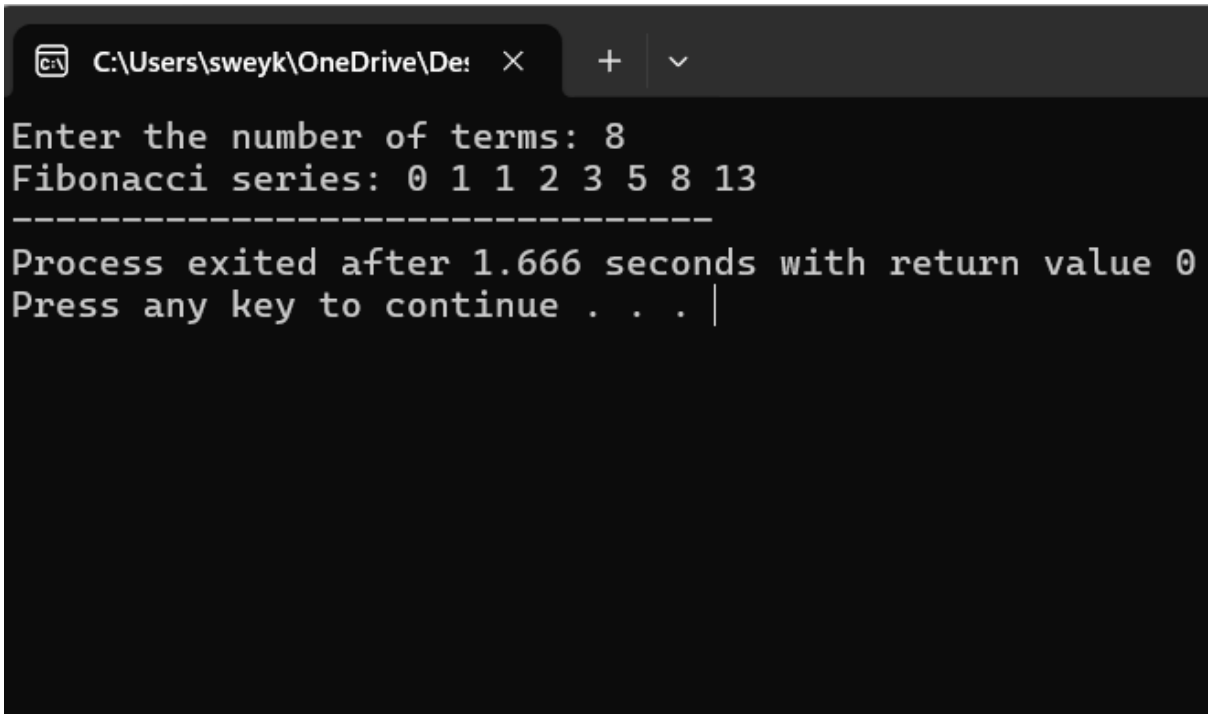
DAA PRACTICAL
SWETHA S
(192211096)
1.FIBONACCI SERIES USING RECURSION

```
#include <stdio.h>
int fibonacci(int n) {
    // Base case: if n is 0 or 1, return n
    if (n <= 1) {
        return n;
    }   else {
        return fibonacci(n - 1) + fibonacci(n - 2);
    }
}

int main() {
    int n;
    printf("Enter the number of terms: ");
    scanf("%d", &n);
    printf("Fibonacci series: ");
    for (int i = 0; i < n; i++) {
        printf("%d ", fibonacci(i));
    }
    return 0;
}
```

OUTPUT:

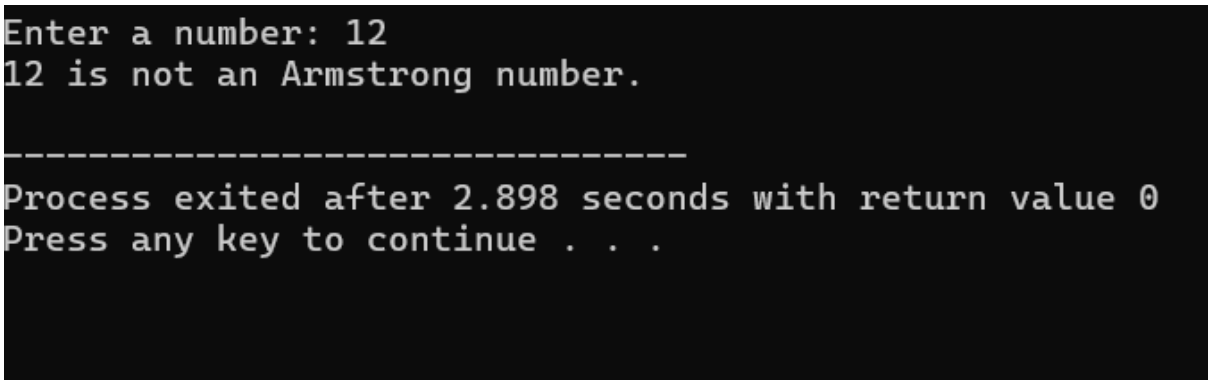


2.ARMSTRONG NUMBER:
SWETHA S
(192211096)

```
#include <stdio.h>
#include <math.h>
int countDigits(int n) {
    int count = 0;
    while (n != 0) {
        n /= 10;
        count++;
    }
    return count;
}
int isArmstrong(int num)
{
    int sum = 0,
originalNum, remainder,
n;
    originalNum = num
n = countDigits(num);  //
Number of digits in the
number
    while (num != 0) {
        remainder = num %
10;  // Extract last digit
        sum +=
pow(remainder, n);  //
```

```
Raise it to the power of
n and add to sum
        num /= 10;  //
Remove last digit
    }
    return (sum ==
originalNum);
}
int main() {
    int num;
    printf("Enter a
number: ");
    scanf("%d", &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:

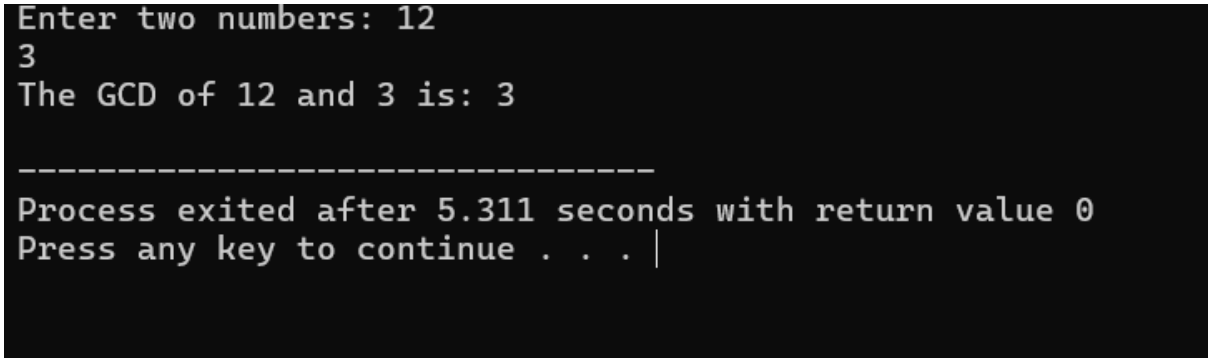


3.GCD OF TWO NUMBERS;

```
#include <stdio.h>
int gcd(int a, int b) {
    while (b != 0) {
        int temp = b;
        b = a % b;  //
Remainder of a divided
by b
     a = temp;   // Replace
a with b
```

```
    }
    return a;  // When b
becomes 0, a contains
the GCD
}

int main() {
    int num1, num2;
    printf("Enter two
numbers: ");
    scanf("%d %d",
&num1, &num2);
    printf("The GCD of
%d and %d is: %d\n",
num1, num2, gcd(num1,
num2));

    return 0;
}
```

OUTPUT:



4.LARGEST ELEMENT IN ARRAY
SWETHA S
(192211096)

```
#include <stdio.h>
int main() {
    int n;
    printf("Enter the
number of elements in
the array: ");
    scanf("%d", &n);
    int arr[n];  // Declare
an array of size n
    printf("Enter %d
elements:\n", n);
    for (int i = 0; i < n; i++)
{
```

```
        scanf("%d", &arr[i]);
    }
    int largest = arr[0];
    for (int i = 1; i < n; i++)
{
        if (arr[i] > largest) {
            largest = arr[i];
        }
    }
    printf("The largest
element in the array is:
%d\n", largest);
    return 0;
}
```

OUTPUT:

```
Enter the number of elements in the array: 5
Enter 5 elements:
10 23 4 56 7
```

6. FACTORIAL OF NUMBERS
SWETHA (192211096)

```
#include <stdio.h>

// Function to calculate
factorial using an
iterative approach
long long int
factorial_iterative(int n) {
    long long int fact = 1;
    for (int i = 1; i <= n;
i++) {
        fact *= i;  // Multiply
fact by i
    }
    return fact;
}

int main() {
    int num;

    // Ask the user to
input a number
```

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

    if (num < 0) {
        printf("Factorial is
not defined for negative
numbers.\n");
    } else {
        // Call the iterative
function and display the
result
        printf("Factorial of
%d (iterative) is: %lld\n",
num,
factorial_iterative(num));
    }

    return 0;
}
```

