CHAPTER 5

LOOP CONTROL STRUCTURE

SHORT AND LONG QUESTIONS

Q1. Highlight the functions of loops.

Ans: Function of Loop:

Loops are used in programs to repeat a block of statements. Repeating a block of statements is a very common and useful task in programming. Loops make the task of writing programs easier and efficient.

Three types of loops are used in C program. These are **for, while and do while** loops.

Q2. What is loop? List essential elements of a loop. Why Programmer might want to execute a loop.

Ans: Loop:

A loop is a statement in a programming language that allows one or more statements to be repeatedly executed as many times as required.

Essential elements of a loop:

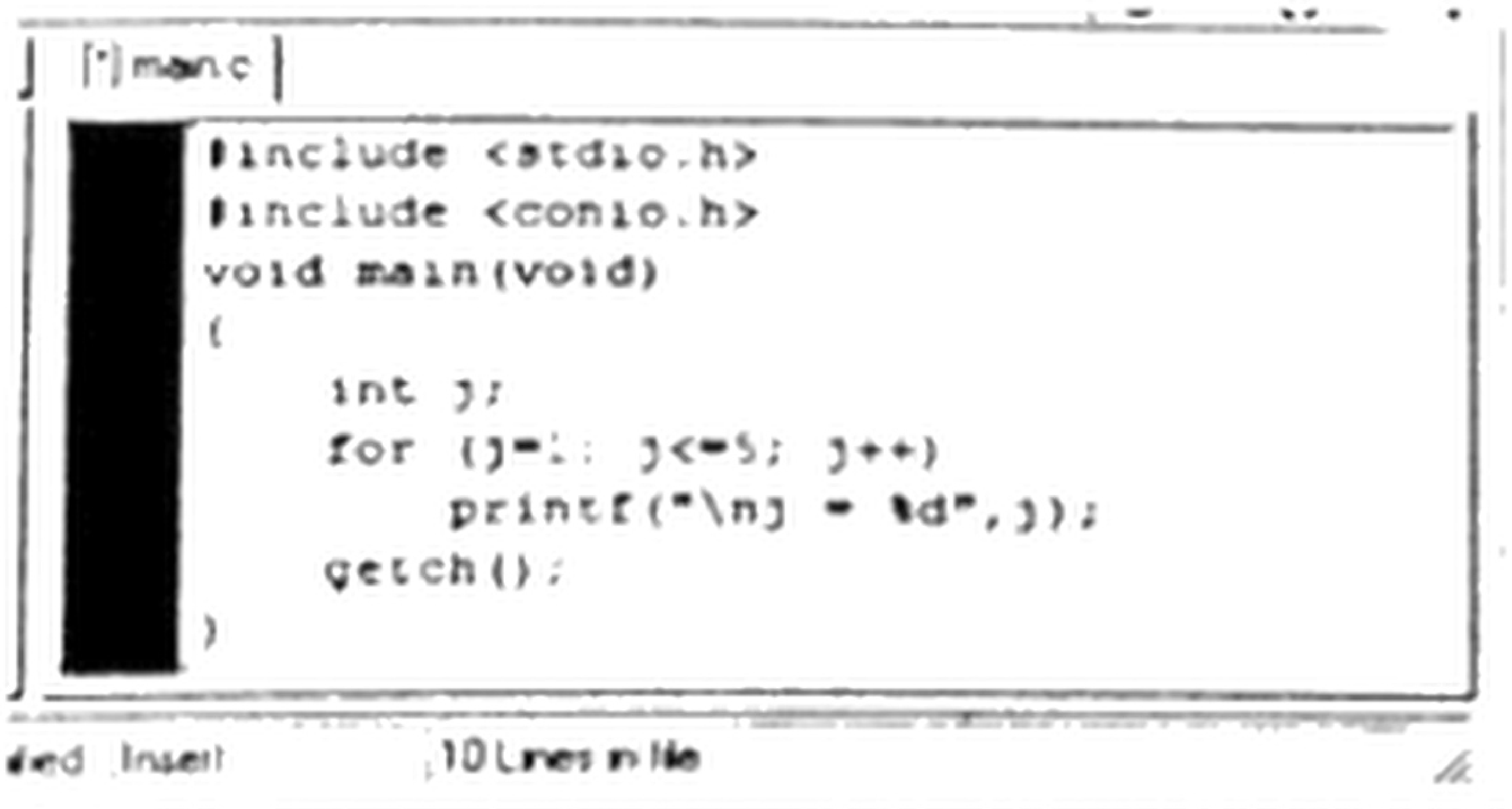
There are two essential elements of a loop. The block of statements forms the body of the loop that is to be executed repeatedly until loop condition is true. Loops terminate based on test conditions.

