

Date-

Assignment No. :

Problem Statement:

Program in C to find the prime factors of a given number in descending order.

Theory:

The integers by which a number is completely divisible are called the factors of the number. Now, it is obvious that the factors must be less than or equal to the number itself. The smallest factor of a number cannot be lesser than 2 except 1. As, any number can be divided by 1 we can consider 2 as the lower limit of the range of the factors. Now if we consider X (not equals to 1) is a given number then the upper limit of the range of its factors must be $X/2$. So, the factors of X must lie between $[2, X/2]$. Now, the numbers which are divided only by itself or 1 only are called prime numbers. So, prime factors are those factors of a number which are divided by itself or 1.

E.g.: The factors of 20 are $\rightarrow 1, 2, 4, 5, 10, 20$. Among which 2 and 5 are prime. So, prime factors of 20 are 2 and 5.

Algorithm:

Input specification: The number for which the prime factors needs to be calculated say, X.

Output specification: Prime factors of X in descending order.

Steps:

Step 1: Set $i=X/2$

Step 2: Print "The prime factors of X are:"

Step 3: Repeat through Step 5 to Step 11 for $i=X/2$ to 2

Step 4: If $(X \bmod i=0)$ Then

Step 5: Set flag=0

Step 6: Repeat through Step 8 to Step 9 for $j=i/2$ to 2

Step 7: If $(i \bmod j=0)$ Then

Step 8: Set flag=1

[End of If structure]

Step 9: Set $j=j-1$

[End of inner for loop]

Step 10: If $(\text{flag}=0)$ Then

Step 11: Print i

[End of If structure]

[End of outer If structure]

Step 12: Set $i=i-1$

[End of outer for loop]

Step 13: End

Source Code:

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

int main()
{

    int x,i,j,k,temp,flag,check=0; char ch;
    do
    {
        printf("Enter the number:");
        scanf("%d",&x); //Taking the number from user
        if(x>=2) //To omit 1 or 0 or negative numbers from the input
        {
            check=0;
            for(k=x/2;k>=2;k--)
            {
                if(x%k==0)
                {
                    check=1;
                }
            }
            if(check==1) //When the input is not prime
            {
                printf("The prime factors for the number %d are: ",x);
                for(i=x/2;i>=2;i--)
                {
                    if(x%i==0) //checking whether it has factors or not
                    {
                        flag=0;//setting the flag variable to 0
                        temp=i;/*taking a temporary variable to
                        avoid calculation errors*/
                        for(j=temp/2;j>=2;j--)//*inner for loop to
                        check whether the factor is prime or not*/
                        {
                            if(temp%j==0)/*prime
```

```

                                number checking*/
                                {
                                    flag=1;/*when the factor is not
                                        prime*/
                                    break;
                                }
                            }
                            if(flag==0)//when the factor is prime
                                printf("%d ",i);
                        }

                    }
                }
            else//when the input is prime
            {
                printf("%d is a prime number. No factors found.",x);
                goto loop;//shifting the control to the continuity check
            }
        }
        else //when the input is less than
            printf("Wrong input given");
        loop: printf("\nDo you want to continue?(Y/N)");//continuity checking
            scanf(" %c",&ch);
            if(ch=='n' | |ch=='N')
                return 0;
            }while(ch=='y' | |ch=='Y');
        if(ch!='y' | |ch!='Y')//when any input other than 1 or 0 is given
        {
            printf("Wrong choice");//shifting the control to the continuity
                                    check*/

            goto loop;
        }
        getch();
        return 0;
    }

```

Input & Output:

Set 1:

```
Enter the number:1155
The prime factors for the number 1155 are: 11 7 5 3
Do you want to continue?(Y/N)
```

Set 2:

```
Enter the number:15566
The prime factors for the number 15566 are: 181 43 2
Do you want to continue?(Y/N)
```

Set 3:

```
Enter the number:78
The prime factors for the number 78 are: 13 3 2
Do you want to continue?(Y/N)
```

Set 4:

```
Enter the number:13
13 is a prime number. No factors found.
Do you want to continue?(Y/N)
```

Discussion:

This program uses iterative approach to fulfill its purpose. Hence it can be problematic for some large numbers. It performs a total of $(X/2-2)*(F/2-2)$ numbers of iterations for a arbitrarily chosen number X and F numbers of factors.

So, it is difficult when the number is large as the number of iterations become too large which increases the time complexity of the program.