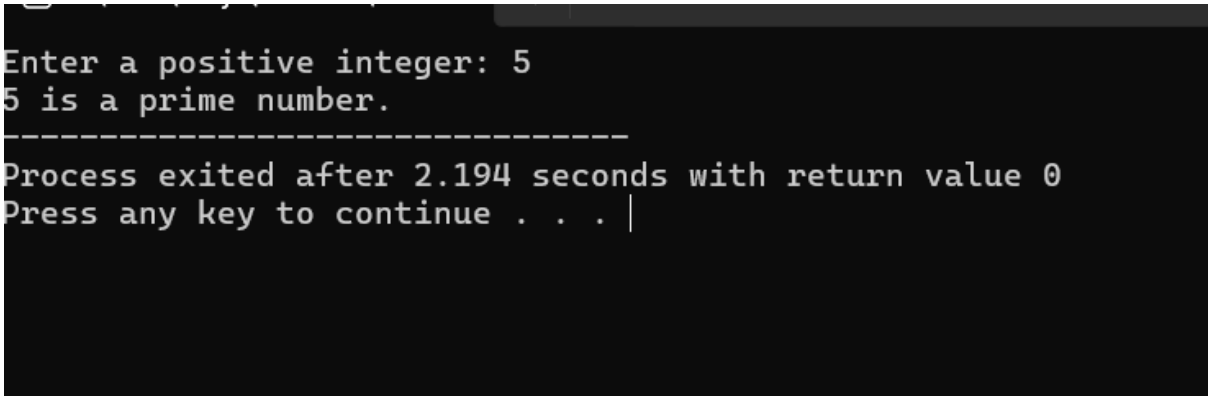
7.PRIME OR NOT:

SWETHA 192211096

```
#include <stdio.h>

int main() {

  int n, i, flag = 0;
  printf("Enter a positive
integer: ");
  scanf("%d", &n);

  // 0 and 1 are not prime
numbers
  // change flag to 1 for
non-prime number
  if (n == 0 || n == 1)
    flag = 1;

  for (i = 2; i <= n / 2; ++i)
{

    // if n is divisible by i,
then n is not prime
    // change flag to 1 for
non-prime number
```

```
    if (n % i == 0) {
      flag = 1;
      break;
    }
  }

  // flag is 0 for prime
numbers
  if (flag == 0)
    printf("%d is a prime
number.", n);
  else
    printf("%d is not a
prime number.", n);

  return 0;
}
```

OUTPPPUT;



9.**SELECTION SORT:**
SWETHA 192211096

```
#include <stdio.h>

// Function to perform
selection sort
void selectionSort(int
arr[], int n) {
    // Traverse through all
array elements
    for (int i = 0; i < n - 1;
i++) {
        // Find the
minimum element in the
unsorted portion
        int minIndex = i;
        for (int j = i + 1; j <
n; j++) {
```

```
            if (arr[j] <
arr[minIndex]) {
                minIndex = j;
// Update the index of
the minimum element
            }
        }

        // Swap the found
minimum element with
the first element
        if (minIndex != i) {
            int temp = arr[i];
            arr[i] =
arr[minIndex];
            arr[minIndex] =
temp;
        }
    }
}

// Function to print the
array
void printArray(int arr[],
int n) {
    for (int i = 0; i < n; i++)
{
        printf("%d ", arr[i]);
    }
    printf("\n");
}

int main() {
    int n;

    // Ask the user for the
size of the array
    printf("Enter the
number of elements: ");
    scanf("%d", &n);

    int arr[n];  // Declare
an array of size n

    // Input the array
elements from the user
```

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

    // Perform selection
sort
    selectionSort(arr, n);

    // Output the sorted
array
    printf("Sorted array:
");
    printArray(arr, n);

    return 0;
}
```

OUTPUT:

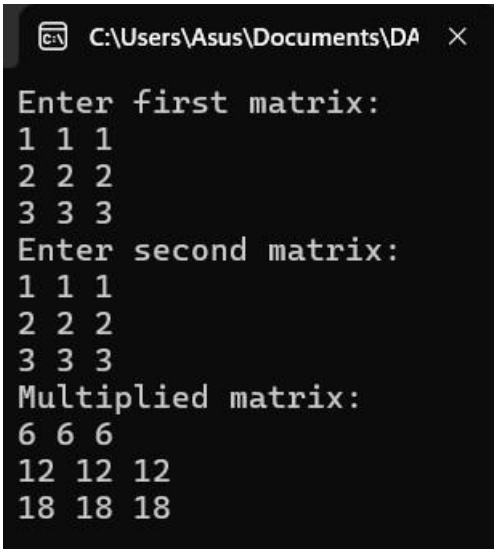
9. Matrix Multiplication.

SWETHA(192211096)

```
#include<stdio.h> int main(){        int
a[3][3],b[3][3],c[3][3];          int i,j,k;
printf("Enter first matrix: \n");
for(i=0;i<3;i++){
for(j=0;j<3;j++){
scanf("%d",&a[i][j]);
                    }
          }
          printf("Enter second matrix: \n");
for(i=0;i<3;i++){
for(j=0;j<3;j++){
scanf("%d",&b[i][j]);                    }

          }
```

```
        for(i=0;i<3;i++){
for(j=0;j<3;j++){
                        c[i][j]=0;
for(k=0;k<3;k++){
c[i][j]+=a[i][k]*b[k][j];
                        }
                }
        }
        printf("Multiplied matrix:\n");
for(i=0;i<3;i++){
for(j=0;j<3;j++){
printf("%d ",c[i][j]);
                }
                printf("\n");
        }
        return 0;
}
```

Output:

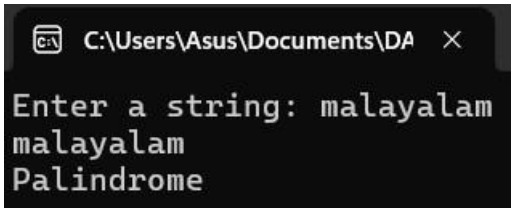


10. String Palindrome.

SWETHA(192211096)

```
#include<stdio.h>
#include<string.h> int
main(){
        char
str[100],temp,ori[100];
printf("Enter a string: ");
scanf("%s",str);
strcpy(ori,str);        int
l=strlen(str);  int s,e;        s=0;
e=l-1;          while(s<e){
temp=str[s];            str[s]=str[e];
        str[e]=temp;
                s++;
e--;
        }
        printf("%s\n",str);
if(strcmp(ori,str)==0){
printf("Palindrome");
        }
        else{
                printf("Not Palindrome");
        }
        return 0;
}
```

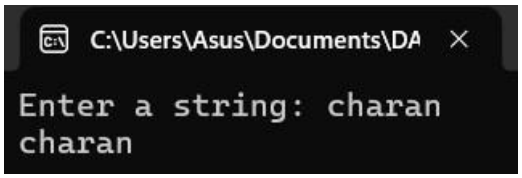
Output:



11. Copy String.

```
#include <stdio.h>
#include<string.h> int
main() {     char str[100],
ori[100];
   int i;     printf("Enter a string:
");     scanf("%s",str);
for(i=0;i<strlen(str);i++){
ori[i]=str[i];
         }
         printf("%s",ori);
   return 0;
}
```

Output:

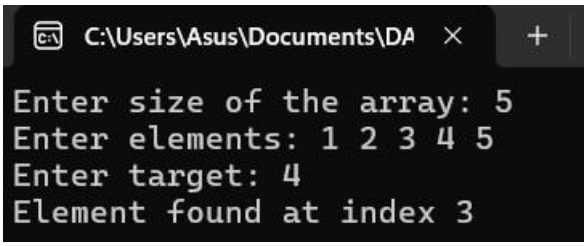


12. Binary Search. #include<stdio.h> int

```
binarySearch(int arr[],int n,int target){
         int low=0,high=n-1;
while(low<=high){              int
mid=(low+high)/2;
if(arr[mid]==target){
```

```
                return mid;
            }
            if(arr[mid]<target){
low=mid+1;
            }
            else{
high=mid-1;
            }
        }
        return -1;
}
int main(){
        int i,n,target;
printf("Enter size of the array: ");
scanf("%d",&n);       int arr[n];
printf("Enter elements: ");
for(i=0;i<n;i++){
scanf("%d",&arr[i]);
        }
        printf("Enter target: ");        scanf("%d",&target);
int result=binarySearch(arr,n,target);       if(result!=-1){
        printf("Element found at index %d",result);
        }
        else{
            printf("Element not found");
        }
        return 0;
}
```

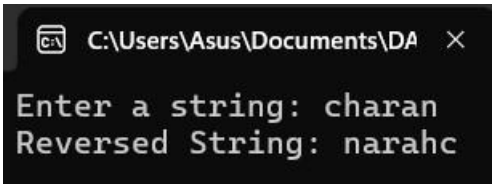
Output:



13. Reverse String.