Programmer might want to execute a loop:

- **i.** A given number of times
- **ii.** Until a given value exceeds another value
- **iii.** Until a particular character is entered

Q3. Write a program to print numbers from 1 to 5 by using for () loop.

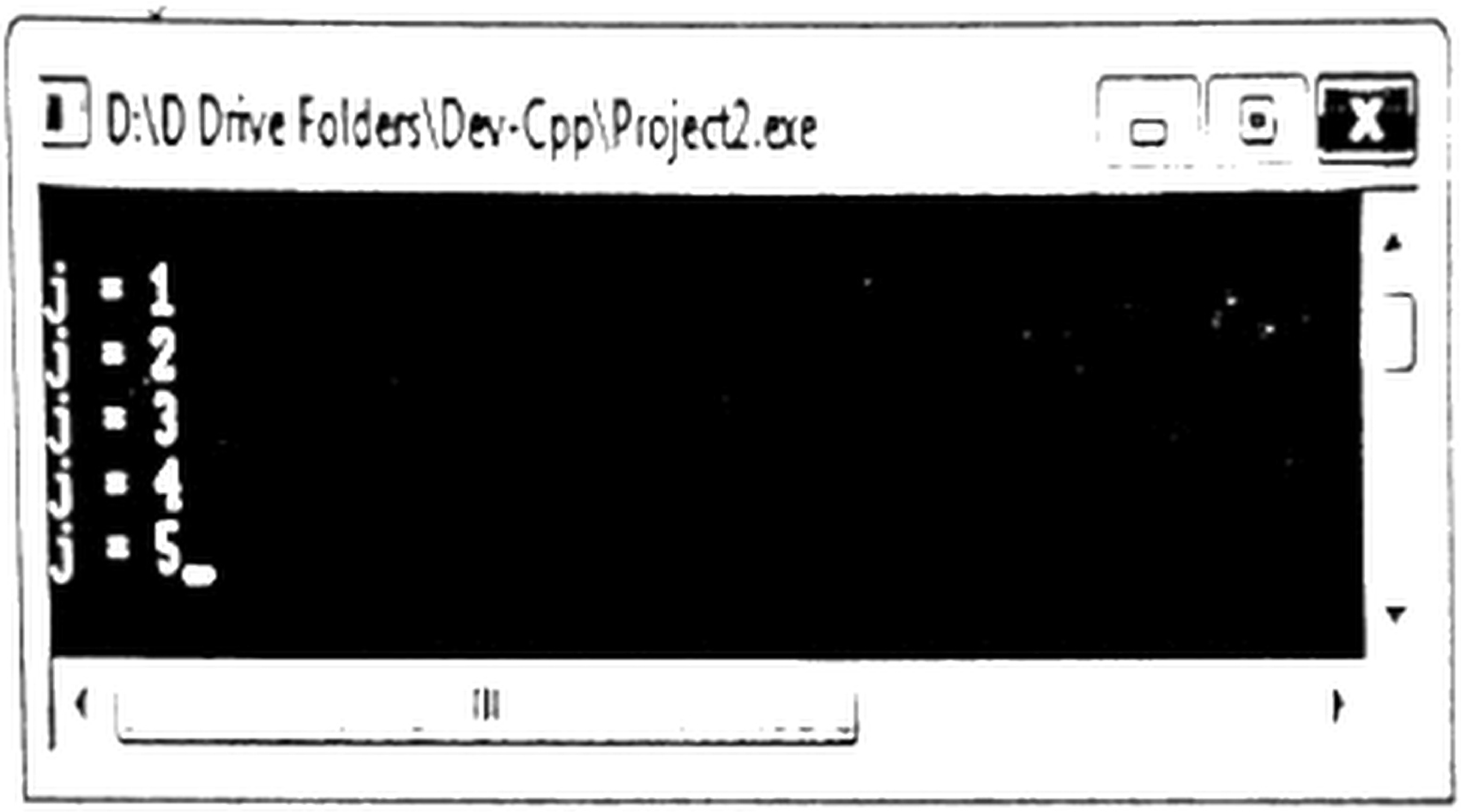
Ans: Program to print numbers from 1 to 5 using for () loop.



```
#include <stdio.h>
#include <conio.h>
void main(void)
{
    int j;
    for (j=1; j<=5; j++)
        printf("\nj = %d",j);
    getch();
}
```

Program to print numbers from 1 to 5

When the program is compiled and executed it will produce the output shown in Fig.



```
j = 1
j = 2
j = 3
j = 4
j = 5_
```

Output of program

- The expression j=1 inside the parenthesis initializes the j variable to 1. Initialization is done as soon as the loop is entered.
- The second expression (test condition) j<=5 tests each time through the loop to see if j is less than or equal to 5. If the test is true, the body of the

