    return 0;
}
```

Output:

```
Enter the number of workers/tasks (n): 4
Enter the cost matrix (n x n):
9 2 7 8
6 4 3 7
5 8 1 8
7 6 9 4
Cost Matrix after Reduction:
4 0 5 6
0 1 0 4
1 7 0 7
0 2 5 0

--------------------------------
Process exited after 24.58 seconds with return value 0
Press any key to continue . . .
```

40. Write a c-program to print minimum and maximum value sequency for all the numbers in a list.

Code:

```
#include <stdio.h>
void findMinMax(int arr[], int n) {
    int min = arr[0];
    int max = arr[0];
    for (int i = 1; i < n; i++) {
        if (arr[i] < min) {
            min = arr[i];
        }
        if (arr[i] > max) {
            max = arr[i];
```

```
        }
    }
    printf("Minimum Value: %d\n", min);
    printf("Maximum Value: %d\n", max);
}
int main() {
    int n;
    printf("Enter the number of elements in the list: ");
    scanf("%d", &n);
    int arr[n];
    printf("Enter the elements of the list:\n");
    for (int i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }
    findMinMax(arr, n);
    return 0;
}
```

Output: