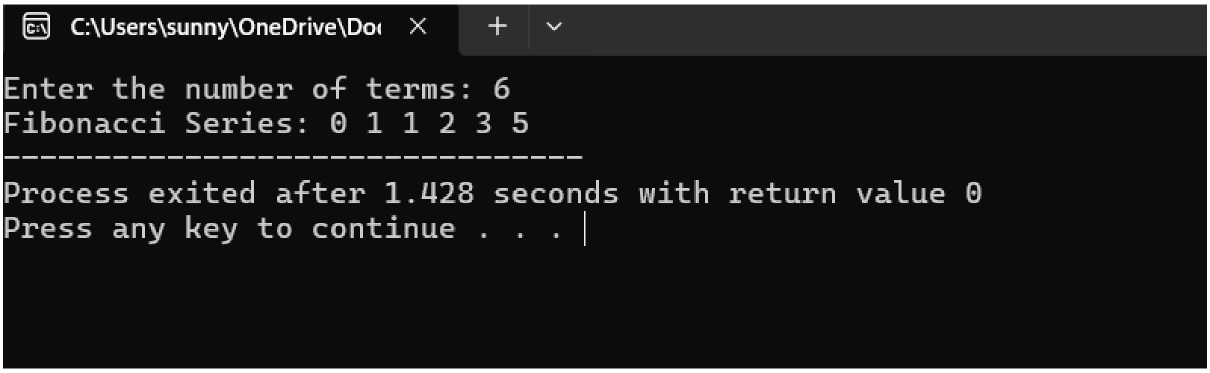
CSA0609-DESIGN AND ANALYSIS FOR ALGORITHMS

1.Fibonacci series using recursion

```
#include <stdio.h>
int fib(int n) {
    if (n <= 1) {
        return n;
    } else {
        return fib(n - 1) + fib(n - 2);
    }
}
int main() {
    int n, i;
    printf("Enter the number of terms: ");
    scanf("%d", &n);

    printf("Fibonacci Series: ");
    for (i = 0; i < n; i++) {
        printf("%d ", fib(i));
    }
    return 0;
}
```

Output:

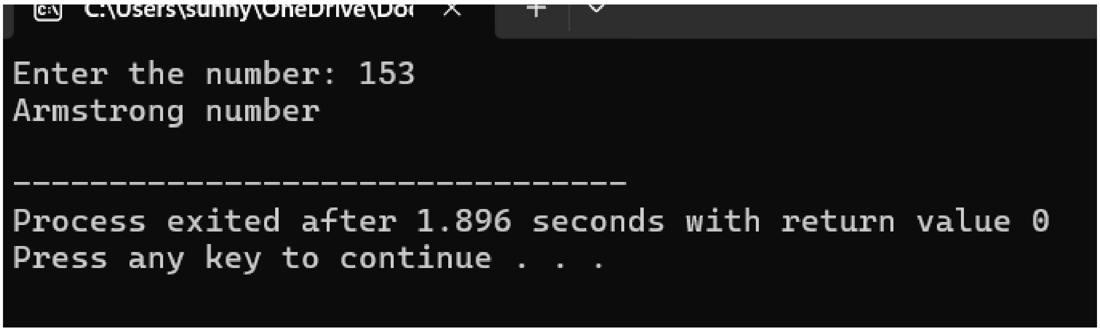


```
Enter the number of terms: 6
Fibonacci Series: 0 1 1 2 3 5
--------------------------------
Process exited after 1.428 seconds with return value 0
Press any key to continue . . .
```

2.Armstrong number or not

```
#include <stdio.h>

int main() {

   int num, rem, sum = 0, temp, digit;

   printf("Enter the number: ");

   scanf("%d", &num);

   temp = num;

   while (num > 0) {

      digit = num % 10;

      sum += digit * digit * digit;

      num /= 10;

   }

   if (sum == temp) {

      printf("Armstrong number\n");

   } else {

      printf("Not an Armstrong number\n");

   }

   return 0;

}
```

OUTPUT



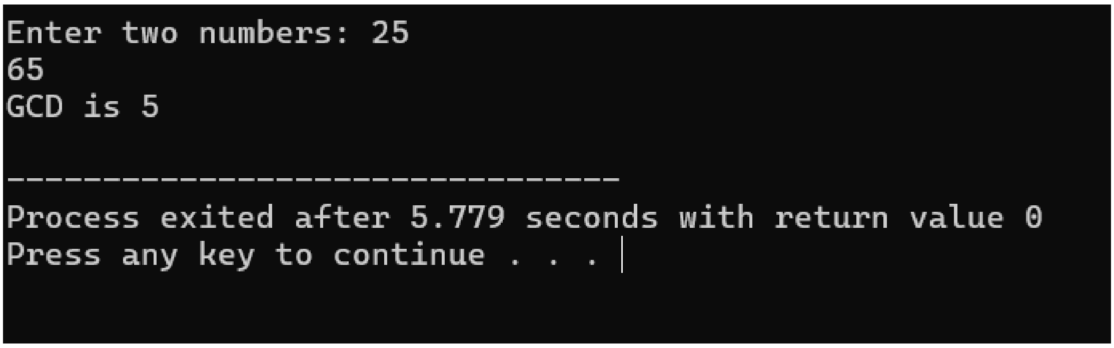
```
Enter the number: 153
Armstrong number

--------------------------------
Process exited after 1.896 seconds with return value 0
Press any key to continue . . .
```

3.GCD OF TWO NUMBERS

```
#include <stdio.h>

int main() {

   int a, b, temp;

   printf("Enter two numbers: ");

   scanf("%d %d", &a, &b);
```

```
    while (b != 0) {
        temp = b;
        b = a % b;
        a = temp;
    }
    printf("GCD is %d\n", a);
    return 0;
}
```

OUTPUT:

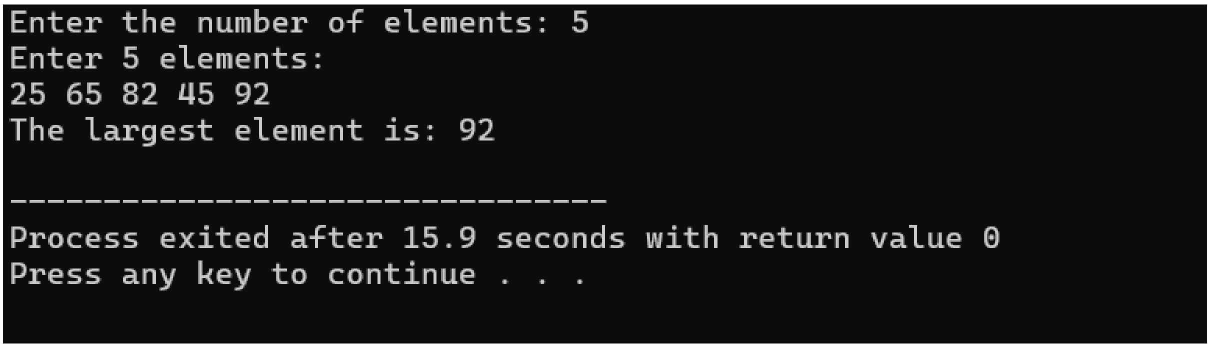


```
Enter two numbers: 25
65
GCD is 5

--------------------------------
Process exited after 5.779 seconds with return value 0
Press any key to continue . . .
```

4.LARGEST ELEMENT OF AN ARRAY

```
#include <stdio.h>
int main() {
    int n, i;
    printf("Enter the number of elements: ");
    scanf("%d", &n);


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

OUTPUT:



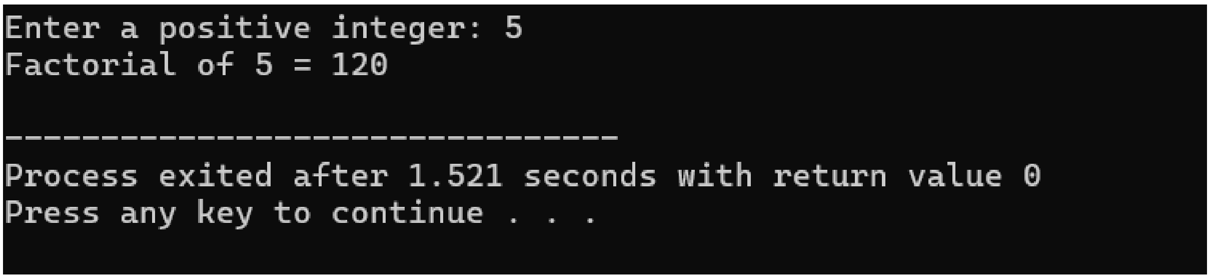
```
Enter the number of elements: 5
Enter 5 elements:
25 65 82 45 92
The largest element is: 92

--------------------------------
Process exited after 15.9 seconds with return value 0
Press any key to continue . . .
```

5.FACTORIAL OF A NUMBER

```
#include <stdio.h>
int main() {
    int i,n;
    int factorial = 1;

    printf("Enter a positive integer: ");
    scanf("%d", &n);

    if (n < 0) {
        printf("Factorial is not defined for negative numbers.\n");
    } else {
        for (i = 1; i <= n; i++) {
            factorial *= i;
        }
        printf("Factorial of %d = %d\n", n, factorial);
    }
```

```
  return 0;
}
```

OUTPUT:



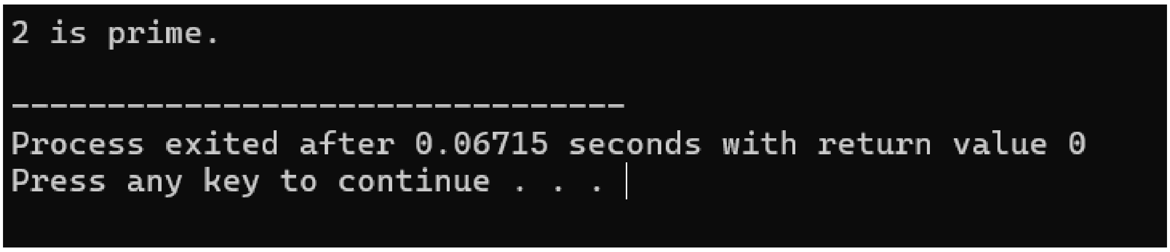
```
Enter a positive integer: 5
Factorial of 5 = 120

--------------------------------
Process exited after 1.521 seconds with return value 0
Press any key to continue . . .
```

6.PRIME OR NOT

```
#include <stdio.h>
#include <math.h>
#include <stdbool.h>
int main() {
  int i;
        int num = 2;
  bool isPrime = true;
  if (num < 2) {
    isPrime = false;
  } else {
    for (i = 2; i <= sqrt(num); i++) {
      if (num % i == 0) {
        isPrime = false;
        break;
      }
    }
  }
  if (isPrime) {
    printf("%d is prime.\n", num);
  } else {
    printf("%d is not prime.\n", num);
  }
```

```
   return 0;
}
```

OUTPUT:



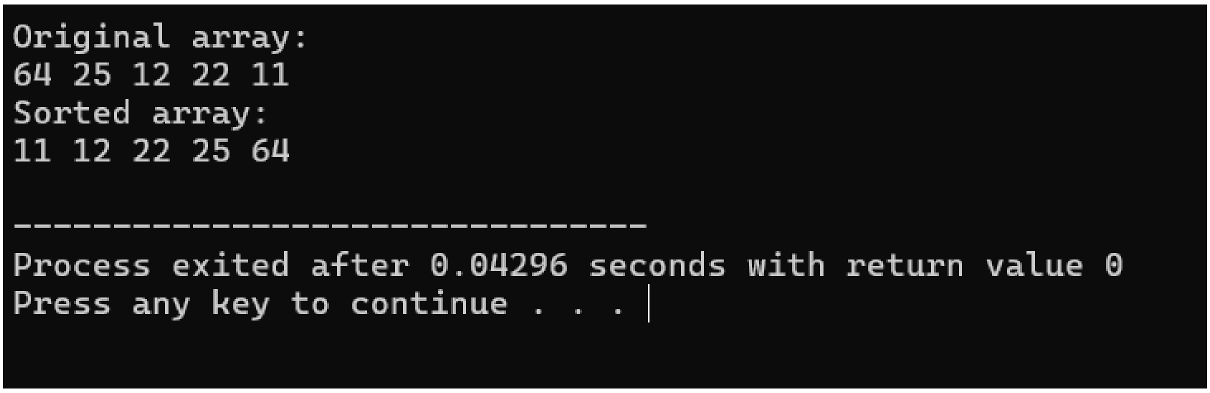
```
2 is prime.

--------------------------------
Process exited after 0.06715 seconds with return value 0
Press any key to continue . . .
```

7.SELECTION SORT

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

```
int main() {
   int array[] = {64, 25, 12, 22, 11};
   int n = sizeof(array) / sizeof(array[0]);
printf("Original array: \n");
printArray(array, n);
selectionSort(array, n);
printf("Sorted array: \n");
printArray(array, n);
   return 0;
}
```

OUTPUT:



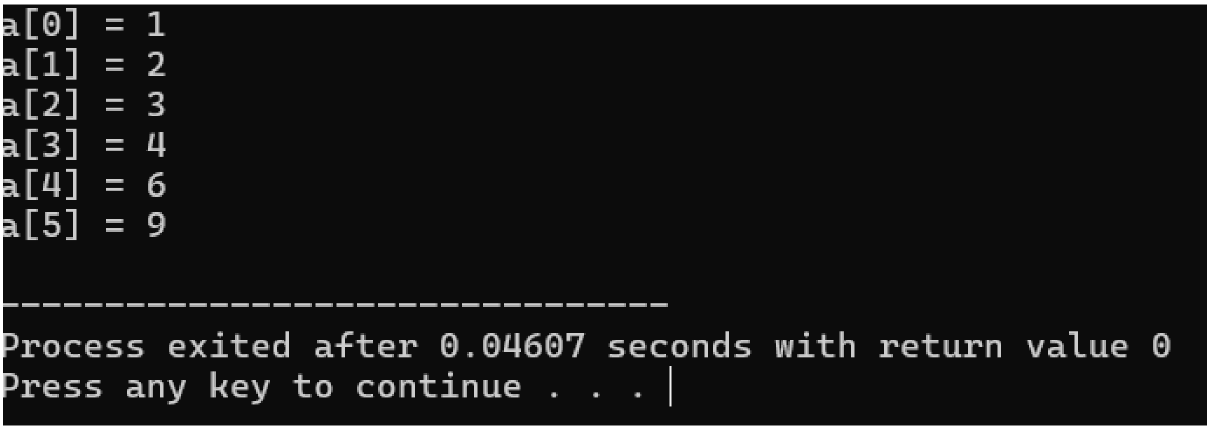
```
Original array:
64 25 12 22 11
Sorted array:
11 12 22 25 64

--------------------------------
Process exited after 0.04296 seconds with return value 0
Press any key to continue . . .
```

8.BUBBLE SORT

```
#include <stdio.h>
void bubble_sort(int a[], int length) {
   int i, j, temp, flag;
   for (i = 0; i< length - 1; i++) {
      flag = 0;
      for (j = 0; j < length - 1 - i; j++) {
         if (a[j] >a[j + 1]) {
            temp = a[j];
            a[j] = a[j + 1];
a[j + 1] = temp;
            flag = 1;
         }
```

```
        }
        if (flag == 0)
            break;
    }
}
int main(void) {
    int a[] = {3, 4, 9, 2, 1, 6};
    int length = 6;
    int i;
bubble_sort(a, length);
    for (i = 0; i< length; i++) {
printf("a[%d] = %d\n", i, a[i]);
    }
    return 0;
}
```

OUTPUT:



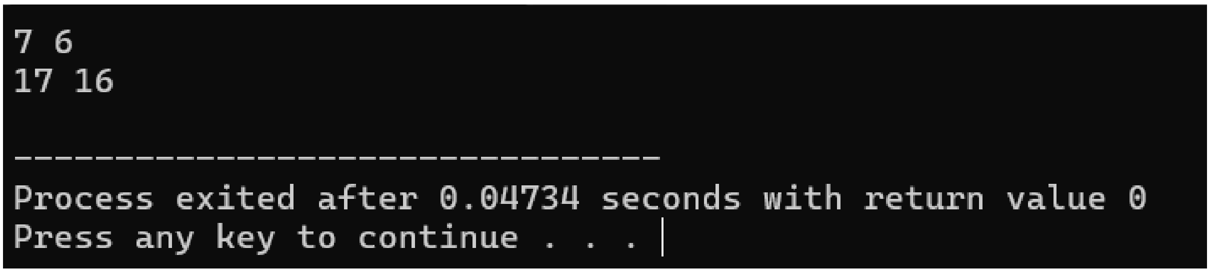
```
a[0] = 1
a[1] = 2
a[2] = 3
a[3] = 4
a[4] = 6
a[5] = 9

--------------------------------
Process exited after 0.04607 seconds with return value 0
Press any key to continue . . .
```

9.MULTIPLY TWO MATRICES

```
#include <stdio.h>
int main() {
    int a[2][2] = {{1, 2}, {3, 4}};
    int b[2][2] = {{3, 4}, {2, 1}};
    int c[2][2] = {{0, 0}, {0, 0}};
    int i, j, k;
```

```
   for (i = 0; i< 2; i++) {
       for (j = 0; j < 2; j++) {
           for (k = 0; k < 2; k++) {
               c[i][j] += a[i][k] * b[k][j];
           }
       }
   }

   for (i = 0; i< 2; i++) {
       for (j = 0; j < 2; j++) {
printf("%d ", c[i][j]);
       }
printf("\n");
   }

   return 0;
}
```

OUTPUT:

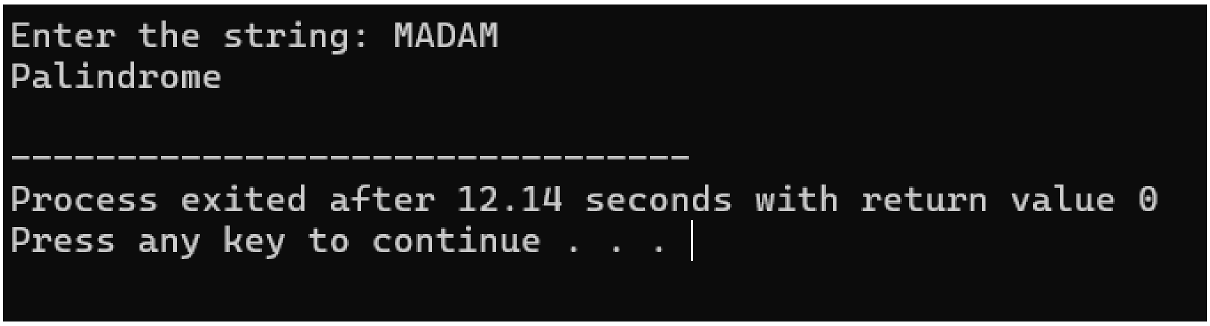


```
7 6
17 16

--------------------------------
Process exited after 0.04734 seconds with return value 0
Press any key to continue . . .
```

10.PALINDROME

```
#include <stdio.h>
#include <string.h>
int main() {
   char str[100], reversed[100];
   int len, i, is_palindrome = 1;
printf("Enter the string: ");
scanf("%s", str);
len = strlen(str);
   for (i = 0; i<len; i++) {
      reversed[i] = str[len - i - 1];
   }
   reversed[len] = '\0';
   if (strcmp(str, reversed) == 0) {
printf("Palindrome\n");
   } else {
printf("Not a palindrome\n");
   }
   return 0;
}
```

OUTPUT:



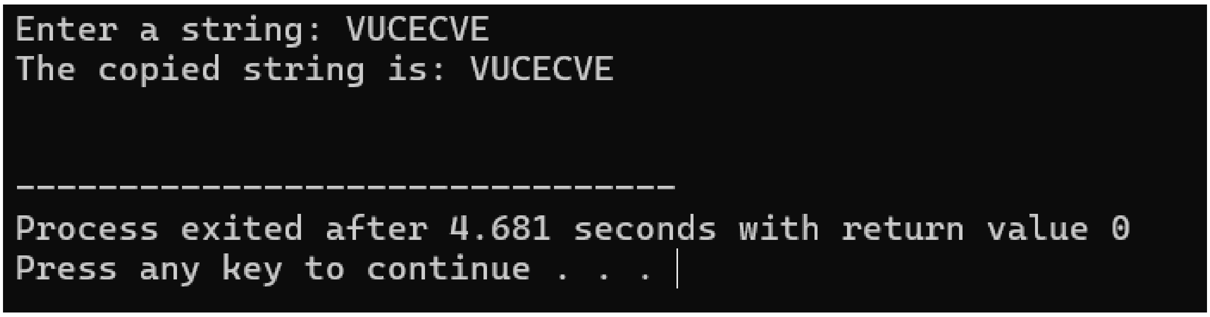
```
Enter the string: MADAM
Palindrome

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

11.COPY ONE STRING TO ANOTHER

```
#include <stdio.h> v
int main() {
   char source[100], destination[100];
   int i = 0;
printf("Enter a string: ");
fgets(source, sizeof(source), stdin);
   while (source[i] != '\0') {
      destination[i] = source[i];
i++;
   }
```

```
    destination[i] = '\0';
printf("The copied string is: %s\n", destination);
    return 0;
}
```

OUTPUT:



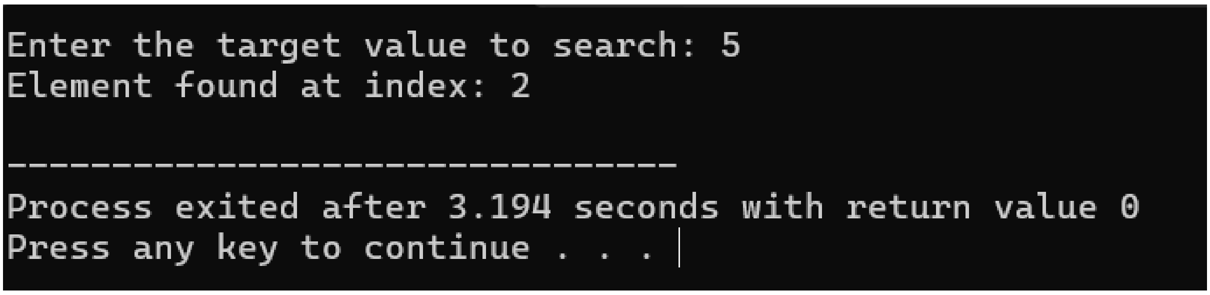
```
Enter a string: VUCECVE
The copied string is: VUCECVE


--------------------------------
Process exited after 4.681 seconds with return value 0
Press any key to continue . . .
```

12.BINARY SEARCH

```
#include <stdio.h>
int binarySearch(int arr[], int size, int target) {
    int low = 0, high = size - 1;
    while (low <= high) {
        int mid = low + (high - low) / 2;
        if (arr[mid] == target) {
            return mid;
        }
        if (arr[mid] < target) {
            low = mid + 1;
        }
        else {
            high = mid - 1;
        }
    }
    return -1;
}
int main() {
    int arr[] = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19};
```

```
   int target, result;
printf("Enter the target value to search: ");
scanf("%d", &target);
   result = binarySearch(arr, sizeof(arr) / sizeof(arr[0]), target);
   if (result != -1) {
printf("Element found at index: %d\n", result);
   } else {
printf("Element not found\n");
   }
   return 0;
}
```

OUTPUT:



```
Enter the target value to search: 5
Element found at index: 2

--------------------------------
Process exited after 3.194 seconds with return value 0
Press any key to continue . . .
```

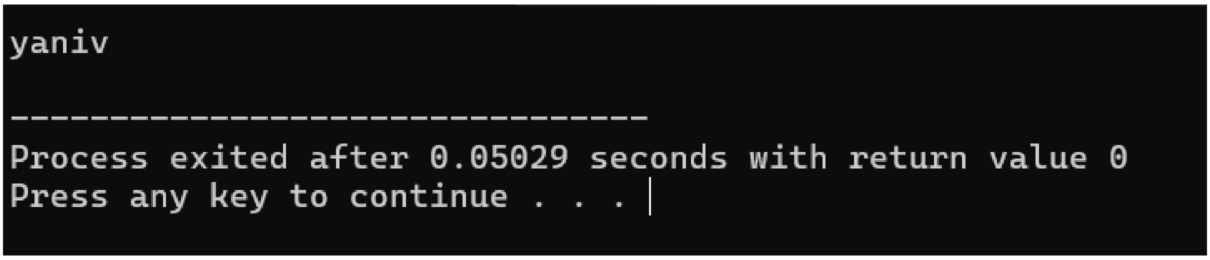
13.REVERSE A STRING

```
#include <stdio.h>
#include <string.h>
int main() {
   char str[100], reversed[100];
   int len, i;
strcpy(str, "vinay");
len = strlen(str);
   for (i = 0; i<len; i++) {
      reversed[i] = str[len - i - 1];
   }
   reversed[len] = '\0';
printf("%s\n", reversed);
   return 0;
}
```