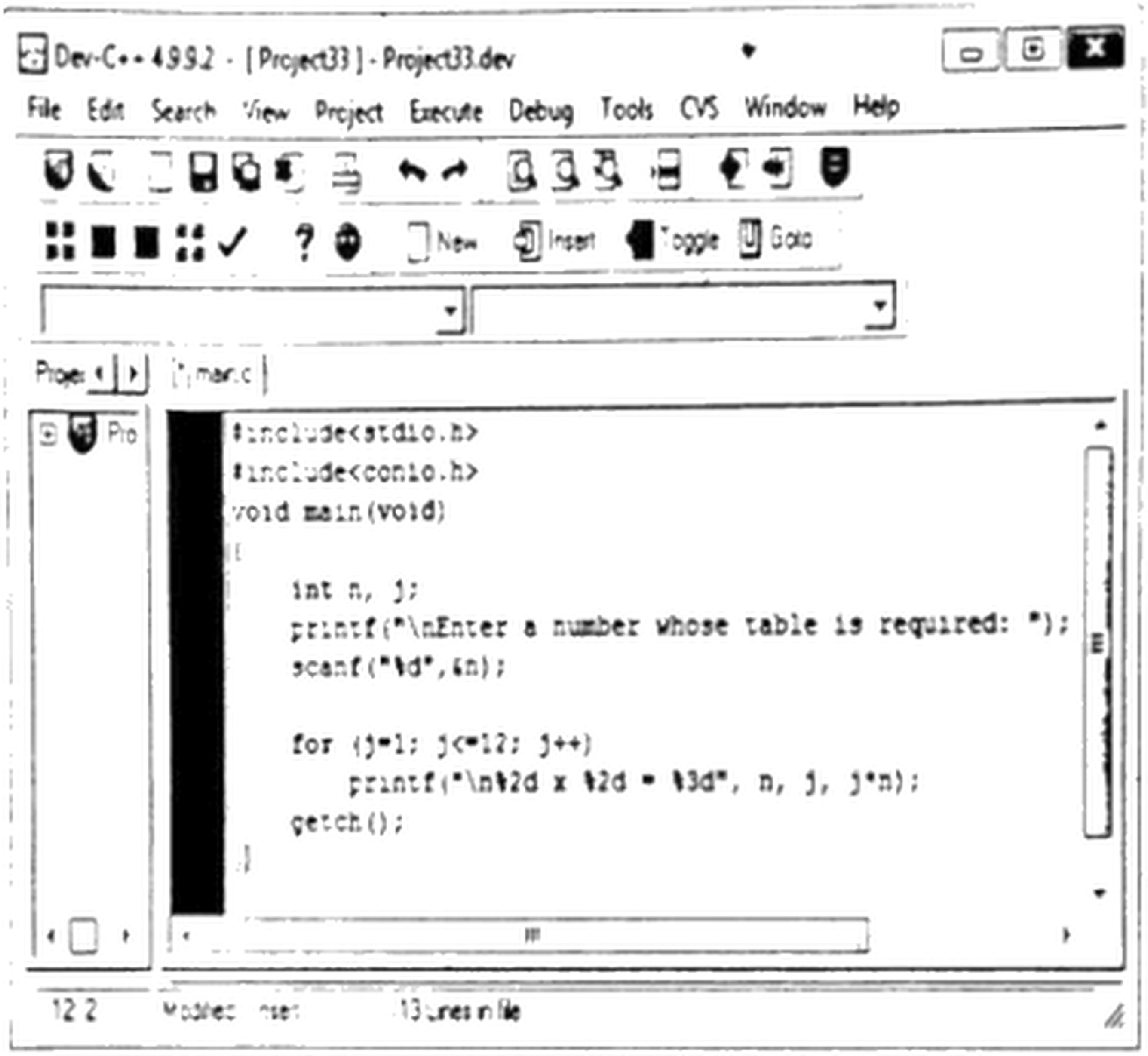
loop is executed. If the test is false, the loop will be terminated and control will be transferred to the next statement following the for loop.

- The thirds expression j++ increments the loop variable j, each time the loop is executed. In general, any expression can be used for incrementing the loop is executed. When a far loop terminates, the loop variable is still defined and contains the value assigned by the last increment. In Program 1, the last value assigned to j will be 6. However, a well designed program will not use this feature.

Q4. Write a program to read a number and prints its table by using for () loop.