```
#include<stdio.h>
#include<string.h> int
main(){
        char
str[100],temp,ori[100];
printf("Enter a string: ");
scanf("%s",str);
strcpy(ori,str);        int
l=strlen(str);  int s,e;        s=0;
e=l-1;          while(s<e){
temp=str[s];            str[s]=str[e];
        str[e]=temp;
                s++;
e--;
        }
        printf("Reversed String: %s\n",str);

        return 0;
}
```

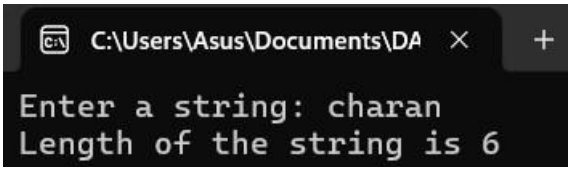
Output:



14. String length.

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

Output:



15. Strassen's Matrix.

SWETHA (192211096)

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

#define MAX 4  // Matrix size 4x4
```

```
// Function to add matrices
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];
        }
    }
}
// Function to subtract matrices
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];
        }
    }
}
// Strassen's algorithm for matrix multiplication
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];
```

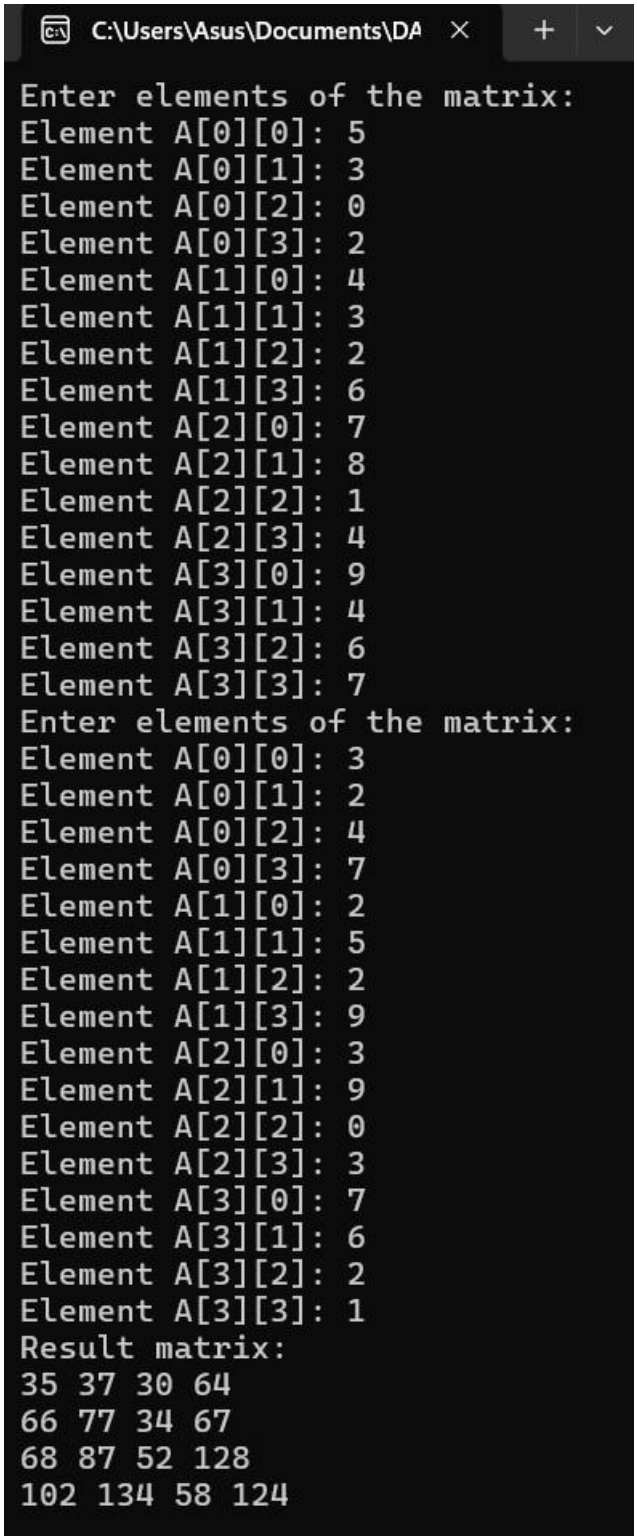
```
    int M1[MAX][MAX], M2[MAX][MAX], M3[MAX][MAX], M4[MAX][MAX],
M5[MAX][MAX], M6[MAX][MAX], M7[MAX][MAX];
int temp1[MAX][MAX], temp2[MAX][MAX];

    // Divide the matrices into submatrices
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];
        }
    }

    // Calculate M1 to M7      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);

    // Calculate C11, C12, C21, C22
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);
```

```
    // Combine C11, C12, C21, C22 into C
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];
        }
    }
}
// Function to take matrix input 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++) {             printf("Element
A[%d][%d]: ", i, j);             scanf("%d",
&A[i][j]);
        }
    }
}
// Function to display matrix 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;  //
Matrix size is 4x4

    int A[MAX][MAX], B[MAX][MAX], C[MAX][MAX];

    // Input matrices A and B
inputMatrix(A, size);     inputMatrix(B,
size);

    // Perform Strassen's matrix multiplication
strassen(A, B, C, size);

    // Display the result
displayMatrix(C, size);

    return 0;
}
```

Output:



16. Merge Sort.

SWETHA (192211096)

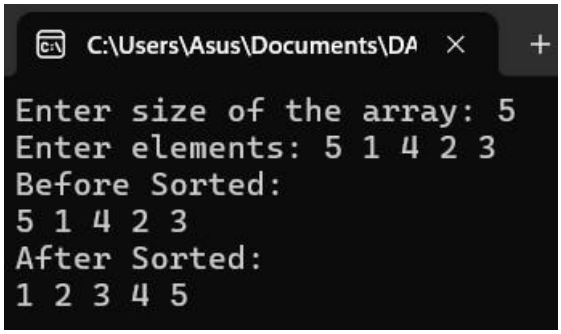
```
#include <stdio.h>
```

```
// Function to merge two subarrays
void merge(int arr[], int left, int mid, int right) {
int n1 = mid - left + 1;     int n2 = right - mid;

   // Create temporary arrays
int L[n1], R[n2];

   // Copy data to temporary arrays L[] and R[]
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];
   }

   // Merge the temporary arrays back into arr[left..right]
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++;
   }

   // Copy the remaining elements of L[], if any
   while (i < n1) {
       arr[k] = L[i];
i++;         k++;
   }
```

```
    // Copy the remaining elements of R[], if any
while (j < n2) {         arr[k] = R[j];         j++;
k++;
    }
}
// Function to implement merge sort void
mergeSort(int arr[], int left, int right) {     if
(left < right) {         int mid = left + (right -
left) / 2;

        // Recursively sort the first and second halves
mergeSort(arr, left, mid);         mergeSort(arr, mid
+ 1, right);

        // Merge the sorted halves
merge(arr, left, mid, right);
    }
}
// Function to print the array void
printArray(int arr[], int size) {
    for (int i = 0; i < size; i++) {
        printf("%d ", arr[i]);
    }
printf("\n");
}
// Main function to test the merge sort
int main() {     int arrSize;
```

```
    // Get user input for array size
printf("Enter the number of elements: ");
scanf("%d", &arrSize);

    int arr[arrSize];

    // Get user input for array elements
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:



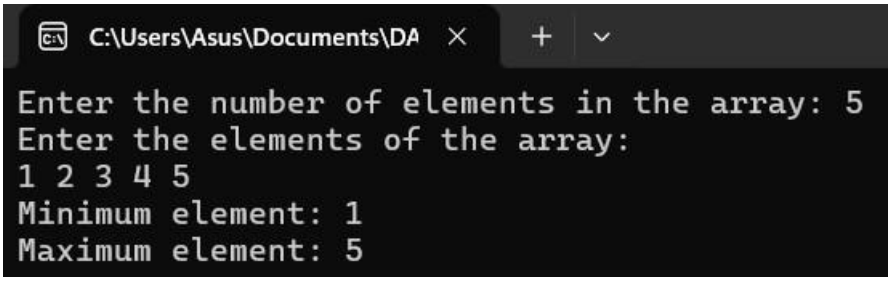
17. Min and Max elements in array.

SWETHA (192211096)

```
#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 element: %d\n", min);
printf("Maximum element: %d\n", max);
}

int main() {
    int n;

    // Input the number of elements      printf("Enter the
number of elements in the array: ");      scanf("%d",
&n);
```

```
        int
arr[n];

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

    // Call the function to find the min and max
findMinMax(arr, n);

    return 0;
}
```

Output:



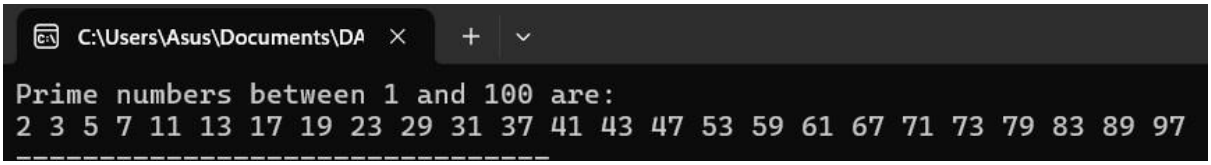
18. Prime numbers between 1 and 100.

SWETHA (192211096)

```
#include <stdio.h>
#include <stdbool.h>

// Function to check if a number is prime bool isPrime(int
num) {     if (num <= 1) {         return false; // 1 and numbers
less than 1 are not prime
```

```
    }

    for (int i = 2; i * i <= num; i++) {         if (num % i == 0) {
return false; // Number is divisible by i, so it's not prime
        }
    }
    return true; // If no divisors were found, the number is prime
}