WITHOUT USING FUNCTION

```
#include <stdio.h>
int main() {
   char str[] = "vinay";
   char reversed[100];
   int len = 0, i;
   while (str[len] != '\0') {
len++;
   }
   for (i = 0; i<len; i++) {
      reversed[i] = str[len - i - 1];
   }
   reversed[len] = '\0';
printf("%s\n", reversed);
   return 0;
}
```

OUTPUT:



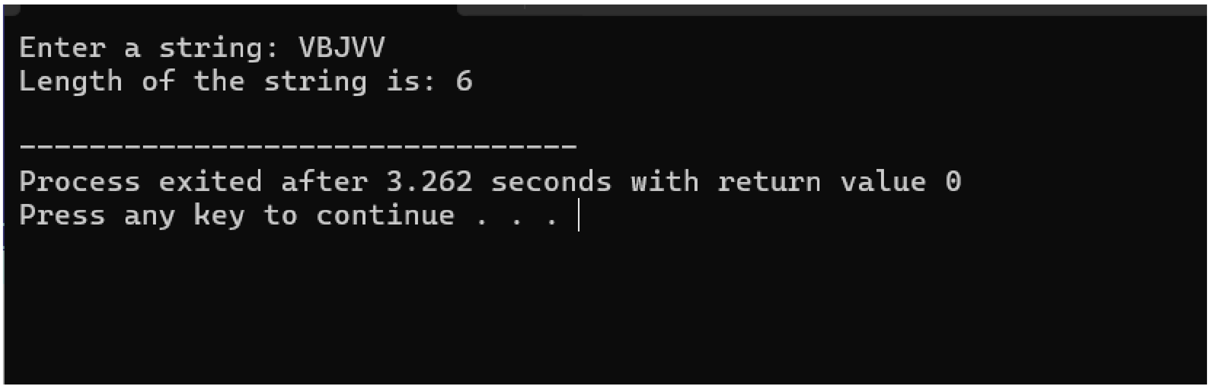
```
yaniv

--------------------------------
Process exited after 0.05029 seconds with return value 0
Press any key to continue . . .
```

14.LENGTH OF CA STRING

```
#include <stdio.h>
int main() {
   char str[100];
   int length = 0;
printf("Enter a string: ");
fgets(str, sizeof(str), stdin);
   while (str[length] != '\0') {
      length++;
```

```
    }
printf("Length of the string is: %d\n", length);
    return 0;
}
```

OUTPUT:



```
Enter a string: VBJVV
Length of the string is: 6

--------------------------------
Process exited after 3.262 seconds with return value 0
Press any key to continue . . .
```

15.STRASSEN'S MULTIPLICATION

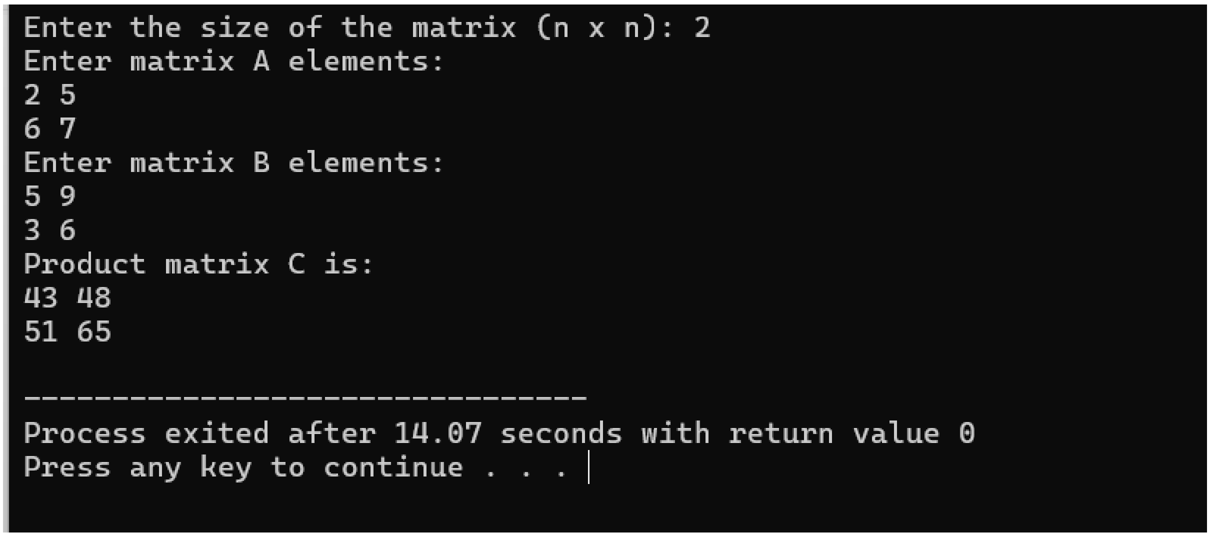
```
#include <stdio.h>
#include <stdlib.h>
void addMatrix(int n, int A[n][n], int B[n][n], int result[n][n]) {
    for (int i = 0; i< n; i++) {
        for (int j = 0; j < n; j++) {
            result[i][j] = A[i][j] + B[i][j];
        }
    }
}
void subtractMatrix(int n, int A[n][n], int B[n][n], int result[n][n]) {
    for (int i = 0; i< n; i++) {
        for (int j = 0; j < n; j++) {
            result[i][j] = A[i][j] - B[i][j];
        }
    }
}
void strassenMultiply(int n, int A[n][n], int B[n][n], int C[n][n]) {
    if (n == 1) {
```

```
C[0][0] = A[0][0] * B[0][0];
        return;
    }
    int newSize = n / 2;
    int A11[newSize][newSize], A12[newSize][newSize], A21[newSize][newSize], A22[newSize][newSize];
    int B11[newSize][newSize], B12[newSize][newSize], B21[newSize][newSize], B22[newSize][newSize];
    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];
        }
    }
    int P1[newSize][newSize], P2[newSize][newSize], P3[newSize][newSize], P4[newSize][newSize];
    int P5[newSize][newSize], P6[newSize][newSize], P7[newSize][newSize];
    int temp1[newSize][newSize], temp2[newSize][newSize];
subtractMatrix(newSize, B12, B22, temp1);
strassenMultiply(newSize, A11, temp1, P1);
addMatrix(newSize, A11, A12, temp1);
strassenMultiply(newSize, temp1, B22, P2);
addMatrix(newSize, A21, A22, temp1);
strassenMultiply(newSize, temp1, B11, P3);
subtractMatrix(newSize, B21, B11, temp1);
strassenMultiply(newSize, A22, temp1, P4);
```

```
addMatrix(newSize, A11, A22, temp1);

addMatrix(newSize, B11, B22, temp2);

strassenMultiply(newSize, temp1, temp2, P5);

subtractMatrix(newSize, A12, A22, temp1);

addMatrix(newSize, B21, B22, temp2);

strassenMultiply(newSize, temp1, temp2, P6);

subtractMatrix(newSize, A11, A21, temp1);

addMatrix(newSize, B11, B12, temp2);

strassenMultiply(newSize, temp1, temp2, P7);

   int C11[newSize][newSize], C12[newSize][newSize], C21[newSize][newSize],
C22[newSize][newSize];

addMatrix(newSize, P5, P4, temp1);

subtractMatrix(newSize, temp1, P2, C11);

addMatrix(newSize, P1, P2, C12);

addMatrix(newSize, P3, P4, C21);

addMatrix(newSize, P1, P5, temp1);

subtractMatrix(newSize, temp1, P3, P7);

subtractMatrix(newSize, temp1, P7, C22);

   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];

      }

   }

}

int main() {

   int n;

printf("Enter the size of the matrix (n x n): ");

scanf("%d", &n);
```

```
    int A[n][n], B[n][n], C[n][n];
printf("Enter matrix A elements:\n");
    for (int i = 0; i< n; i++) {
        for (int j = 0; j < n; j++) {
scanf("%d", &A[i][j]);
        }
    }
printf("Enter matrix B elements:\n");
    for (int i = 0; i< n; i++) {
        for (int j = 0; j < n; j++) {
scanf("%d", &B[i][j]);
        }
    }
strassenMultiply(n, A, B, C);
printf("Product matrix C is:\n");
    for (int i = 0; i< n; i++) {
        for (int j = 0; j < n; j++) {
printf("%d ", C[i][j]);
        }
printf("\n");
    }

    return 0;
}
```

OUTPUT:



```
Enter the size of the matrix (n x n): 2
Enter matrix A elements:
2 5
6 7
Enter matrix B elements:
5 9
3 6
Product matrix C is:
43 48
51 65

--------------------------------
Process exited after 14.07 seconds with return value 0
Press any key to continue . . .
```

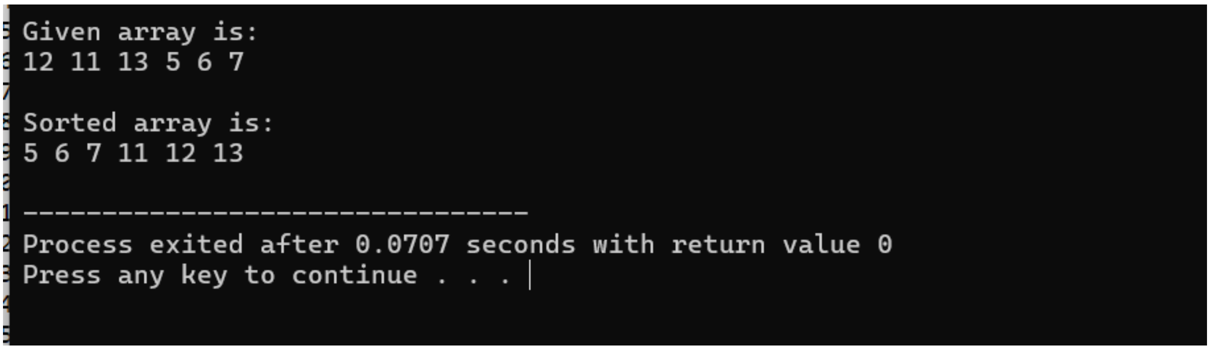
16.MERGE SORT

```
#include <stdio.h>

void merge(int arr[], int left, int mid, int right) {

   int n1 = mid - left + 1;

   int n2 = right - mid;

   int leftArr[n1], rightArr[n2];

   for (int i = 0; i< n1; i++) {

leftArr[i] = arr[left + i];

   }

   for (int i = 0; i< n2; i++) {

rightArr[i] = arr[mid + 1 + i];

   }

   int i = 0, j = 0, k = left;

   while (i< n1 && j < n2) {

       if (leftArr[i] <= rightArr[j]) {

arr[k] = leftArr[i];

i++;

       } else {

arr[k] = rightArr[j];

j++;

       }
```

```
        k++;
    }
    while (i< n1) {
arr[k] = leftArr[i];
i++;
        k++;
    }
    while (j < n2) {
arr[k] = rightArr[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 arr[] = {12, 11, 13, 5, 6, 7};
    int arr_size = sizeof(arr) / sizeof(arr[0]);
printf("Given array is: \n");
```

```
printArray(arr, arr_size);

mergeSort(arr, 0, arr_size - 1);

printf("\nSorted array is: \n");

printArray(arr, arr_size);

   return 0;

}
```

OUTPUT:



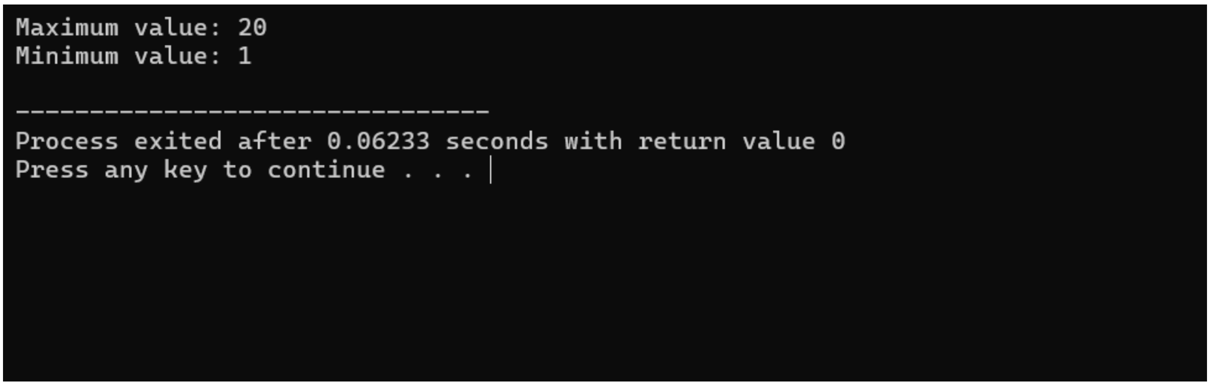
```
Given array is:
12 11 13 5 6 7

Sorted array is:
5 6 7 11 12 13

--------------------------------
Process exited after 0.0707 seconds with return value 0
Press any key to continue . . .
```

17.MAX AND MIN IN THE LIST USING DIVIDE AND CONQUER METHOD

```
#include <stdio.h>

typedef struct {

   int max;

   int min;

} MaxMin;

MaxMinfindMaxMin(int arr[], int low, int high) {

MaxMin result, leftResult, rightResult;

   if (low == high) {

result.max = arr[low];

result.min = arr[low];

      return result;

   }

   int mid = (low + high) / 2;

leftResult = findMaxMin(arr, low, mid);

rightResult = findMaxMin(arr, mid + 1, high);

result.max = (leftResult.max>rightResult.max) ?leftResult.max : rightResult.max;

result.min = (leftResult.min<rightResult.min) ?leftResult.min : rightResult.min;
```

```
    return result;
}
int main() {
    int arr[] = {12, 5, 8, 20, 7, 15, 1};
    int n = sizeof(arr) / sizeof(arr[0]);
MaxMin result = findMaxMin(arr, 0, n - 1);
printf("Maximum value: %d\n", result.max);
printf("Minimum value: %d\n", result.min);
    return 0;
}
```

OUTPUT:



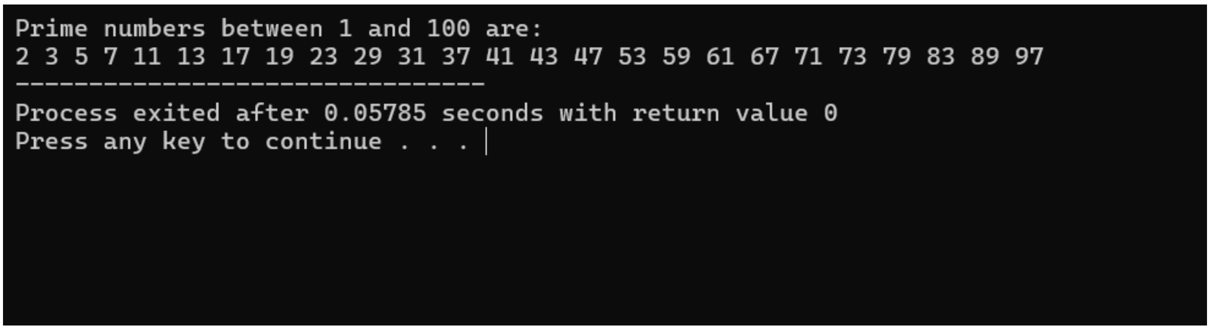
```
Maximum value: 20
Minimum value: 1

--------------------------------
Process exited after 0.06233 seconds with return value 0
Press any key to continue . . .
```

18.PRIME NUMBERS BETWEEN 1 AND 100

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

```
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:



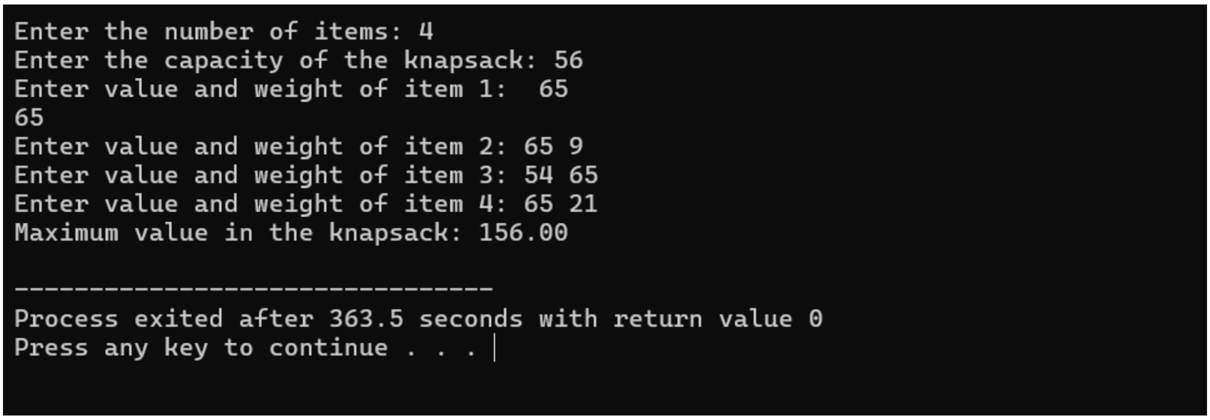
```
Prime numbers between 1 and 100 are:
2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83 89 97
--------------------------------
Process exited after 0.05785 seconds with return value 0
Press any key to continue . . .
```

19.KNAPSACK PROBLEM USING GREEDY TECHNIQUES

```
#include <stdio.h>
#include <stdlib.h>
typedef struct {
   int weight;
   int value;
   float ratio;
} Item;
int compare(const void* a, const void* b) {
   Item* item1 = (Item*)a;
   Item* item2 = (Item*)b;
   return (item2->ratio > item1->ratio) - (item1->ratio > item2->ratio);
}
float fractionalKnapsack(int capacity, Item items[], int n) {
```

```
qsort(items, n, sizeof(Item), compare);
    int currentWeight = 0;
    float totalValue = 0.0;
    for (int i = 0; i< n; i++) {
        if (currentWeight + items[i].weight<= capacity) {
currentWeight += items[i].weight;
totalValue += items[i].value;
        } else {
            int remainingWeight = capacity - currentWeight;
totalValue += items[i].value * ((float)remainingWeight / 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);
    Item items[n];
    for (int i = 0; i< n; i++) {
printf("Enter value and weight of item %d: ", i + 1);
scanf("%d %d", &items[i].value, &items[i].weight);
        items[i].ratio = (float)items[i].value / items[i].weight;
    }
    float maxValue = fractionalKnapsack(capacity, items, n);
printf("Maximum value in the knapsack: %.2f\n", maxValue);
    return 0;
}
```

OUTPUT:



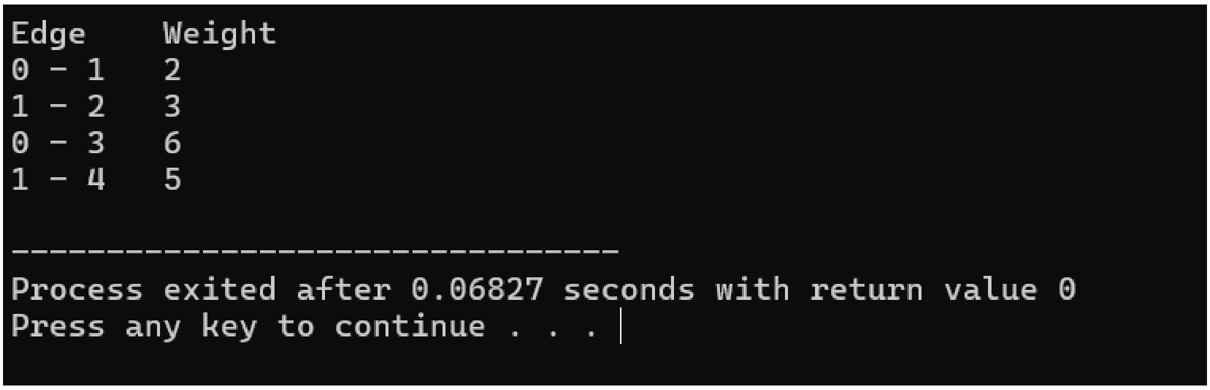
```
Enter the number of items: 4
Enter the capacity of the knapsack: 56
Enter value and weight of item 1:  65
65
Enter value and weight of item 2: 65 9
Enter value and weight of item 3: 54 65
Enter value and weight of item 4: 65 21
Maximum value in the knapsack: 156.00

--------------------------------
Process exited after 363.5 seconds with return value 0
Press any key to continue . . .
```

20.MST USING GREEDY TECHNIQUE

```
#include <stdio.h>

#include <limits.h>

#define V 5

int minKey(int key[], int mstSet[]) {

   int min = INT_MAX, min_index;

   for (int v = 0; v < V; v++)

       if (!mstSet[v] && key[v] < min)

           min = key[v], min_index = v;

   return min_index;

}

void primMST(int graph[V][V]) {

   int parent[V], key[V], mstSet[V] = {0};

   for (int i = 0; i< V; i++) key[i] = INT_MAX;

key[0] = 0, parent[0] = -1;

   for (int count = 0; count < V - 1; count++) {

       int u = minKey(key, mstSet);

mstSet[u] = 1;

       for (int v = 0; v < V; v++)

           if (graph[u][v] && !mstSet[v] && graph[u][v] < key[v])

               parent[v] = u, key[v] = graph[u][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]]);
}
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:

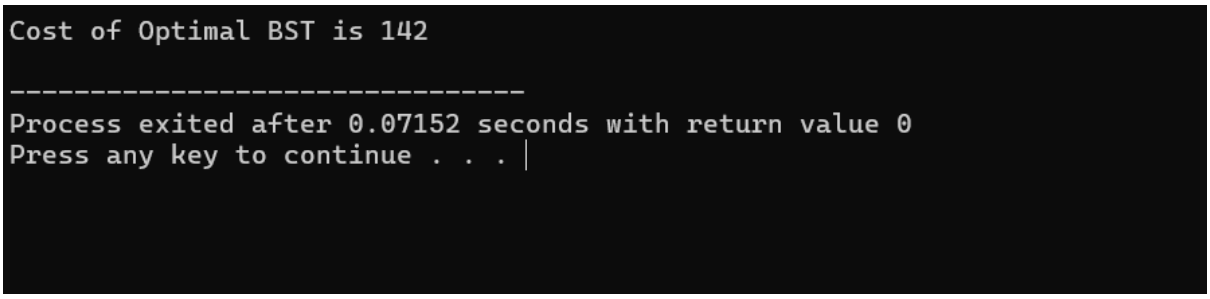


```
Edge    Weight
0 - 1   2
1 - 2   3
0 - 3   6
1 - 4   5

--------------------------------
Process exited after 0.06827 seconds with return value 0
Press any key to continue . . .
```

21.OBST USING DYNAMIC PROGRAMMING

```
#include <stdio.h>
#include <limits.h>
int sum(int freq[], int i, int j) {
   int s = 0;
   for (int k = i; k <= j; k++)
      s += freq[k];
   return s;
}
int optimalBST(int keys[], int freq[], int n) {
  int cost[n][n];
  for (int i = 0; i< n; i++)
    cost[i][i] = freq[i];
  for (int len = 2; len<= n; len++) {
    for (int i = 0; i<= n - len; i++) {
      int j = i + len - 1;
      cost[i][j] = INT_MAX;
      int fsum = sum(freq, i, j);
      for (int r = i; r <= j; r++) {
        int c = ((r >i) ? cost[i][r - 1] : 0) +
            ((r < j) ? cost[r + 1][j] : 0) + fsum;
        if (c < cost[i][j])
          cost[i][j] = c;
      }
    }
  }
  return cost[0][n - 1];
}
int main() {
  int keys[] = {10, 12, 20};
  int freq[] = {34, 8, 50};
  int n = sizeof(keys) / sizeof(keys[0]);
printf("Cost of Optimal BST is %d\n", optimalBST(keys, freq, n));
  return 0;
}
```