Ans: Program to read a number and print its table using for () loop:

- The execution of program is shown in Fig, when the value of n is 7. The program will print the value of n in first column, the value of j in second column and the product of n*j in the third column according to the format given in printf() function.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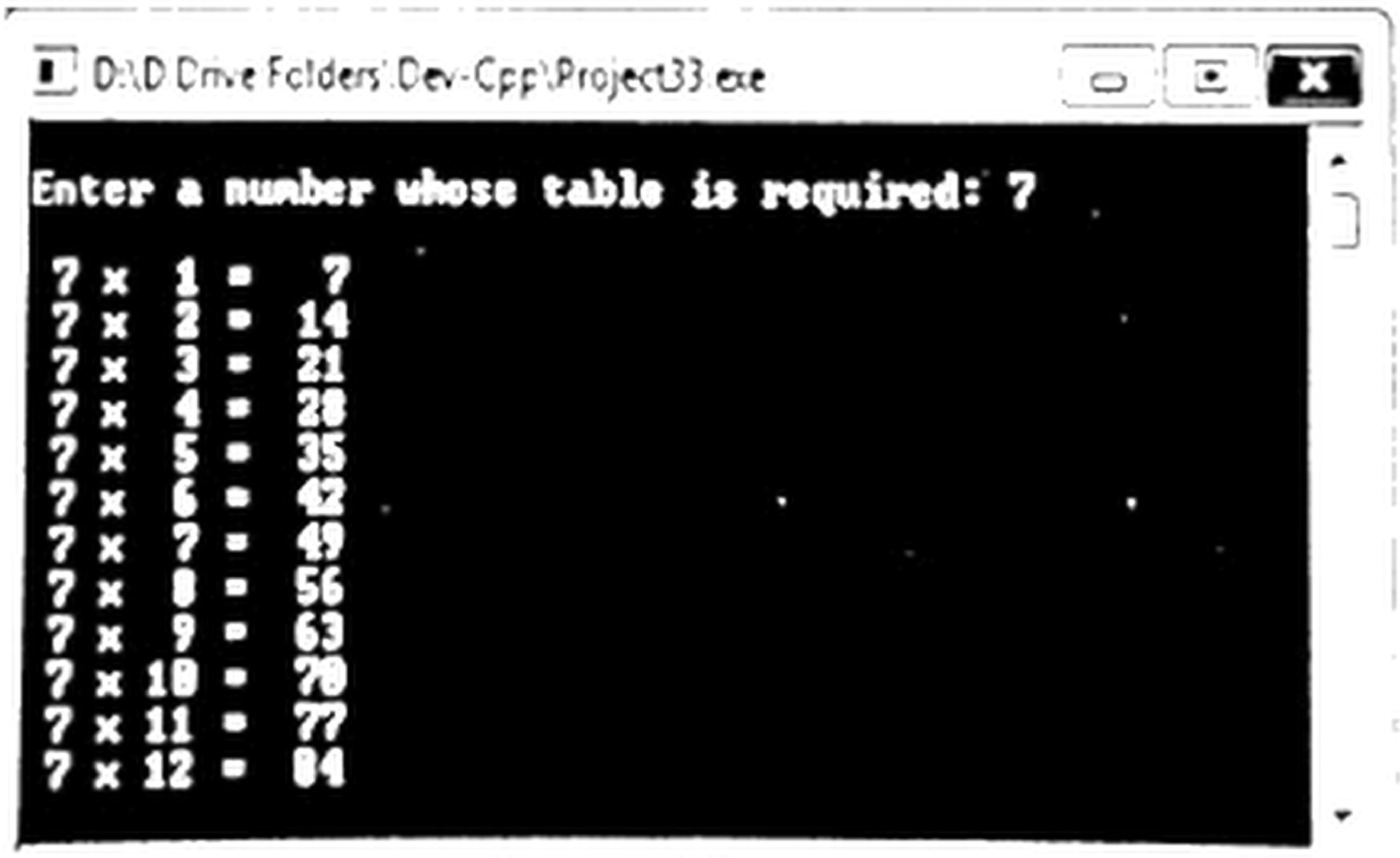
12: 2 Modified Insert 13 Lines in file

```
#include<stdio.h>
#include<conio.h>
void main(void)
{
    int n, j;
    printf("\nEnter a number whose table is required: ");
    scanf("%d",&n);

    for (j=1; j<=12; j++)
        printf("\n%2d x %2d = %3d", n, j, j*n);
    getch();
}
```