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:



19. Knapsack using Greedy method.

SWETHA (192211096)

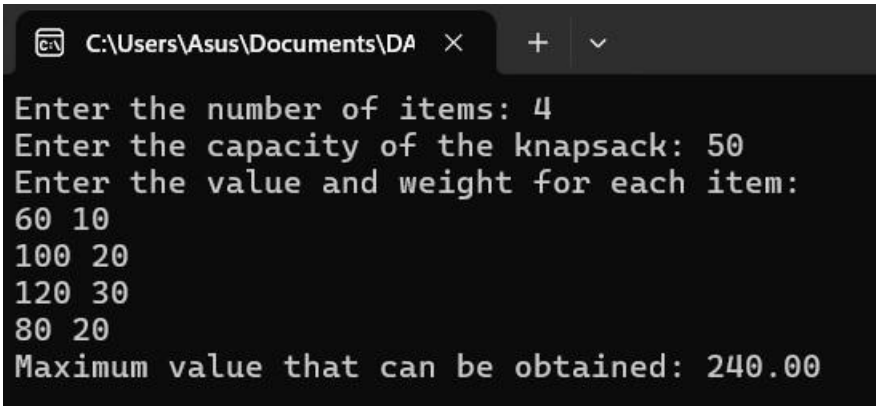
```
#include <stdio.h>
```

```
#include <stdlib.h>

// Structure for an item struct Item {
int value;     int weight;     float ratio;
// Value-to-weight ratio
};

// Comparison function for sorting items based on value-to-weight 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);
}

// Function to solve the Fractional Knapsack problem using Greedy approach
float knapsack(struct Item items[], int n, int capacity) {     // Sort items by
value-to-weight ratio in descending order     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) {
            // Take the whole item
remainingCapacity -= items[i].weight;
totalValue += items[i].value;

       } else {
            // Take the fraction of the item that fits             totalValue +=
items[i].value * ((float)remainingCapacity / items[i].weight);             break;
```

```
        }
    }

    return totalValue;
}

int main() {     int
n, capacity;

    // Input number of items and knapsack capacity
printf("Enter the number of items: ");     scanf("%d",
&n);

    printf("Enter the capacity of the knapsack: ");
scanf("%d", &capacity);

    struct Item items[n];

    // Input value, weight and calculate value-to-weight ratio for each item
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;
    }

    // Calculate the maximum value that can be obtained
float maxValue = knapsack(items, n, capacity);

    // Output the result     printf("Maximum value that can be
obtained: %.2f\n", maxValue);
```

```
    return 0;
}
```

Output:



20. MST using Greedy techniques.

SWETHA (192211096)

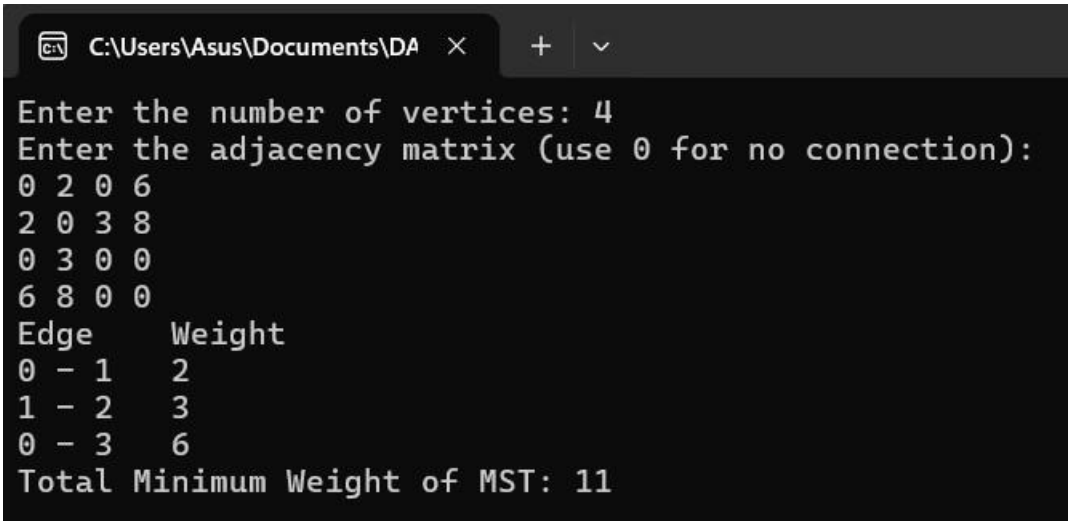
```
#include <stdio.h>
#include <limits.h>
#include <stdbool.h>

#define V 100 // Maximum number of vertices

// Function to find the vertex with the minimum key value
int minKey(int key[], bool mstSet[], int vertices) {     int
min = INT_MAX, min_index;

    for (int v = 0; v < vertices; v++) {
        if (mstSet[v] == false && key[v] < min) {
min = key[v];             min_index = v;
```

```
        }
    }
    return min_index;
}

// Function to print the constructed MST and calculate the total weight
void printMST(int parent[], int graph[V][V], int vertices) {     int
totalWeight = 0;     printf("Edge \tWeight\n");     for (int i = 1; i <
vertices; i++) {         printf("%d - %d \t%d\n", parent[i], i,
graph[i][parent[i]]);         totalWeight += graph[i][parent[i]]; // Sum the
weights
    }
    printf("Total Minimum Weight of MST: %d\n", totalWeight);
}

// Function to construct and print the MST using Prim's algorithm
void primMST(int graph[V][V], int vertices) {     int parent[V]; // Array
to store the constructed MST     int key[V];    // Key values used to
pick the minimum weight edge     bool mstSet[V]; // To represent the
set of vertices included in MST

    // Initialize all keys as INFINITE
for (int i = 0; i < vertices; i++) {
key[i] = INT_MAX;         mstSet[i]
= false;
    }

    // Include the first vertex in MST     key[0] = 0;
parent[0] = -1; // First node is always the root of the MST
```

```
    for (int count = 0; count < vertices - 1; count++) {
int u = minKey(key, mstSet, vertices);         mstSet[u]
= true;

        for (int v = 0; v < vertices; v++) {             if (graph[u][v] &&
mstSet[v] == false && graph[u][v] < key[v]) {                 parent[v] = u;
key[v] = graph[u][v];
            }
        }
    }

    printMST(parent, graph, vertices);
}

int main() {     int vertices;     printf("Enter
the number of vertices: ");     scanf("%d",
&vertices);

    int graph[V][V];     printf("Enter the adjacency matrix (use 0 for
no connection):\n");     for (int i = 0; i < vertices; i++) {         for (int j
= 0; j < vertices; j++) {             scanf("%d", &graph[i][j]);
        }
    }

    primMST(graph, vertices);

    return 0;
```

}

Output:



21. OBST using Dynamic Programming.

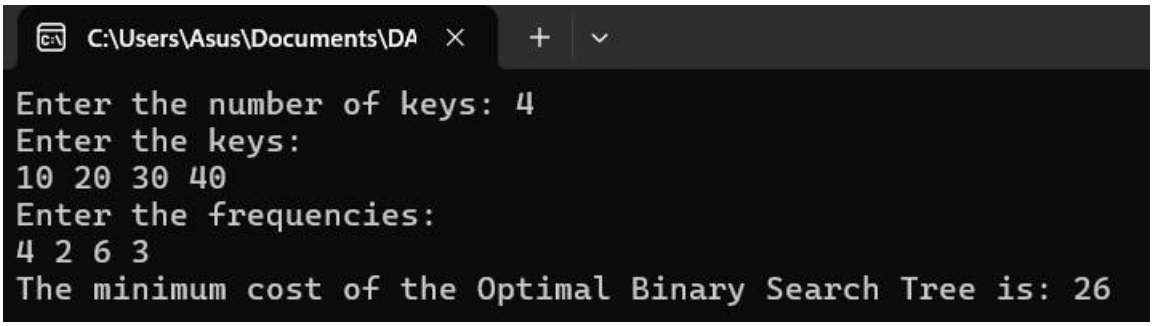
SWETHA (192211096)

```
#include <stdio.h>
#include <limits.h>

// Function to calculate the sum of frequencies from i to j
int sum(int freq[], int i, int j) {     int s = 0;     for (int k = i;
k <= j; k++) {         s += freq[k];
   }
return s;
}

// Function to build the OBST using dynamic programming int
optimalSearchTree(int keys[], int freq[], int n) {     int cost[n][n]; // cost[i][j]
stores the minimum cost of OBST for keys[i..j]
```

```
    // Initialize the cost of single keys (single nodes)
for (int i = 0; i < n; i++) {         cost[i][i] = freq[i];
    }

    // Build the table for subtrees of increasing size
for (int length = 2; length <= n; length++) {
for (int i = 0; i <= n - length; i++) {             int j = i
+ length - 1;             cost[i][j] = INT_MAX;

            // Try making each key in keys[i..j] as the root
for (int r = i; r <= j; r++) {                 int c = ((r > i) ?
cost[i][r - 1] : 0) +                         ((r < j) ? cost[r +
1][j] : 0) +                         sum(freq, i, j);
                if (c < cost[i][j])
{                     cost[i][j] = c;
                }
            }
        }
    }

    return cost[0][n - 1]; // Minimum cost of OBST for keys[0..n-1]
}

int main() {     int n;     printf("Enter the
number of keys: ");     scanf("%d",
&n);

    int keys[n], freq[n];
printf("Enter the keys:\n");     for
```

```
(int i = 0; i < n; i++) {
scanf("%d", &keys[i]);
    }

    printf("Enter the frequencies:\n");
for (int i = 0; i < n; i++) {
scanf("%d", &freq[i]);
    }

    int minCost = optimalSearchTree(keys, freq, n);     printf("The minimum cost of
the Optimal Binary Search Tree is: %d\n", minCost);

    return 0;
}
```