OUTPUT:

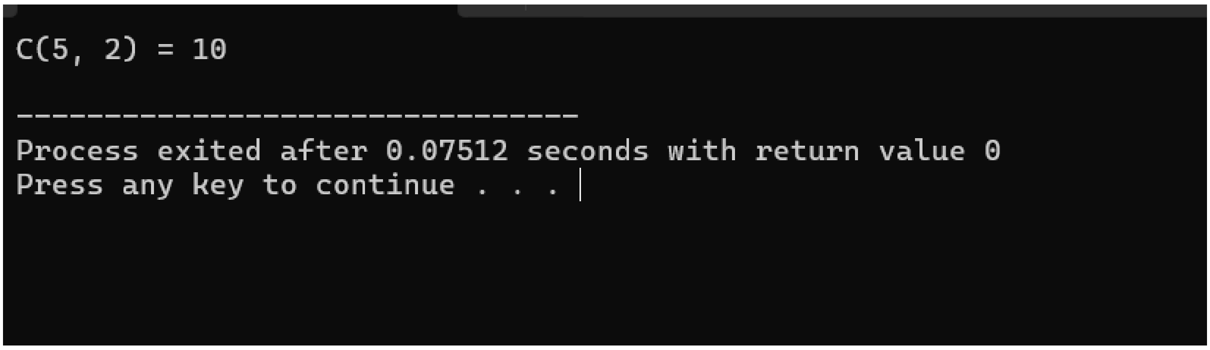


```
Cost of Optimal BST is 142

--------------------------------
Process exited after 0.07152 seconds with return value 0
Press any key to continue . . .
```

22.BINOMIAL COEFFICIENT USING DYNAMIC PROGRAMMING

```
#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 <= (i<k ?i : k); 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 = 5, k = 2;

printf("C(%d, %d) = %d\n", n, k, binomialCoeff(n, k));

   return 0;

}
```

OUTPUT:



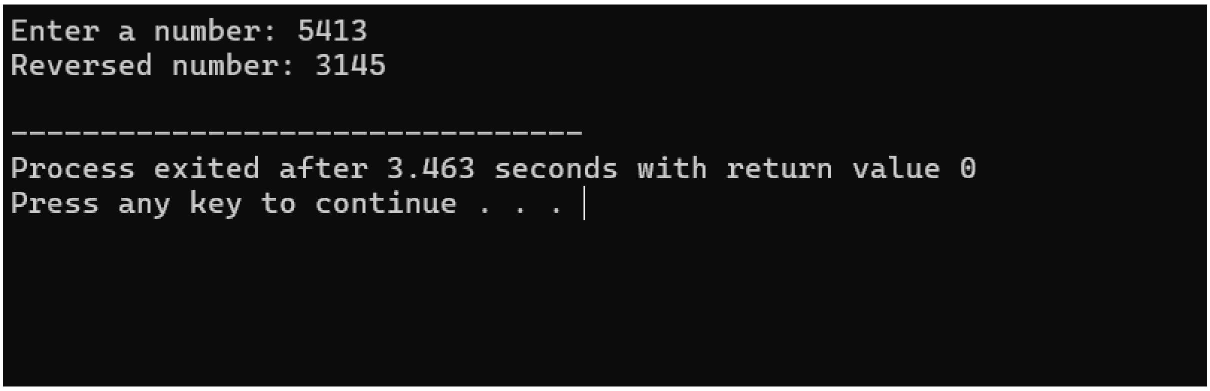
```
C(5, 2) = 10

--------------------------------
Process exited after 0.07512 seconds with return value 0
Press any key to continue . . .
```

23.REVERSE A GIVEN NUMBER

```
#include <stdio.h>

int main() {

   int num, reversed = 0;

printf("Enter a number: ");

scanf("%d", &num);
```

```
    while (num != 0) {
        reversed = reversed * 10 + num % 10;
num /= 10;
    }
printf("Reversed number: %d\n", reversed);
    return 0;
}
```

OUTPUT:



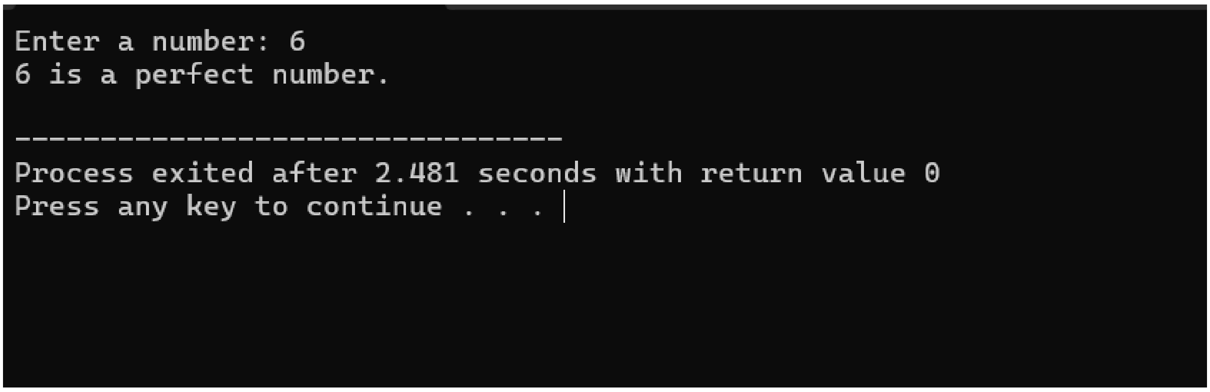
```
Enter a number: 5413
Reversed number: 3145

--------------------------------
Process exited after 3.463 seconds with return value 0
Press any key to continue . . .
```

24.PERFECT NUMBER

```
#include <stdio.h>
int main() {
    int num, sum = 0;
printf("Enter a number: ");
scanf("%d", &num);

    for (int i = 1; i<num; 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:



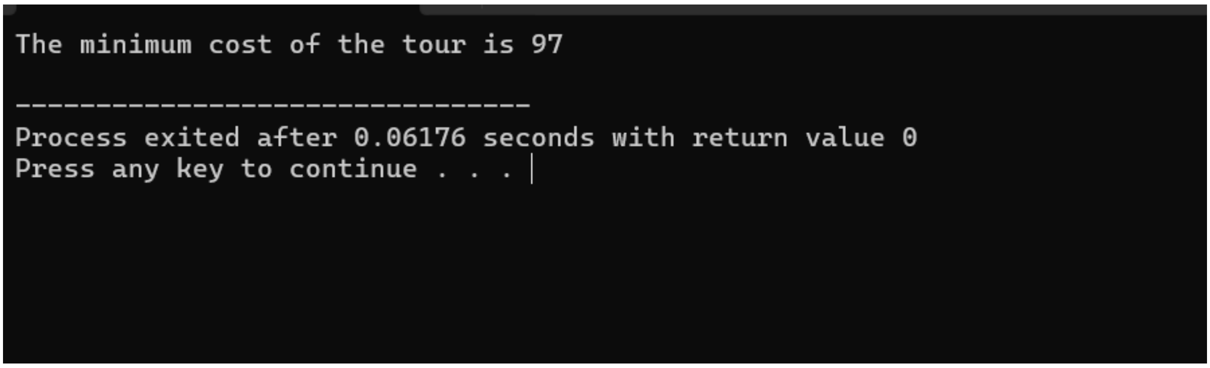
```
Enter a number: 6
6 is a perfect number.

--------------------------------
Process exited after 2.481 seconds with return value 0
Press any key to continue . . .
```

25.TSP USING DYNAMIC PROGRAMMING

```
#include <stdio.h>

#include <limits.h>

#define N 4

#define INF INT_MAX

int dist[N][N] = {

    {0, 20, 42, 35},

    {20, 0, 30, 34},

    {42, 30, 0, 12},

    {35, 34, 12, 0}

};

int dp[1 << N][N];

int tsp(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))) {

            int newAns = dist[pos][city] + tsp(mask | (1 << city), city);
```

```
      if (newAns<ans)
ans = newAns;
    }
  }
  return dp[mask][pos] = ans;
}
int main() {
  for (int i = 0; i< (1 << N); i++)
    for (int j = 0; j < N; j++)
dp[i][j] = -1;
  int result = tsp(1, 0);
printf("The minimum cost of the tour is %d\n", result);
  return 0;
}
```

OUTPUT:



```
The minimum cost of the tour is 97

--------------------------------
Process exited after 0.06176 seconds with return value 0
Press any key to continue . . .
```

26. PATTERN

1

1 2

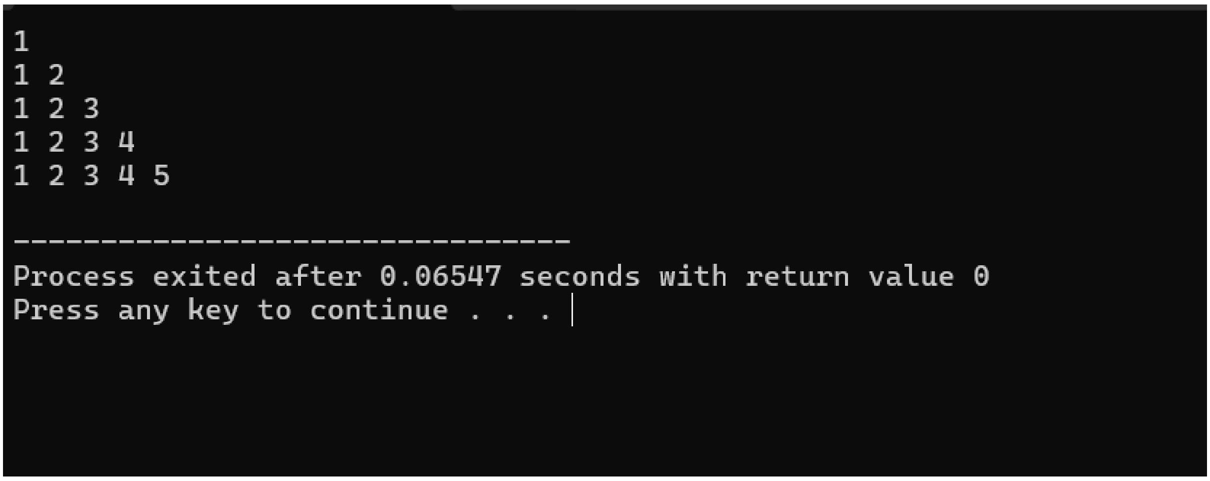
1 2 3

1 2 3 4

```
#include <stdio.h>
int main() {
  for (int i = 1; i<= 5; i++) {
    for (int j = 1; j <= i; j++) {
printf("%d ", j);
```

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

OUTPUT:

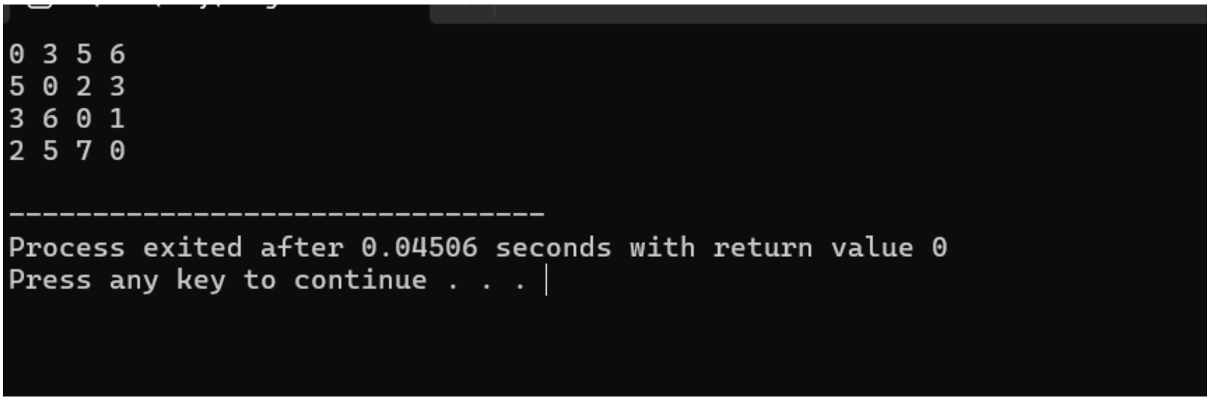