Program to print table of a number



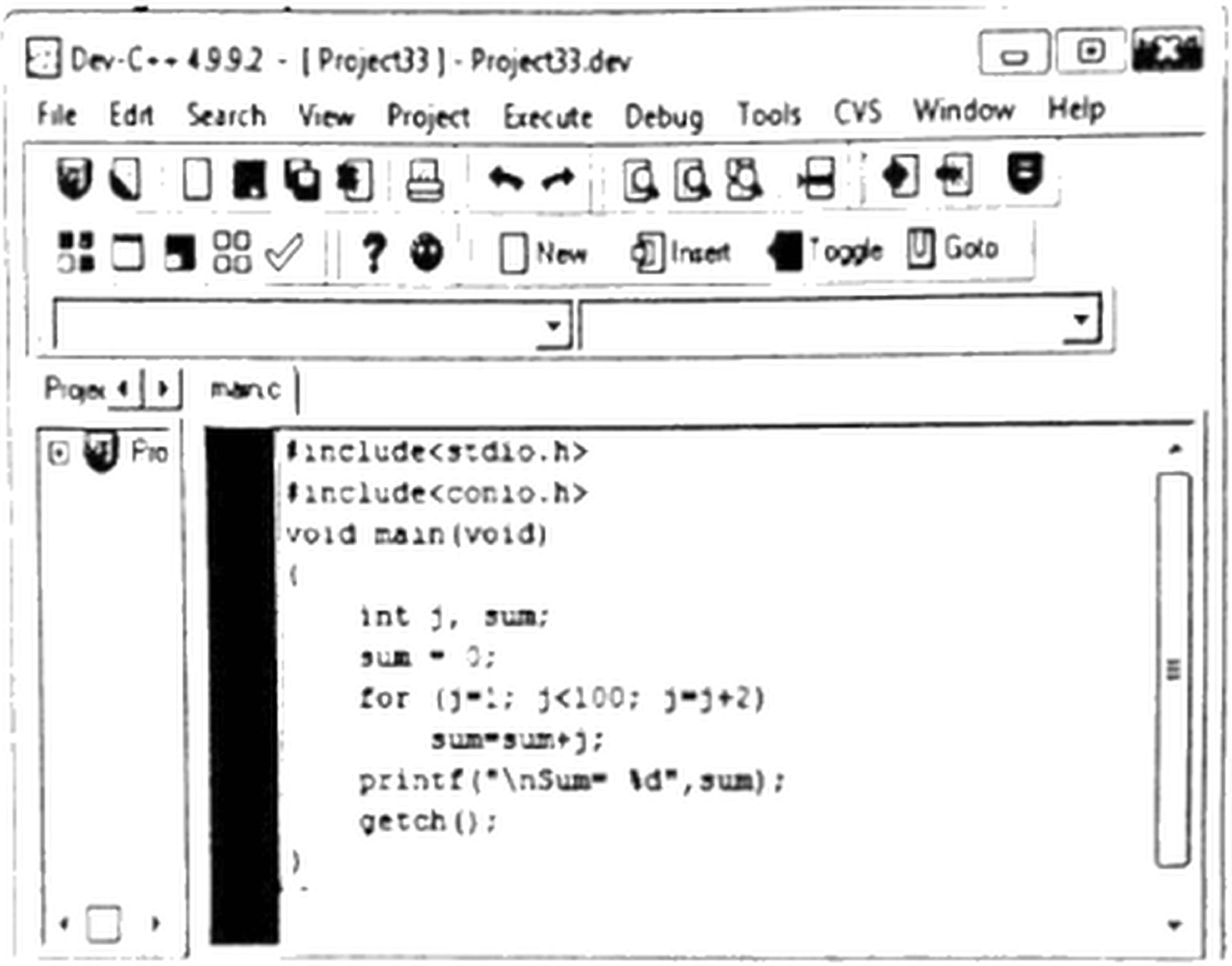
```
Enter a number whose table is required: 7

 7 x  1 =   7
 7 x  2 =  14
 7 x  3 =  21
 7 x  4 =  28
 7 x  5 =  35
 7 x  6 =  42
 7 x  7 =  49
 7 x  8 =  56
 7 x  9 =  63
 7 x 10 =  70
 7 x 11 =  77
 7 x 12 =  84
```

Output of Program

- In the printf() function %2d means to print the values of n and j in field width of 2 and %3d means to print the product of j*n in field width of 3.

Q5. Write a program to print the sum of odd numbers from 1 to 100 by using for () loop.