Output:

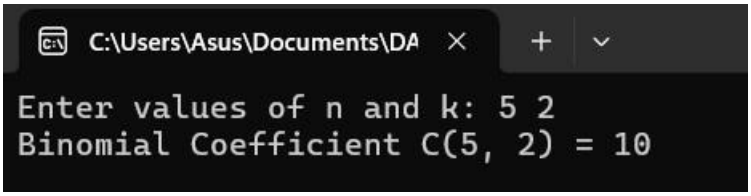


22. Binomial Coefficient.

```
#include <stdio.h>

// Function to calculate Binomial Coefficient using dynamic programming
int binomialCoeff(int n, int k) {     int C[n+1][k+1];

    // Calculate value of Binomial Coefficient in bottom-up manner
```

```
    for (int i = 0; i <= n; i++) {          for (int j = 0;
j <= (i < k ? i : k); j++) {              // Base Case:
C(i, 0) = 1 and C(i, i) = 1              if (j == 0 || j
== i) {
                C[i][j] = 1;
            } else {
                // Recursive Case: C(i, j) = C(i-1, j-1) + C(i-1, j)
                C[i][j] = C[i-1][j-1] + C[i-1][j];
            }
        }
    }

    return C[n][k]; // Return the binomial coefficient C(n, k)
}

int main() {
int n, k;

    // Input values for n and k
printf("Enter values of n and k: ");
scanf("%d %d", &n, &k);

    // Output the binomial coefficient      printf("Binomial Coefficient C(%d,
%d) = %d\n", n, k, binomialCoeff(n, k));

    return 0;
}
```

Output:



23. Reverse a number. #include <stdio.h>

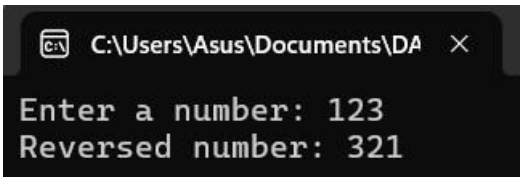
int main() { int num, reversed = 0, remainder; printf("Enter a number: "); scanf("%d", &num); while (num != 0) { remainder = num % 10; reversed = reversed * 10 + remainder; num = num / 10; }

printf("Reversed number: %d\n", reversed);

return 0;

}

Output:

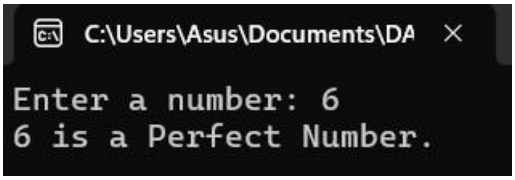


24. Perfect number.

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

```
    if (sum == num) {         printf("%d is a
Perfect Number.\n", num);
    } else {         printf("%d is not a Perfect
Number.\n", num);
    }
    return 0;
}
```

Output:



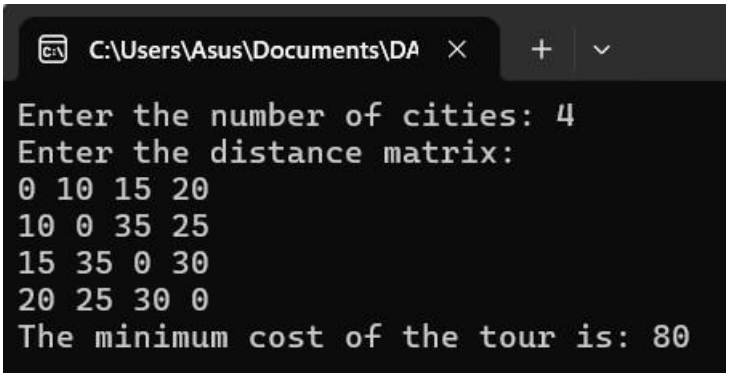
26. TSP using Dynamic Programming.

```
#include <stdio.h>

#define MAX 16
#define INF 9999999   // Define a large number to represent infinity

int dp[1 << MAX][MAX];  // DP table to store the minimum cost
int dist[MAX][MAX];     // Matrix to store distances between cities

// Function to solve the Traveling Salesman Problem using Dynamic Programming
and Bitmasking
int tsp(int mask, int pos, int n) {     if (mask == (1 << n) -
1) {  // All cities have been visited         return dist[pos][0];
// Return to the starting city
    }
```

```
    if (dp[mask][pos] != -1)  // If the result is already calculated, return it
return dp[mask][pos];

    int ans = INF;     for (int city = 0; city < n; city++) {         if ((mask & (1 <<
city)) == 0) {  // If the city hasn't been visited             int newAns =
dist[pos][city] + tsp(mask | (1 << city), city, n);             ans = (ans < newAns)
? ans : newAns;  // Choose the minimum cost
        }
    }
    return dp[mask][pos] = ans;  // Store the result in DP table
}

int main() {     int n;     printf("Enter the
number of cities: ");     scanf("%d",
&n);

    if (n > MAX) {         printf("The maximum number of cities supported
is %d.\n", MAX);
        return -1;
    }

    printf("Enter the distance matrix:\n");
for (int i = 0; i < n; i++) {         for (int j =
0; j < n; j++) {             scanf("%d",
&dist[i][j]);
        }
    }
```

```
    // Initialize DP table with -1 (meaning uncalculated)
for (int i = 0; i < (1 << n); i++) {         for (int j = 0; j <
n; j++) {             dp[i][j] = -1;
        }
    }

    // Calculate the result starting from city 0, with only city 0 visited (mask = 1)
int result = tsp(1, 0, n);        printf("The minimum cost of the tour is: %d\n",
result);

    return 0;
}
```

Output:



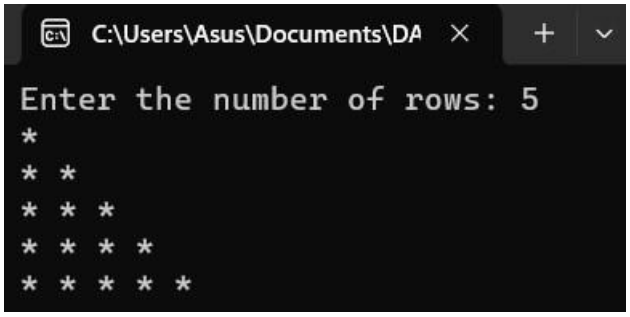
Print the pattern. SWETHA (192211096)

27.

```
#include <stdio.h>

int main() {
    int i, j, n;
```

```
    printf("Enter the number of rows: ");
scanf("%d", &n);

    for (i = 1; i <= n; i++) {
for (j = 1; j <= i; j++) {
printf("* ");
        }
printf("\n");
    }

    return 0;
}
```

Output:



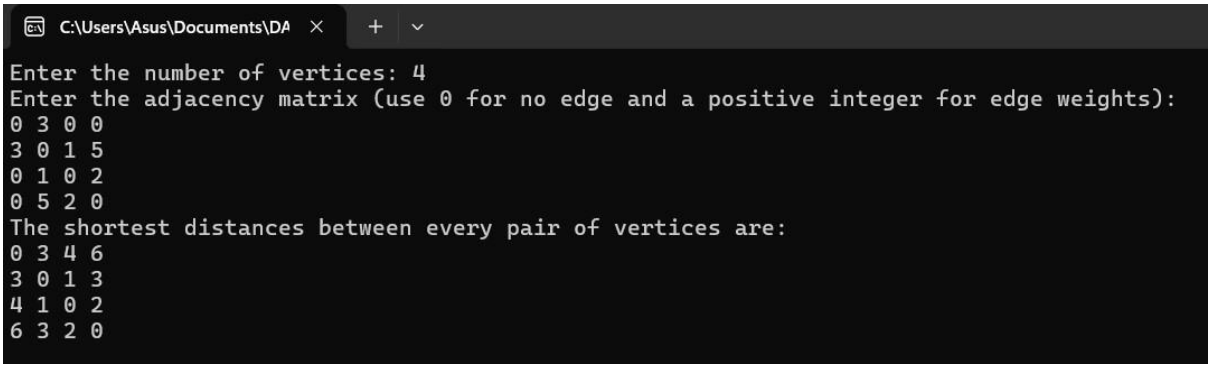
27. Floyd's algorithm. SWETHA (192211096)

```
#include <stdio.h>
#define INF 9999999 #define
MAX 10
void floydWarshall(int graph[MAX][MAX], int n) {
int dist[MAX][MAX], i, j, k;     for (i = 0; i < n; i++)
{
```

```
        for (j = 0; j < n; j++) {             if (i == j)
dist[i][j] = 0;             else if (graph[i][j] == 0)
dist[i][j] = INF;             else dist[i][j] =
graph[i][j];
        }
    }
    for (k = 0; k < n; k++) {         for (i = 0; i < n; i++) {             for (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 (i = 0; i < n; i++) {         for (j = 0; j < n; j++) {             if (dist[i][j] ==
INF) printf("INF ");             else printf("%d ", dist[i][j]);
        }
printf("\n");
    }
}
int main() {
    int n, i, j;
    printf("Enter the number of vertices: ");
scanf("%d", &n);     int
graph[MAX][MAX];
    printf("Enter the adjacency matrix (use 0 for no edge and a positive integer for
edge weights):\n");
    for (i = 0; i < n; i++) {
for (j = 0; j < n; j++) {
scanf("%d", &graph[i][j]);
```

```
        }
    }
    floydWarshall(graph, n);
return 0;
}
```