```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5

--------------------------------
Process exited after 0.06547 seconds with return value 0
Press any key to continue . . .
```

27.FLOYD'S ALGORITHM

```
#include <stdio.h>
#define INF 99999
#define V 4
void floydWarshall(int graph[V][V]) {
    int dist[V][V], i, j, k;
    for (i = 0; i< V; i++) {
        for (j = 0; j < V; j++) {
dist[i][j] = graph[i][j];
        }
    }
    for (k = 0; k < V; k++) {
        for (i = 0; i< V; i++) {
            for (j = 0; j < V; j++) {
                if (dist[i][k] + dist[k][j] <dist[i][j]) {
dist[i][j] = dist[i][k] + dist[k][j];
                }
            }
        }
    }
    for (i = 0; i< V; i++) {
        for (j = 0; j < V; j++) {
            if (dist[i][j] == INF) printf("INF ");
            else printf("%d ", dist[i][j]);
        }
printf("\n");
    }
}
int main() {
    int graph[V][V] = {
        {0, 3, INF, 7},
        {8, 0, 2, INF},
        {5, INF, 0, 1},
        {2, INF, INF, 0}
    };
floydWarshall(graph);
    return 0;
}
```

OUTPUT:



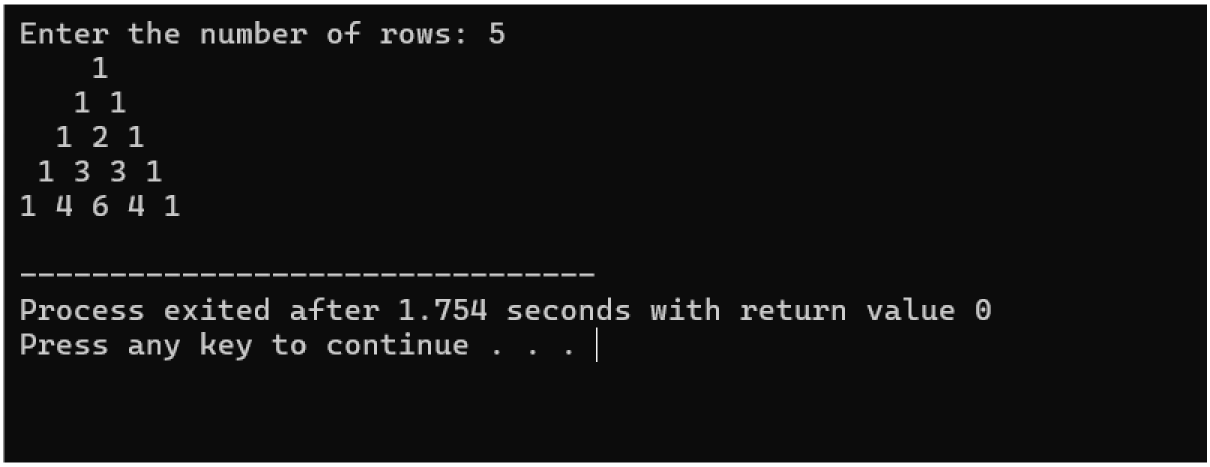
```
0 3 5 6
5 0 2 3
3 6 0 1
2 5 7 0

--------------------------------
Process exited after 0.04506 seconds with return value 0
Press any key to continue . . .
```

28.PASCAL’S TRIANGLE

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

```
int main() {
    int n, i, j, num;
printf("Enter the number of rows: ");
scanf("%d", &n);
    for (i = 0; i< n; i++) {
num = 1;
        for (j = 0; j < n - i - 1; j++) {
printf(" ");
        }
        for (j = 0; j <= i; j++) {
printf("%d ", num);
num = num * (i - j) / (j + 1);
        }
printf("\n");
    }
    return 0;
}
```

OUTPUT:

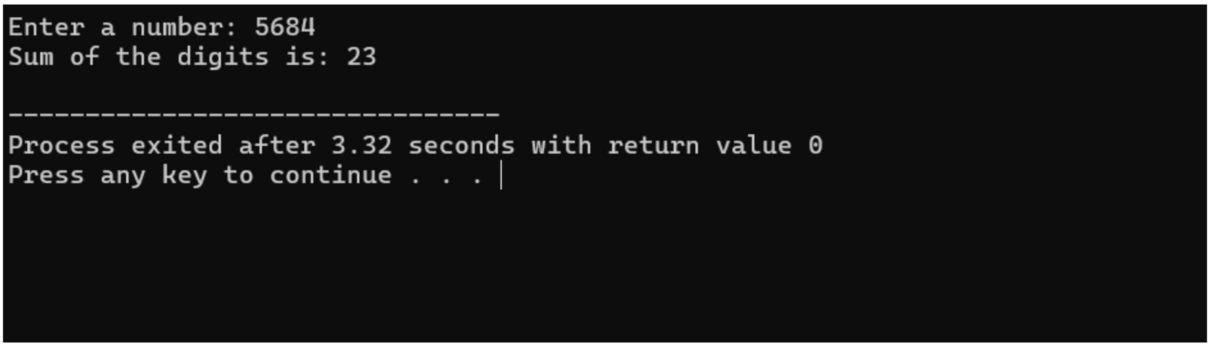


```
Enter the number of rows: 5
    1
   1 1
  1 2 1
 1 3 3 1
1 4 6 4 1

--------------------------------
Process exited after 1.754 seconds with return value 0
Press any key to continue . . .
```

29.SUM OF DIDGITS

```
#include <stdio.h>

int main() {
    int num, sum = 0, digit;
printf("Enter a number: ");
scanf("%d", &num);
   while (num != 0) {
      digit = num % 10;
      sum += digit;
num = num / 10;
   }
printf("Sum of the digits is: %d\n", sum);
   return 0;
}
```

OUTPUT:



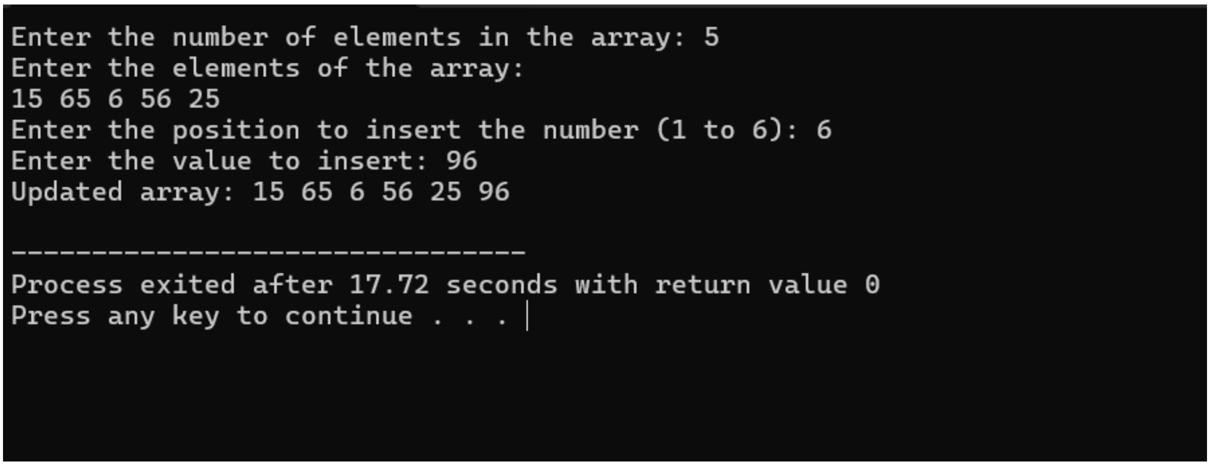
```
Enter a number: 5684
Sum of the digits is: 23

--------------------------------
Process exited after 3.32 seconds with return value 0
Press any key to continue . . .
```

30.INSERT A NUMBER IN THE LIST

```
#include <stdio.h>
int main() {
   int arr[100], n, i, position, value;
printf("Enter the number of elements in the array: ");
scanf("%d", &n);
printf("Enter the elements of the array: \n");
   for (i = 0; i< n; i++) {
scanf("%d", &arr[i]);
   }
printf("Enter the position to insert the number (1 to %d): ", n + 1);
scanf("%d", &position);
printf("Enter the value to insert: ");
scanf("%d", &value);
   for (i = n; i>= position; i--) {
```

```
arr[i] = arr[i - 1];
   }
arr[position - 1] = value;
   n++;
printf("Updated array: ");
   for (i = 0; i< n; i++) {
printf("%d ", arr[i]);
   }
printf("\n");
   return 0;
}
```

OUTPUT:

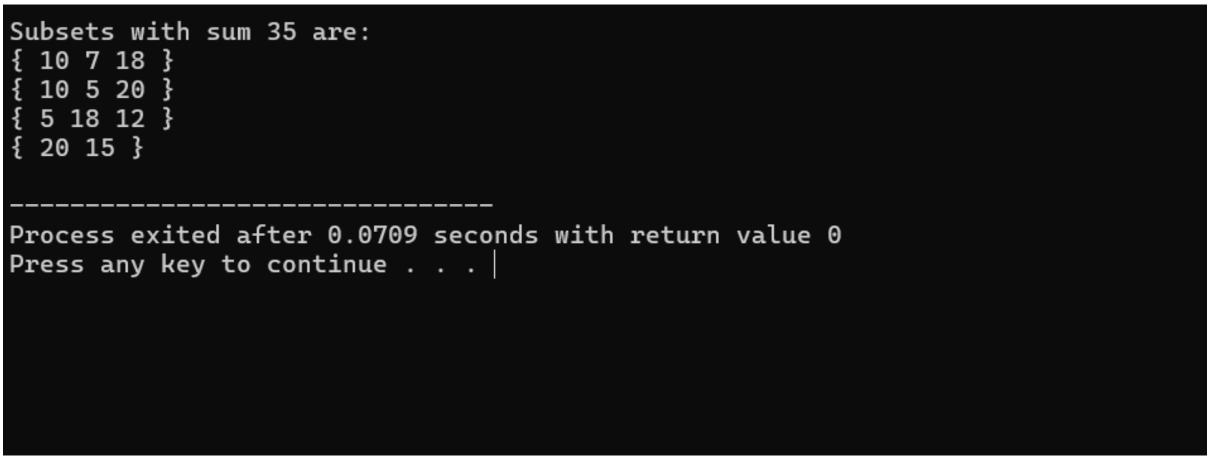


```
Enter the number of elements in the array: 5
Enter the elements of the array:
15 65 6 56 25
Enter the position to insert the number (1 to 6): 6
Enter the value to insert: 96
Updated array: 15 65 6 56 25 96

--------------------------------
Process exited after 17.72 seconds with return value 0
Press any key to continue . . .
```

31.SUM OF SUBSETS USING BACKTRACKING

```
#include <stdio.h>
void subsetSum(int arr[], int n, int target_sum, int index, int current_sum, int current_subset[], int
subset_size) {
   if (current_sum == target_sum) {
printf("{ ");
      for (int i = 0; i<subset_size; i++) {
printf("%d ", current_subset[i]);
      }
printf("}\n");
      return;
   }
   if (current_sum>target_sum || index == n) {
      return;
   }
current_subset[subset_size] = arr[index];
subsetSum(arr, n, target_sum, index + 1, current_sum + arr[index], current_subset, subset_size + 1);
subsetSum(arr, n, target_sum, index + 1, current_sum, current_subset, subset_size);
}
void findAllSubsets(int arr[], int n, int target_sum) {
   int current_subset[n];
subsetSum(arr, n, target_sum, 0, 0, current_subset, 0);
}
int main() {
   int arr[] = {10, 7, 5, 18, 12, 20, 15};
   int target_sum = 35;
   int n = sizeof(arr) / sizeof(arr[0]);
printf("Subsets with sum %d are:\n", target_sum);
findAllSubsets(arr, n, target_sum);
   return 0;
}
```

OUTPUT:



```
Subsets with sum 35 are:
{ 10 7 18 }
{ 10 5 20 }
{ 5 18 12 }
{ 20 15 }

--------------------------------
Process exited after 0.0709 seconds with return value 0
Press any key to continue . . .
```

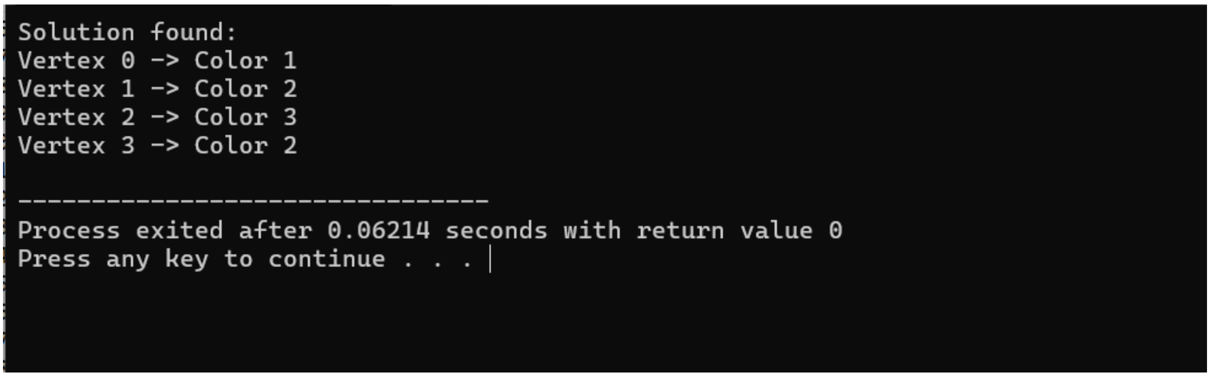
32.GRAPH COLOURING USING BACKTRACKING

```
#include <stdio.h>

#include <stdbool.h>
```

```
#define N 4
bool isSafe(int vertex, int graph[N][N], int colors[], int color) {
    for (int i = 0; i< N; i++) {
        if (graph[vertex][i] &&colors[i] == color) {
            return false;
        }
    }
    return true;
}
bool graphColoring(int graph[N][N], int m, int colors[], int vertex) {
    if (vertex == N) {
        return true;
    }
    for (int color = 1; color<= m; color++) {
        if (isSafe(vertex, graph, colors, color)) {
colors[vertex] = color;
            if (graphColoring(graph, m, colors, vertex + 1)) {
                return true;
            }
colors[vertex] = 0;
        }
    }
    return false;
}
void solveGraphColoring(int graph[N][N], int m) {
    int colors[N] = {0};
    if (graphColoring(graph, m, colors, 0)) {
printf("Solution found:\n");
        for (int i = 0; i< N; i++) {
printf("Vertex %d ->Color %d\n", i, colors[i]);
        }
```

```
   } else {
printf("No solution exists\n");
   }
}
int main() {
   int graph[N][N] = {
      {0, 1, 1, 1},
      {1, 0, 1, 0},
      {1, 1, 0, 1},
      {1, 0, 1, 0}
   };
   int m = 3;
solveGraphColoring(graph, m);
   return 0;
}
```

OUTPUT:



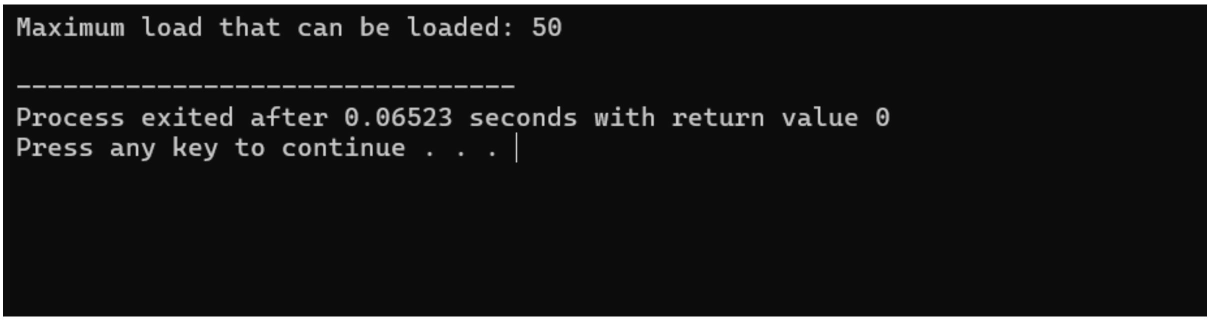
```
Solution found:
Vertex 0 -> Color 1
Vertex 1 -> Color 2
Vertex 2 -> Color 3
Vertex 3 -> Color 2

--------------------------------
Process exited after 0.06214 seconds with return value 0
Press any key to continue . . .
```

33.CONTAINER LOADING PROBLEM

```
#include <stdio.h>
int maxLoad = 0;
void backtrack(int weights[], int n, int capacity, int index, int currentLoad) {
   if (currentLoad> capacity) {
      return;
   }
   if (currentLoad>maxLoad) {
maxLoad = currentLoad;
```

```
  }
  if (index == n) {
    return;
  }
backtrack(weights, n, capacity, index + 1, currentLoad + weights[index]);
backtrack(weights, n, capacity, index + 1, currentLoad);
}
int maxContainerLoad(int weights[], int n, int capacity) {
maxLoad = 0;
backtrack(weights, n, capacity, 0, 0);
  return maxLoad;
}
int main() {
  int weights[] = {10, 20, 30, 40};
  int n = sizeof(weights) / sizeof(weights[0]);
  int capacity = 50;
  int maxLoadPossible = maxContainerLoad(weights, n, capacity);
printf("Maximum load that can be loaded: %d\n", maxLoadPossible);
  return 0;
}
```

OUTPUT:



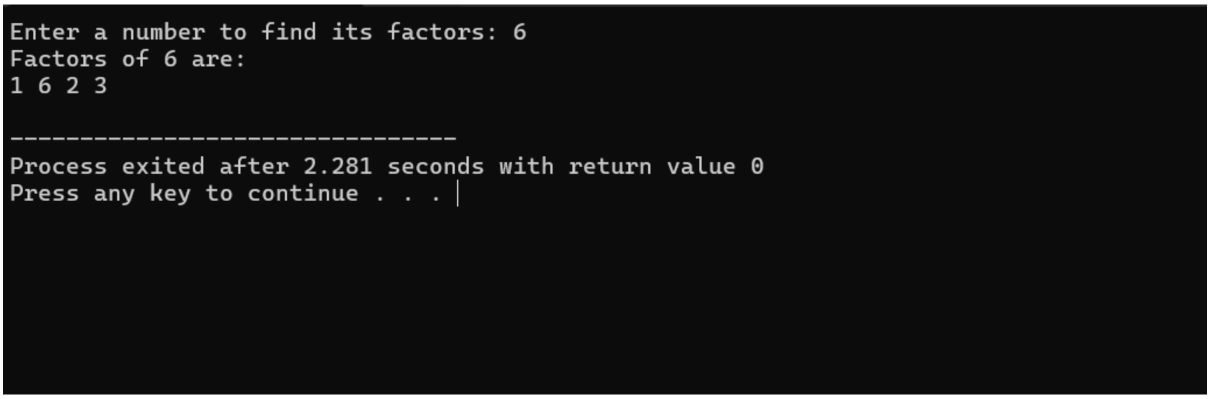
```
Maximum load that can be loaded: 50

--------------------------------
Process exited after 0.06523 seconds with return value 0
Press any key to continue . . .
```

34.LIST OF ALL FACTORS FOR N VALUE

```
#include <stdio.h>
#include <math.h>
void findFactors(int n) {
printf("Factors of %d are:\n", n);
```

```
  for (int i = 1; i<= sqrt(n); i++) {
    if (n % i == 0) {
printf("%d ", i);
      if (i != n / i) {
printf("%d ", n / i);
      }
    }
  }
printf("\n");
}
int main() {
  int n;
printf("Enter a number to find its factors: ");
scanf("%d", &n);
findFactors(n);
  return 0;
}
```

OUTPUT:



```
Enter a number to find its factors: 6
Factors of 6 are:
1 6 2 3

--------------------------------
Process exited after 2.281 seconds with return value 0
Press any key to continue . . .
```

35.JOB ASSIGNMENT PROBLEM USING BRANCH AND BOUND

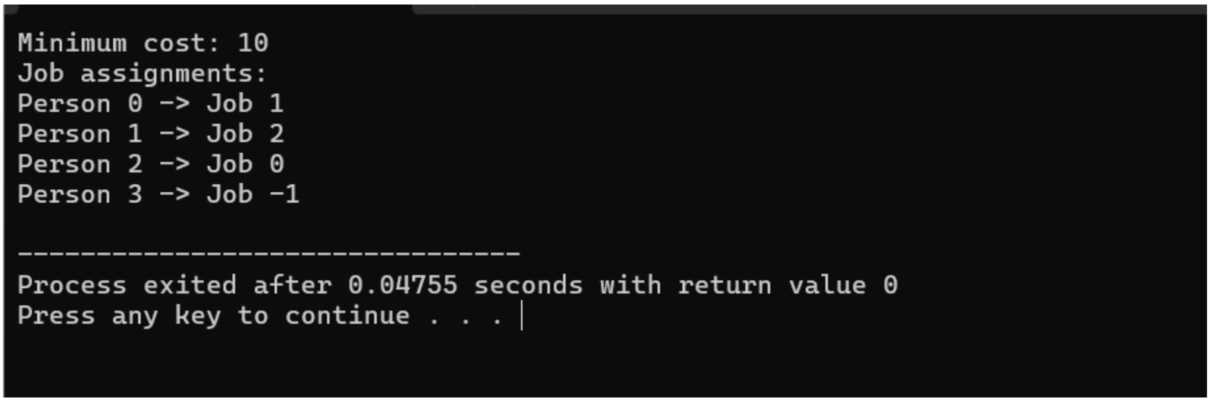
```
#include <stdio.h>
#include <limits.h>
#include <stdbool.h>
#define N 4
```

```
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:

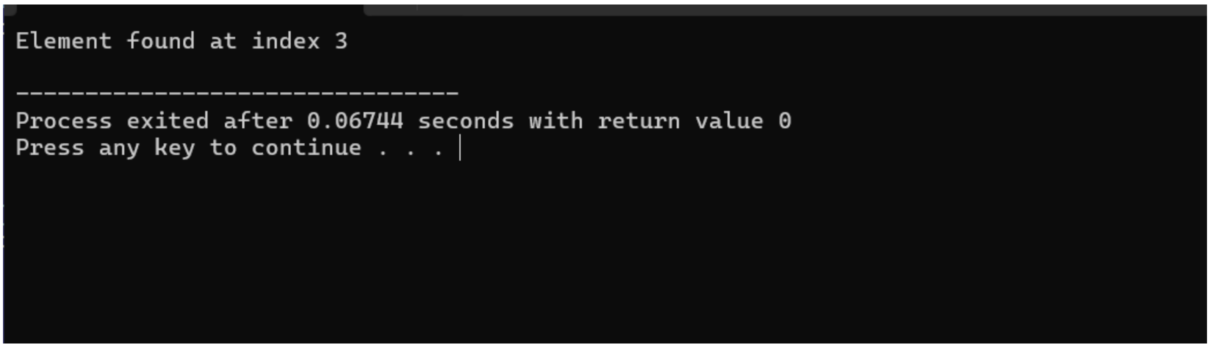


```
Minimum cost: 10
Job assignments:
Person 0 -> Job 1
Person 1 -> Job 2
Person 2 -> Job 0
Person 3 -> Job -1

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

36.LINEAR SEARCH

```
#include <stdio.h>
int linearSearch(int arr[], int n, int target) {
   for (int i = 0; i< n; i++) {
      if (arr[i] == target) {
         return i;
      }
   }
   return -1;
}
int main() {
   int arr[] = {34, 21, 56, 78, 90, 23, 12};
   int n = sizeof(arr) / sizeof(arr[0]);
   int target = 78;
   int result = linearSearch(arr, n, target);
   if (result != -1) {
printf("Element found at index %d\n", result);
   } else {
printf("Element not found in the array\n");
   }
   return 0;
}
```

OUTPUT:



```
Element found at index 3

--------------------------------
Process exited after 0.06744 seconds with return value 0
Press any key to continue . . .
```

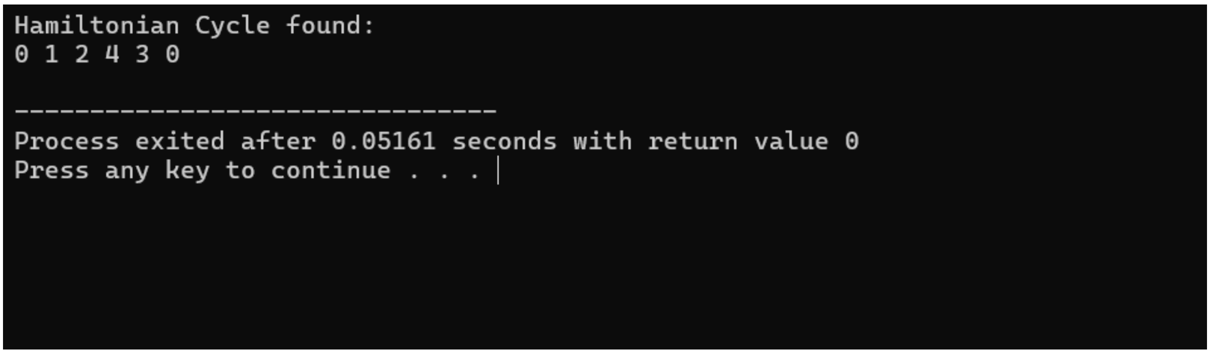
37.HAMILTONIAN CIRCUIT USING BACKTRACKING

```
#include <stdio.h>
#include <stdbool.h>
#define V 5
bool canAddToPath(int v, int graph[V][V], int path[], int position) {
   if (graph[path[position - 1]][v] == 0)
      return false;
   for (int i = 0; i< position; i++) {
      if (path[i] == v)
         return false;
   }
```

```
    return true;
}
bool hamiltonianCycle(int graph[V][V], int path[], int position) {
    if (position == V) {
        if (graph[path[position - 1]][path[0]] == 1)
            return true;
        else
            return false;
    }
    for (int v = 1; v < V; v++) {
        if (canAddToPath(v, graph, path, position)) {
            path[position] = v;
            if (hamiltonianCycle(graph, path, position + 1))
                return true;
            path[position] = -1;
        }
    }
    return false;
}
int main() {
    int graph[V][V] = {
        {0, 1, 0, 1, 0},
        {1, 0, 1, 1, 0},
        {0, 1, 0, 1, 1},
        {1, 1, 1, 0, 1},
        {0, 0, 1, 1, 0}
    };
    int path[V];
    for (int i = 0; i< V; i++) {
        path[i] = -1;
    }
```

```
path[0] = 0;
   if (hamiltonianCycle(graph, path, 1)) {
printf("Hamiltonian Cycle found: \n");
      for (int i = 0; i< V; i++) {
printf("%d ", path[i]);
      }
printf("%d\n", path[0]);
   } else {
printf("No Hamiltonian Cycle found\n");
   }
   return 0;
}
```

OUTPUT:



```
Hamiltonian Cycle found:
0 1 2 4 3 0

--------------------------------
Process exited after 0.05161 seconds with return value 0
Press any key to continue . . .
```

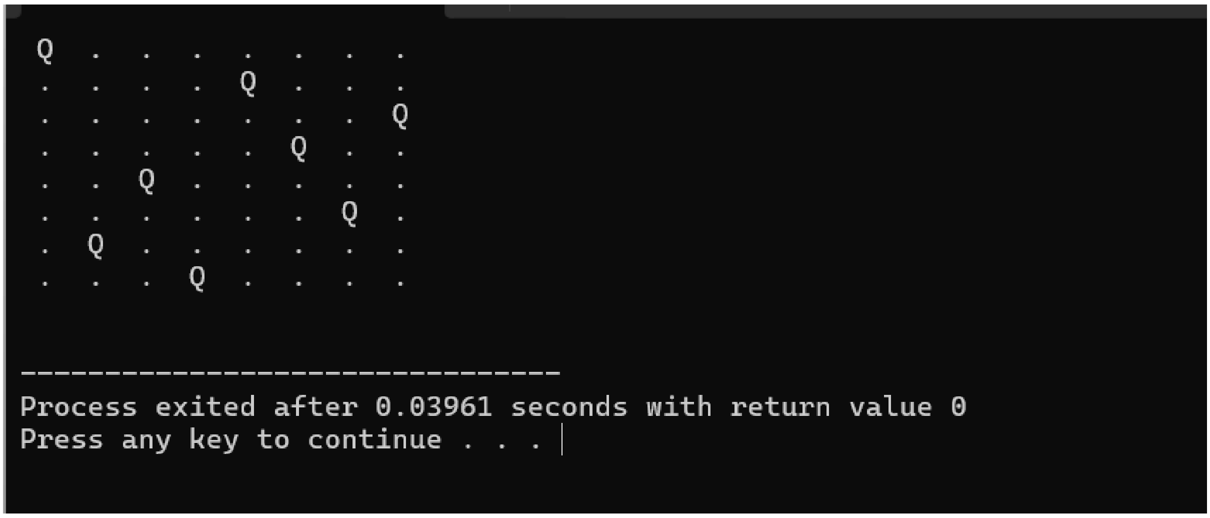
38.N QUEENS PROBLEM

```
#include <stdio.h>
#include <stdbool.h>
#define N 8
int board[N][N];
void printSolution() {
   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< row; i++) {
        if (board[i][col] == 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>= 0 && j < N; i--, j++) {
        if (board[i][j] == 1)
            return false;
    }
    return true;
}
bool solveNQueens(int row) {
    if (row == N)
        return true;
    for (int col = 0; col < N; col++) {
        if (isSafe(row, col)) {
            board[row][col] = 1;
            if (solveNQueens(row + 1))
                return true;
            board[row][col] = 0;
        }
    }
```

```
  return false;
}
int main() {
  for (int i = 0; i< N; i++)
    for (int j = 0; j < N; j++)
      board[i][j] = 0;
  if (solveNQueens(0)) {
printSolution();
  } else {
printf("No solution exists\n");
  }
  return 0;
}
```

OUTPUT:



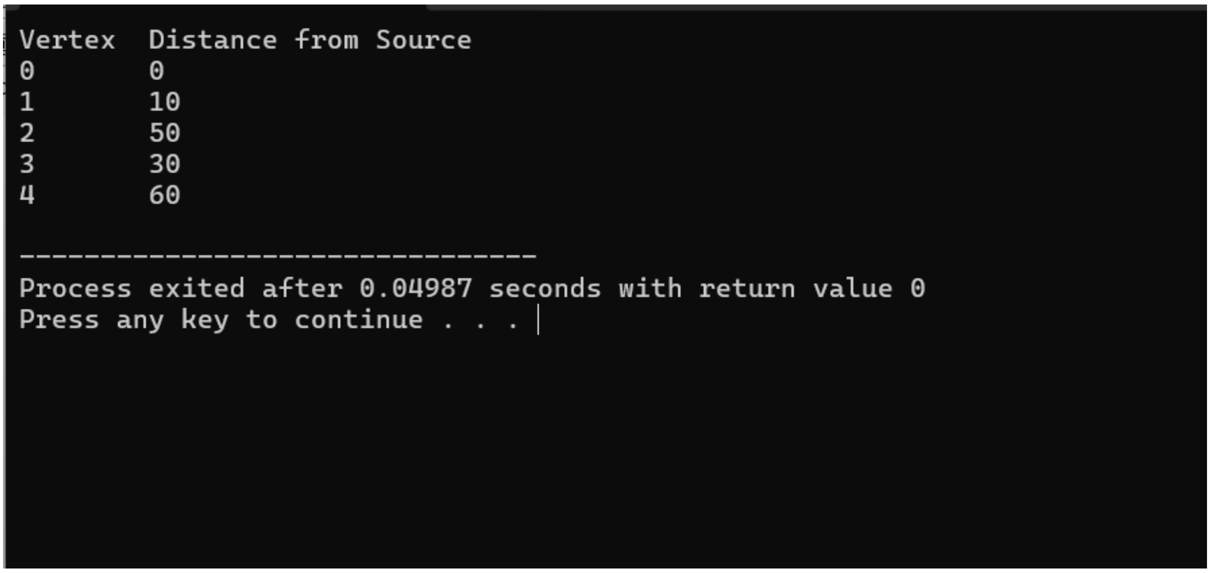
```
 Q  .  .  .  .  .  .  .
 .  .  .  .  Q  .  .  .
 .  .  .  .  .  .  .  Q
 .  .  .  .  .  Q  .  .
 .  .  Q  .  .  .  .  .
 .  .  .  .  .  .  Q  .
 .  Q  .  .  .  .  .  .
 .  .  .  Q  .  .  .  .


--------------------------------
Process exited after 0.03961 seconds with return value 0
Press any key to continue . . .
```

39.OPTIMAL COST BY USING APPROPRIATE ALGORITHM

```
#include <stdio.h>
#include <limits.h>
#include <stdbool.h>
#define V 5
#define INF INT_MAX
void dijkstra(int graph[V][V], int src) {
  int dist[V];
```

```
    bool sptSet[V];
    for (int i = 0; i< V; i++) {
dist[i] = INF;
sptSet[i] = false;
    }
dist[src] = 0;
    for (int count = 0; count < V - 1; count++) {
        int u = -1;
        for (int v = 0; v < V; v++) {
            if (!sptSet[v] && (u == -1 || dist[v] <dist[u])) {
                u = v;
            }
        }
sptSet[u] = true;
        for (int v = 0; v < V; v++) {
            if (graph[u][v] && !sptSet[v] &&dist[u] != INF &&dist[u] + graph[u][v] <dist[v]) {
dist[v] = dist[u] + graph[u][v];
            }
        }
    }
printf("Vertex\tDistance from Source\n");
    for (int i = 0; i< V; i++) {
printf("%d\t%d\n", i, dist[i]);
    }
}
int main() {
    int graph[V][V] = {
        {0, 10, 0, 30, 0},
        {10, 0, 50, 0, 0},
        {0, 50, 0, 20, 10},
        {30, 0, 20, 0, 60},
        {0, 0, 10, 60, 0}
    };

dijkstra(graph, 0);

    return 0;
}
```

OUTPUT:

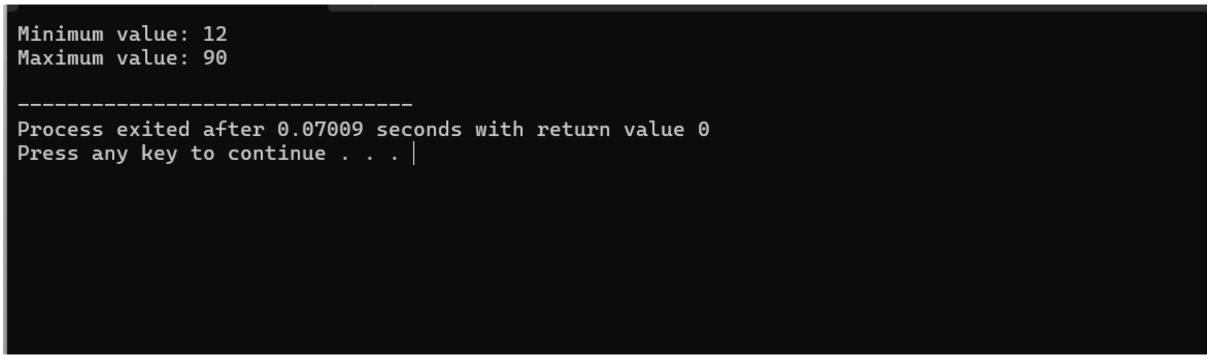


```
Vertex  Distance from Source
0       0
1       10
2       50
3       30
4       60

--------------------------------
Process exited after 0.04987 seconds with return value 0
Press any key to continue . . .
```

40.MIN MAX VALUE SEPERATELY FOR ALL NUMBERS IN THE LIST

```
#include <stdio.h>
void findMinMax(int numbers[], int size, int* min, int* max) {
    *min = numbers[0];
    *max = numbers[0];
    for (int i = 1; i< size; i++) {
        if (numbers[i] < *min) {
            *min = numbers[i];
        }
        if (numbers[i] > *max) {
            *max = numbers[i];
        }
    }
}
int main() {
   int numbers[] = {34, 21, 56, 78, 90, 23, 12};
   int size = sizeof(numbers) / sizeof(numbers[0]);
   int min, max;
findMinMax(numbers, size, &min, &max);
printf("Minimum value: %d\n", min);
printf("Maximum value: %d\n", max);
   return 0;
}
```

OUTPUT:



```
Minimum value: 12
Maximum value: 90

--------------------------------
Process exited after 0.07009 seconds with return value 0
Press any key to continue . . .
```