Ans: Program to print the sum of odd numbers from 1 to 100: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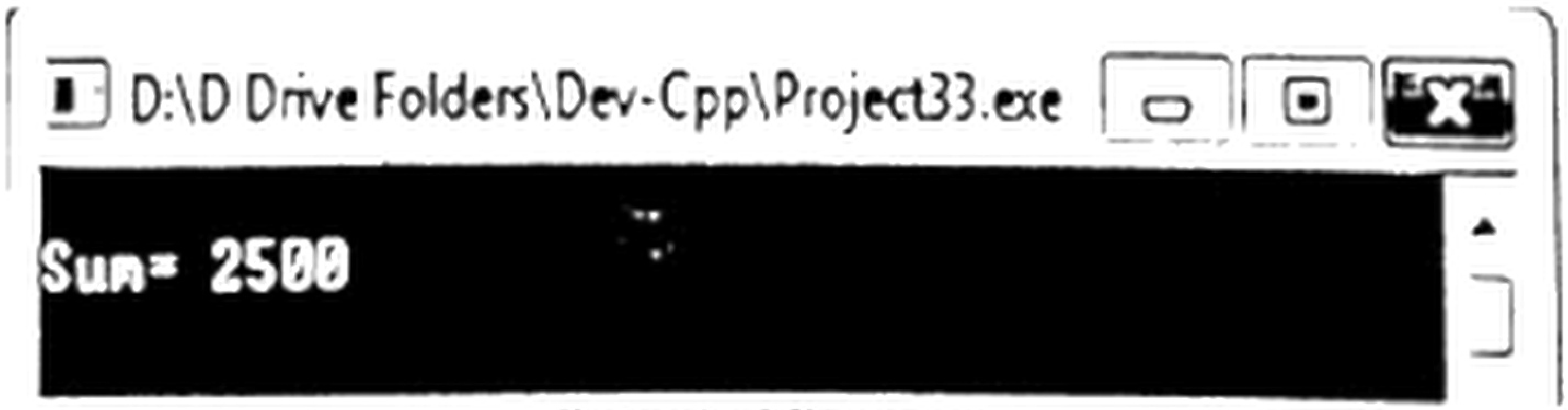
```
#include<stdio.h>
#include<conio.h>
void main(void)
{
    int j, sum;
    sum = 0;
    for (j=1; j<100; j=j+2)
        sum=sum+j;
    printf("\nSum= %d",sum);
    getch();
}
```

Program to print sum of odd numbers

- When this program is executed, the variable sum is initialized to zero and the loop variable j to 1.
- The first value of j which is 1 is added to sum. Then j is incremented by 2 and the number 3 is added.
- One ach pass through the loop the value of j is incremented by 2 and added to the previous sum. This continues till the last odd number 99 is

added to the sum. The output of this program is shown in Fig. This program does not require any input from the keyboard.