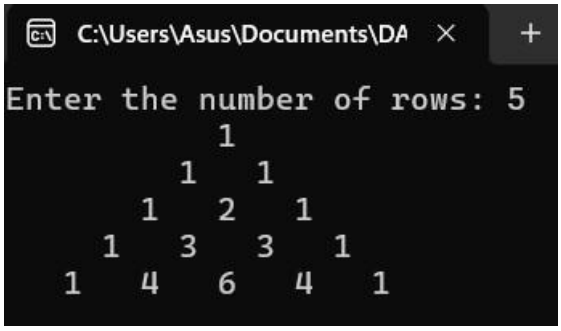
Output:



28. Pascal's Triangle. #include <stdio.h> int main() { int n, i, j, val, space; printf("Enter the number of rows: "); scanf("%d", &n); for (i = 0; i < n; i++) { for (space = 0; space < n - i - 1; space++) { printf(" "); } val = 1; for (j = 0; j <= i; j++) { printf("%4d", val); val = val * (i - j) / (j + 1); } printf("\n"); }

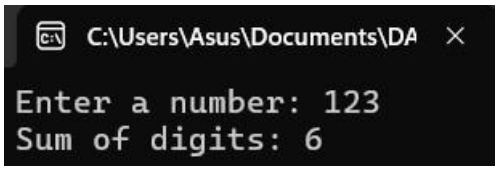
```
    return 0;
}
```

Output:



29. Sum of digits. #include <stdio.h> int main() { int num, sum = 0; printf("Enter a number: "); scanf("%d", &num); while (num != 0) { sum += num % 10; num /= 10; } printf("Sum of digits: %d\n", sum); return 0; }

Output:

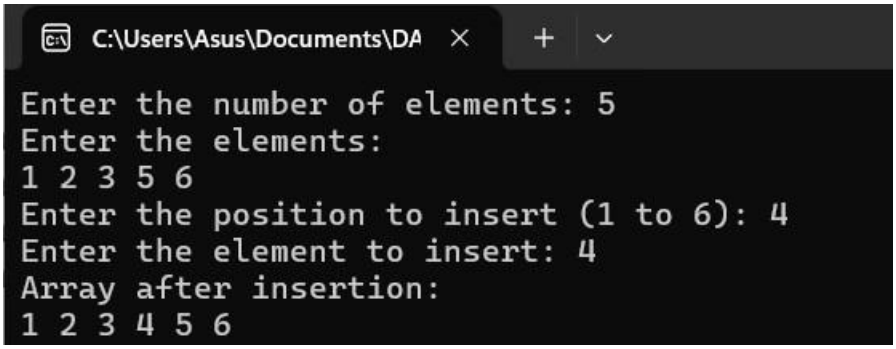


Inserting element in an SWETHA (192211096)

30. array. #include <stdio.h> int main() { int arr[100], n, pos, elem, i; printf("Enter the number of elements: "); scanf("%d", &n); printf("Enter the elements:\n"); for (i = 0; i < n; i++) { scanf("%d", &arr[i]);

```
    }
    printf("Enter the position to insert (1 to %d): ", n + 1);
scanf("%d", &pos);     printf("Enter the element to
insert: ");     scanf("%d", &elem);
    for (i = n; i >= pos - 1; i--) {
arr[i + 1] = arr[i];
    }
    arr[pos - 1] = elem;     n++;
printf("Array after insertion:\n");
for (i = 0; i < n; i++) {
printf("%d ", arr[i]);
    }
    return 0;
}
```

Output:

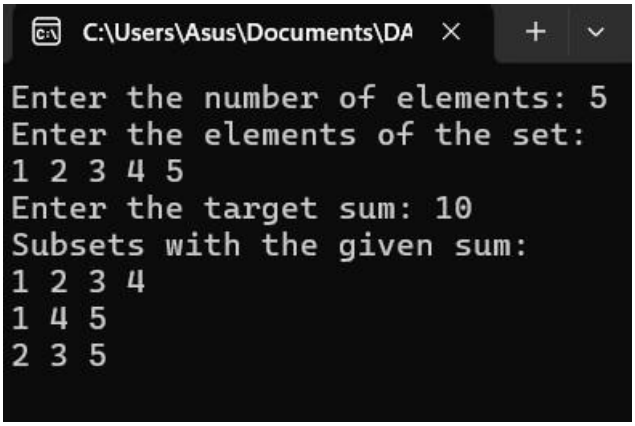


31. Sum of subsets.

```
#include <stdio.h>

int total = 0;

void subsetSum(int set[], int subset[], int n, int subsetSize, int sum, int targetSum, int
index) {     if (sum == targetSum) {         for (int i = 0; i < subsetSize; i++) {
printf("%d ", subset[i]);
```

```
        }
printf("\n");
return;
    }

    for (int i = index; i < n; i++) {         if (sum + set[i] <= targetSum) {
subset[subsetSize] = set[i];             subsetSum(set, subset, n, subsetSize + 1,
sum + set[i], targetSum, i + 1);
        }
    }
}

int main() {     int n, targetSum;
printf("Enter the number of elements: ");
scanf("%d", &n);     int set[n], subset[n];
printf("Enter the elements of the set:\n");
for (int i = 0; i < n; i++) {
        scanf("%d", &set[i]);
    }
    printf("Enter the target sum: ");     scanf("%d",
&targetSum);     printf("Subsets with the given
sum:\n");     subsetSum(set, subset, n, 0, 0,
targetSum, 0);     return 0;
}
```

Output:



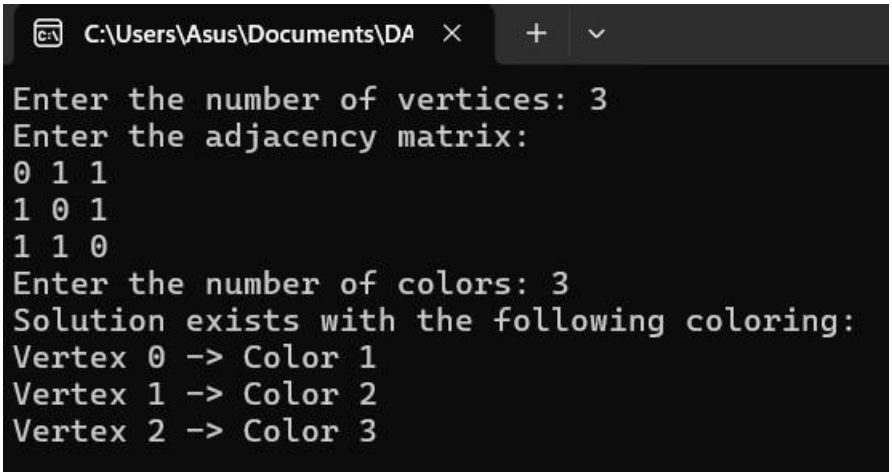
32. Graph coloring. SWETHA (192211096)

```
#include <stdio.h>
#define MAX 10

int graph[MAX][MAX], colors[MAX], n;

int isSafe(int node, int color) {     for (int i =
0; i < n; i++) {         if (graph[node][i] &&
colors[i] == color) {             return 0;
       }
   }
   return 1;
}

int graphColoring(int node, int m) {
if (node == n) {         return 1;
   }
   for (int color = 1; color <= m; color++) {
if (isSafe(node, color)) {
colors[node] = color;             if
```

```
(graphColoring(node + 1, m)) {
return 1;
            }
            colors[node] = 0;
        }
    }
    return 0;
}

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

    if (graphColoring(0, m)) {         printf("Solution exists
with the following coloring:\n");         for (int i = 0; i < n;
i++) {             printf("Vertex %d -> Color %d\n", i,
colors[i]);
        }
    } else {         printf("No solution exists with %d
colors.\n", m);
    }
```

```
    return 0;
}
```

Output:

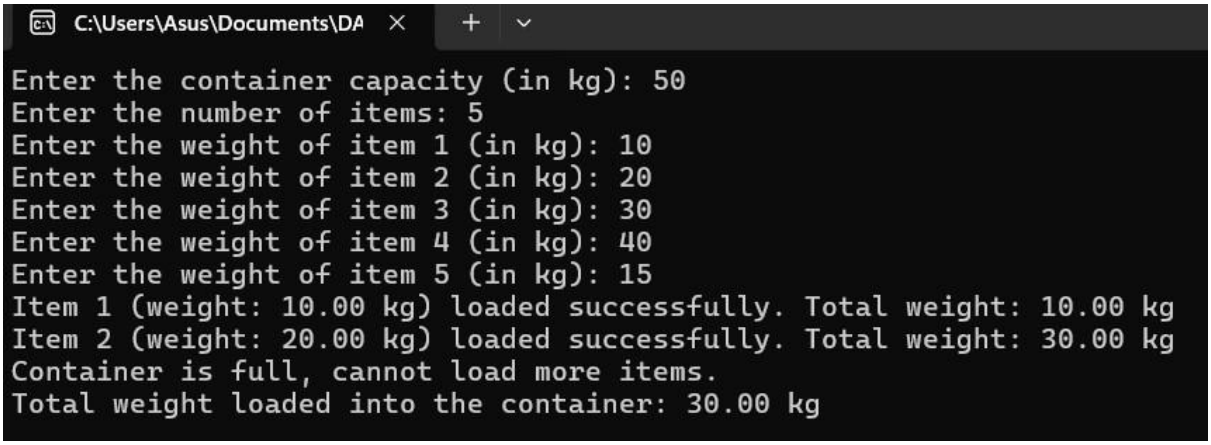


33. Container loader problem. SWETHA (192211096)

```
#include <stdio.h>

int main() {     int numItems, i;     float capacity,
totalWeight = 0.0, itemWeight;

    // Get container capacity from user
printf("Enter the container capacity (in kg): ");
scanf("%f", &capacity);

    // Get the number of items to load
printf("Enter the number of items: ");
scanf("%d", &numItems);

    float itemWeights[numItems];
```

```
    // Get the weights of all items from user      for(i = 0; i
< numItems; i++) {          printf("Enter the weight of item
%d (in kg): ", i + 1);          scanf("%f", &itemWeights[i]);
    }

    // Try to load items into the container
for(i = 0; i < numItems; i++) {
itemWeight = itemWeights[i];

        // Check if adding the item exceeds the container capacity
if(totalWeight + itemWeight > capacity) {
printf("Container is full, cannot load more items.\n");
break;
        } else {             totalWeight +=
itemWeight;
            printf("Item %d (weight: %.2f kg) loaded successfully. Total weight: %.2f kg\n",
i + 1, itemWeight, totalWeight);
        }
    }

    if(totalWeight == capacity) {
printf("Container is now full.\n");      } else {
printf("Total weight loaded into the container:
%.2f kg\n", totalWeight);
    }

    return 0;
}
```

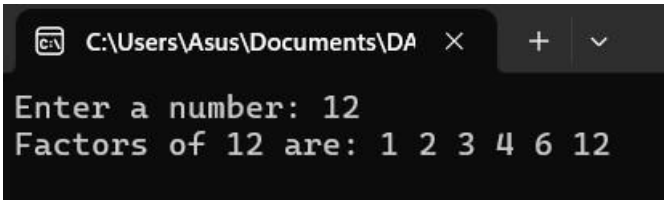
Output:



34. Factors of a given number.

```
#include <stdio.h>

int main() {
    int n, i;
    // Get the value of n from the user
printf("Enter a number: ");     scanf("%d",
&n);

    printf("Factors of %d are: ", n);

    // Loop from 1 to n to find the factors     for(i
= 1; i <= n; i++) {         if(n % i == 0) { // Check
if i is a factor of n             printf("%d ", i);

       }
    }
printf("\n");
return 0;
}
```

Output:



SWETHA (192211096)

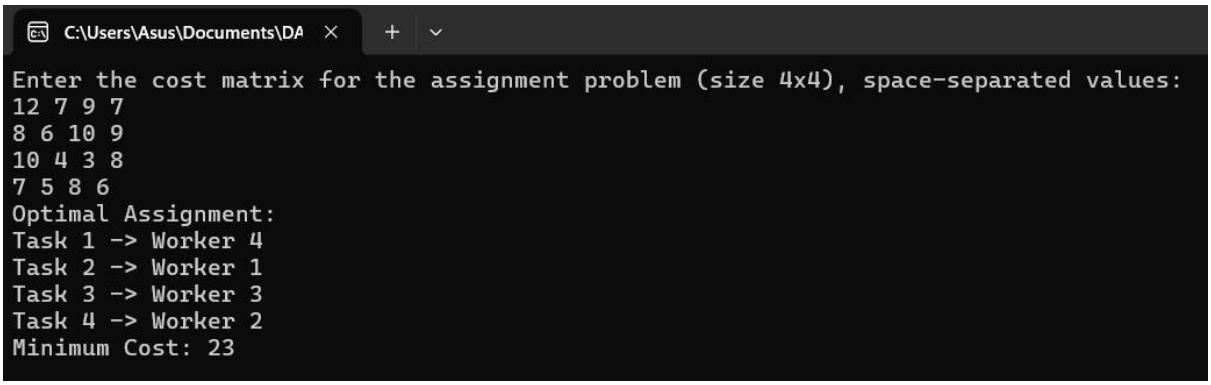
35. Assignment problem.

```
#include <stdio.h>
#include <limits.h>

#define N 4  // Size of the matrix (number of tasks and workers)

int cost[N][N]; int
finalAssignment[N]; int
minCost = INT_MAX;

void printSolution(int assignment[], int costMatrix[N][N]) {
printf("Optimal Assignment:\n");       for (int i = 0; i < N; i++) {
printf("Task %d -> Worker %d\n", i + 1, assignment[i] + 1);
    }
    printf("Minimum Cost: %d\n", minCost);
}

int calculateCost(int assignment[], int costMatrix[N][N]) {
int totalCost = 0;     for (int i = 0; i < N; i++) {
totalCost += costMatrix[i][assignment[i]];
    }
    return totalCost;
}
```

```
void boundAndBranch(int costMatrix[N][N], int assignment[], int n, int level, int
currentCost, int visited[]) {     if (level == n) {
        // Base case: all tasks assigned         if
(currentCost < minCost) {             minCost =
currentCost;             for (int i = 0; i < n; i++) {
finalAssignment[i] = assignment[i];
            }
}
return;
    }

    // Loop through all workers to try assigning tasks     for (int i = 0; i < n; i++) {
if (!visited[i]) {             visited[i] = 1;             assignment[level] = i;             int
newCost = currentCost + costMatrix[level][i];             if (newCost < minCost) {
boundAndBranch(costMatrix, assignment, n, level + 1, newCost, visited);
            }
            visited[i] = 0;  // Backtrack
        }
    }
}

int main() {     int assignment[N] = {-1, -1, -1, -1};  // Holds the final
assignment     int visited[N] = {0, 0, 0, 0};  // Keeps track of
assigned workers

    // Input the entire cost matrix at once
    printf("Enter the cost matrix for the assignment problem (size %dx%d),
spaceseparated values:\n", N, N);
```

```
    for (int i = 0; i < N; i++) {
for (int j = 0; j < N; j++) {
scanf("%d", &cost[i][j]);
        }
    }

    boundAndBranch(cost, assignment, N, 0, 0, visited);
printSolution(finalAssignment, cost);

    return 0;
}
```

Output:



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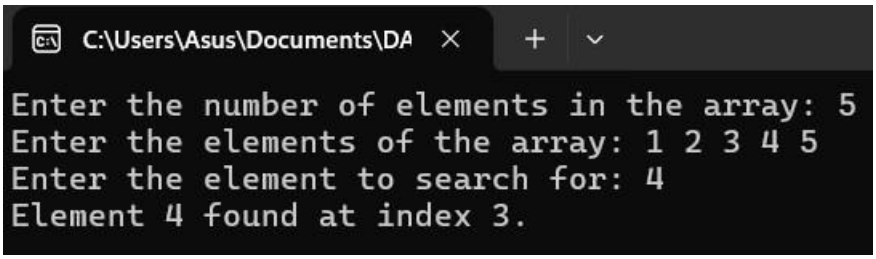
36. Linear search.

```
#include <stdio.h>

int linearSearch(int arr[], int size, int target) {     for
(int i = 0; i < size; i++) {         if (arr[i] == target) {
return i;  // Return index if element is found
        }
    }
    return -1;  // Return -1 if element is not found
```

```
}

int main() {     int
size, target;

    // Input array size     printf("Enter the number of
elements in the array: ");     scanf("%d", &size);

    int arr[size];  // Declare the array with the given size

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

    // Input the target element to search
printf("Enter the element to search for: ");
scanf("%d", &target);

    int result = linearSearch(arr, size, target);
     if (result != -1) {         printf("Element %d found at index
%d.\n", target, result);
    } else {         printf("Element %d not found in the
array.\n", target);
    }

    return 0;
}
```

Output:

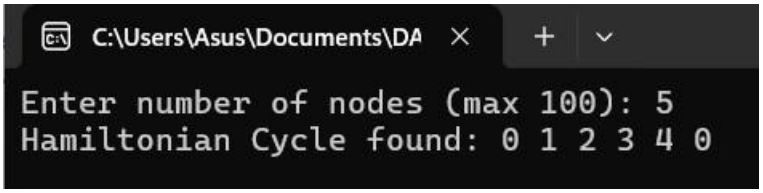


37. Hamiltonian circuit.

```
#include <stdio.h>
#include <stdbool.h>
#define MAX_NODES 100
void generateCompleteGraph(int graph[MAX_NODES][MAX_NODES], int nodes) {
    for (int i = 0; i < nodes; i++)
for (int j = 0; j < nodes; j++)
graph[i][j] = (i != j);
}
bool isSafe(int v, int graph[MAX_NODES][MAX_NODES], int path[], int pos) {
if (!graph[path[pos - 1]][v]) return false;     for (int i = 0; i < pos; i++)         if
(path[i] == v) return false;
    return true;
}
bool hamiltonianCycleUtil(int graph[MAX_NODES][MAX_NODES], int path[], int pos,
int nodes) {     if (pos == nodes) return graph[path[pos - 1]][path[0]];     for (int v = 1;
v < nodes; v++) {         if (isSafe(v, graph, path, pos)) {             path[pos] = v;
if (hamiltonianCycleUtil(graph, path, pos + 1, nodes)) return true;             path[pos] =
-1;
        }
    }
    return false;
```

```
}
void findHamiltonianCycle(int graph[MAX_NODES][MAX_NODES], int nodes) {
int path[MAX_NODES];
    for (int i = 0; i < nodes; i++) path[i] = -1;     path[0]
= 0;     if (hamiltonianCycleUtil(graph, path, 1,
nodes)) {         printf("Hamiltonian Cycle found: ");
for (int i = 0; i < nodes; i++) printf("%d ", path[i]);
printf("%d\n", path[0]);
    } else {         printf("No Hamiltonian Cycle
found.\n");
    }
}
int main() {
    int nodes, graph[MAX_NODES][MAX_NODES];
printf("Enter number of nodes (max %d): ", MAX_NODES);
scanf("%d", &nodes);     if (nodes < 3 || nodes >
MAX_NODES) {
        printf("Invalid number of nodes.\n");
return 1;
    }
    generateCompleteGraph(graph, nodes);
findHamiltonianCycle(graph, nodes);     return
0;
}
```

Output: SWETHA (192211096)



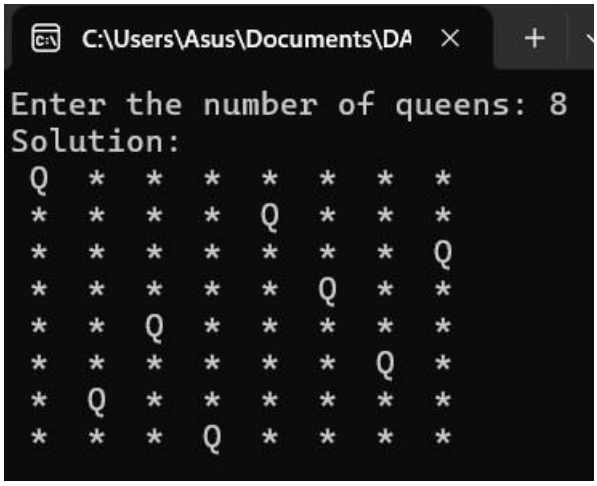
38. N queen’s problem.

```
#include <stdio.h>
#include <stdlib.h>  // For abs()

// Function to print the board with queens placed on it
void printSolution(int board[], int N) {
printf("Solution:\n");     for (int i = 0; i < N; i++) {
for (int j = 0; j < N; j++) {             if (board[i] == j) {
printf(" Q ");  // Queen is placed at [i, j]
          } else {                printf(" * ");
// Empty space
          }        }
printf("\n");
   }
printf("\n"); }
// Function to check if it's safe to place a queen at [row, col]
int isSafe(int board[], int row, int col, int N) {     for (int i = 0;
i < row; i++) {         if (board[i] == col || abs(board[i] - col) ==
abs(i - row)) {             return 0;  // Conflict with another
queen
       }
   }
   return 1;  // No conflict
}
// Backtracking function to solve the N-Queens problem
int solveNQueens(int board[], int row, int N) {     if (row
== N) {
```

```
        // All queens are placed successfully, print the solution
printSolution(board, N);         return 1;  // Return true after
finding the first solution
    }

    for (int col = 0; col < N; col++) {         if (isSafe(board,
row, col, N)) {             board[row] = col;  // Place queen
at [row, col]             if (solveNQueens(board, row + 1,
N)) {                 return 1;  // Stop after finding the first
solution
            }
        }
    }
    return 0;  // No solution found
}
int main() {
int N;
    // Input the number of queens (size of the board)
printf("Enter the number of queens: ");     scanf("%d",
&N);

    // Initialize the board     int board[N];     for
(int i = 0; i < N; i++) {         board[i] = -1;  // No
queens placed initially
    }

    // Solve the N-Queens problem     if
(!solveNQueens(board, 0, N)) {         printf("No
solution exists for %d queens.\n", N);
```

```
    }

    return 0;
}
```

Output: SWETHA (192211096)



39. Approximation algorithm.

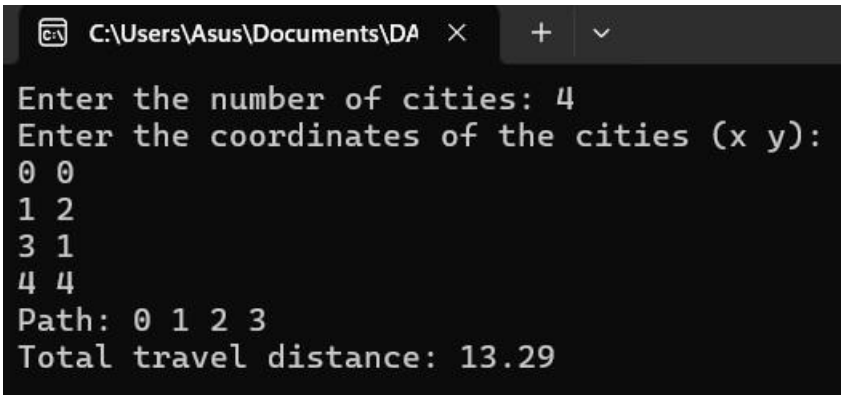
```
#include <stdio.h>
#include <math.h>

#define MAX_CITIES 10
#define INF 99999

// Function to calculate the distance between two cities (Euclidean distance)
double distance(int city1[], int city2[]) {     return sqrt(pow(city1[0] - city2[0],
2) + pow(city1[1] - city2[1], 2));
}

// Nearest Neighbor Approximation Algorithm for TSP
double nearestNeighbor(int cities[][2], int n) {     int
```

```
visited[n];     int path[n];     double totalDistance =
0.0;

   // Initialize visited array     for (int i = 0; i < n;
i++) {         visited[i] = 0;  // No cities are visited
initially
   }

   visited[0] = 1;  // Start at the first city
path[0] = 0;  // First city in the path     int
currentCity = 0;

   // Iterate through all cities
for (int i = 1; i < n; i++) {
double minDist = INF;         int
nextCity = -1;

       // Find the nearest unvisited city         for (int j = 0; j <
n; j++) {             if (!visited[j]) {                 double dist =
distance(cities[currentCity], cities[j]);                 if (dist <
minDist) {                     minDist = dist;                     nextCity
= j;
             }
          }
       }
```

```
        // Mark the next city as visited and add it to the path
visited[nextCity] = 1;          path[i] = nextCity;
totalDistance += minDist;          currentCity = nextCity;
    }

    // Add the distance to return to the start city
totalDistance += distance(cities[currentCity], cities[0]);

    // Print the path
printf("Path: ");     for (int i
= 0; i < n; i++) {
printf("%d ", path[i]);
    }
printf("\n");
return
totalDistance;

}

int main() {
int n;
    // Input the number of cities
printf("Enter the number of cities: ");
scanf("%d", &n);

    // Input the coordinates of the cities     int
cities[n][2];     printf("Enter the coordinates of the
cities (x y):\n");     for (int i = 0; i < n; i++) {
scanf("%d %d", &cities[i][0], &cities[i][1]);
```

```
    }

    // Call the nearest neighbor algorithm
double totalCost = nearestNeighbor(cities, n);

    printf("Total travel distance: %.2f\n", totalCost);

    return 0;
}
```

Output:

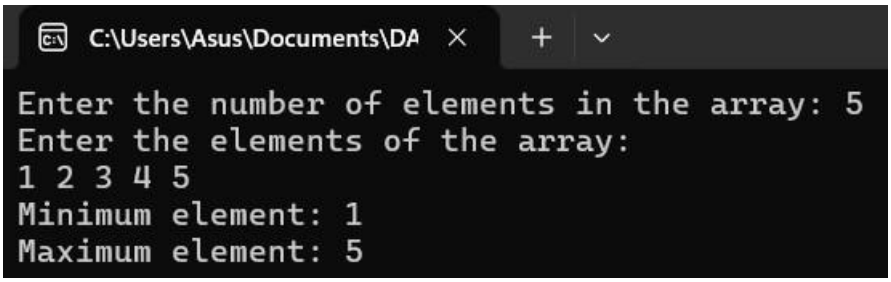


40. Min and max in array. SWETHA (192211096)

```
#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 element: %d\n", min);
printf("Maximum element: %d\n", max);
}

int main() {
int n;

    // Input the number of elements      printf("Enter the
number of elements in the array: ");      scanf("%d",
&n);
          int
arr[n];

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

    // Call the function to find the min and max
findMinMax(arr, n);

    return 0;
}
```

Output:


C:\Users\Asus\Documents\DA
Enter the number of elements in the array: 5
Enter the elements of the array:
1 2 3 4 5
Minimum element: 1
Maximum element: 5