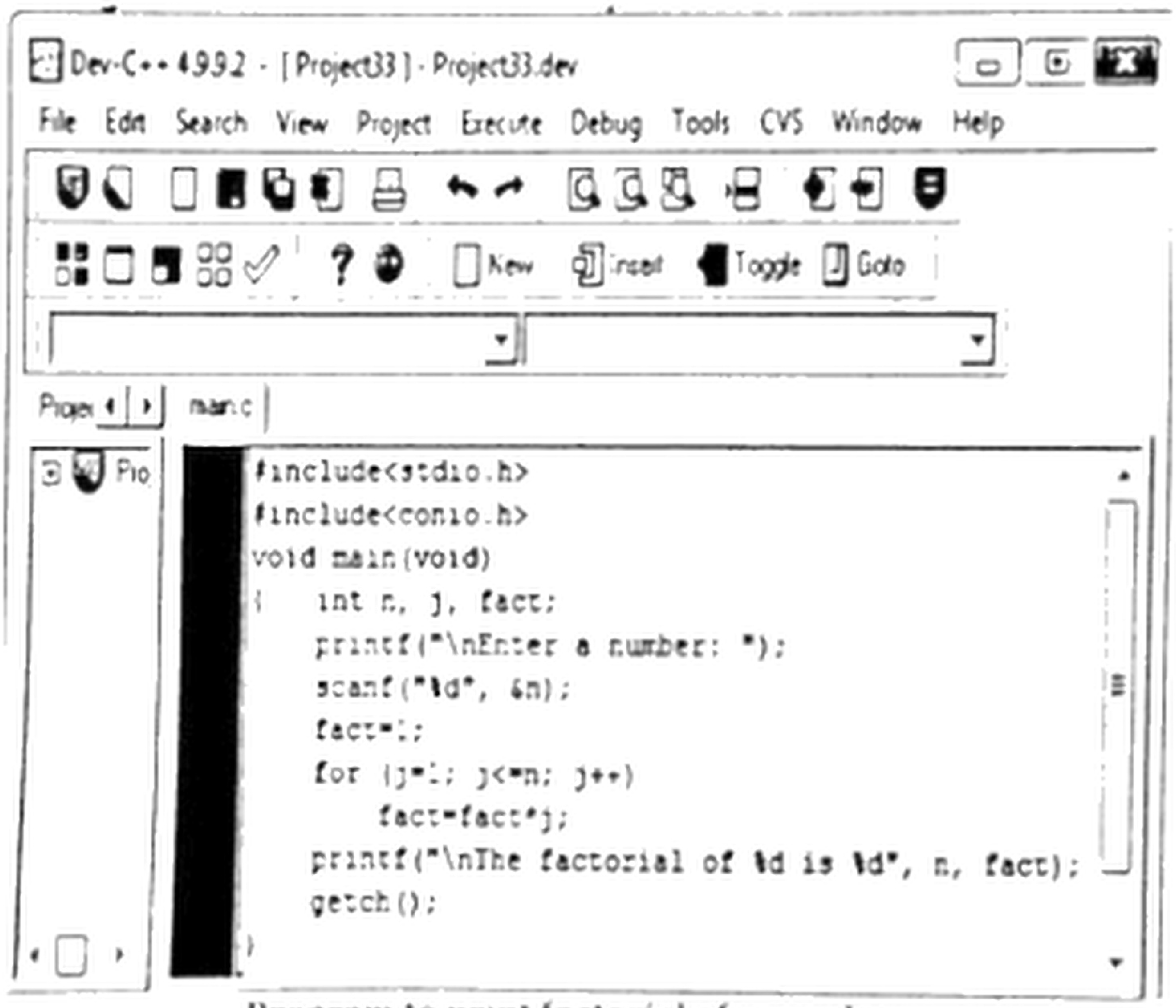


```
Sum= 2500
```

Output of Program

Q6. Write a program to read a number and print its factorial by using for () loop.

Ans: Program to read a number and print its factorial: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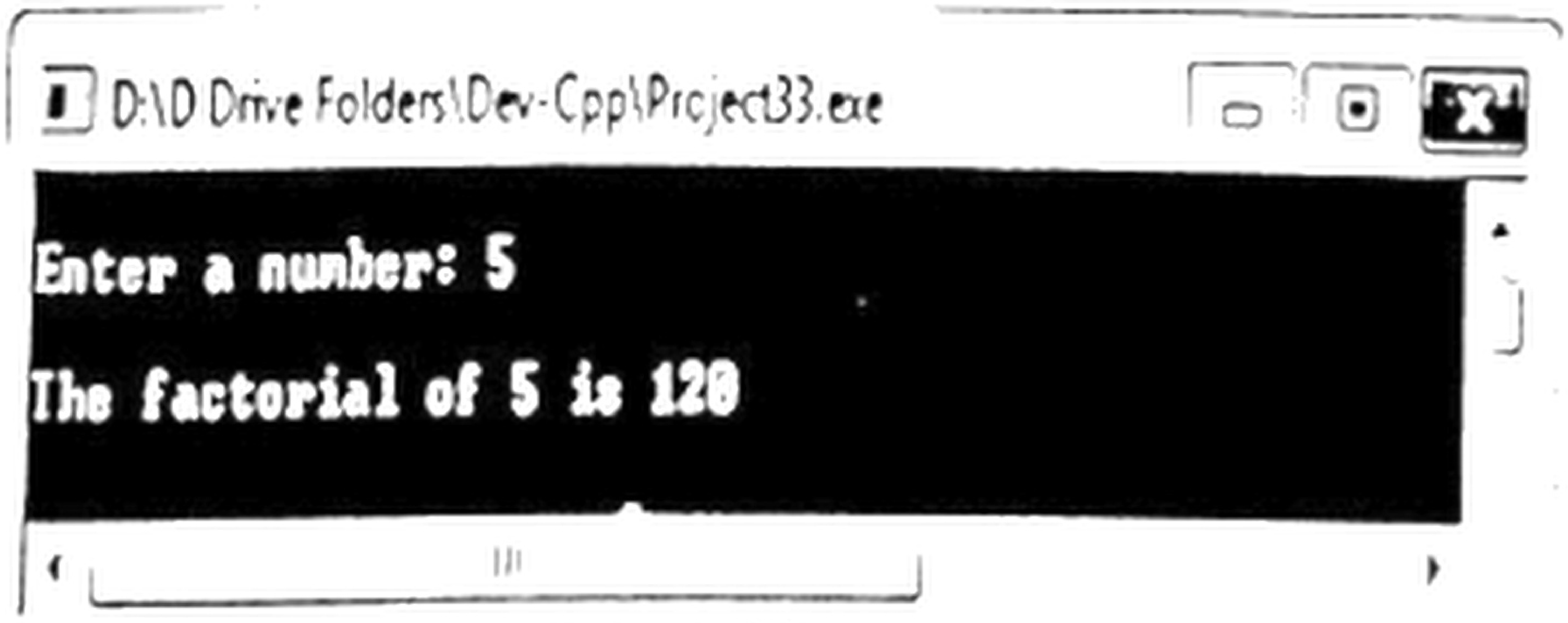
```
#include<stdio.h>
#include<conio.h>
void main(void)
{   int n, j, fact;
    printf("\nEnter a number: ");
    scanf("%d", &n);
    fact=1;
    for (j=1; j<=n; j++)
        fact=fact*j;
    printf("\nThe factorial of %d is %d", n, fact);
    getch();
}
```

Program to print factorial of a number

Execution of the program is shown in Fig.



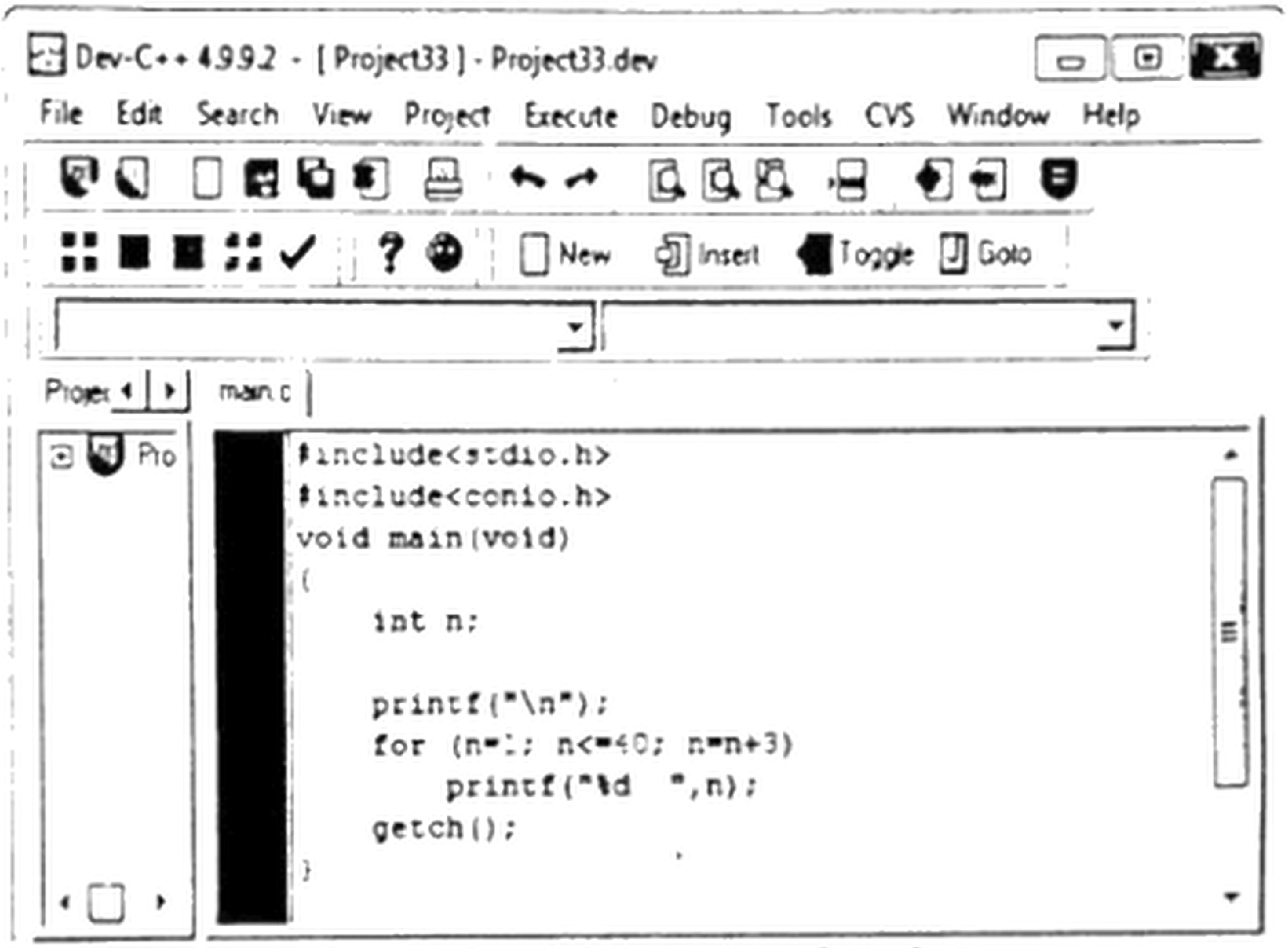
```
Enter a number: 5
The factorial of 5 is 120
```

Output of Program

Q7. Write a program to print the given sequence of numbers on a single line. 1 4 7 10 13 16 19 22 25 28 31 34 37 40 by using for () loop.

Ans: Program to print the given sequence of numbers on a single line .

1 4 7 10 13 16 19 22 25 28 31 34 37 40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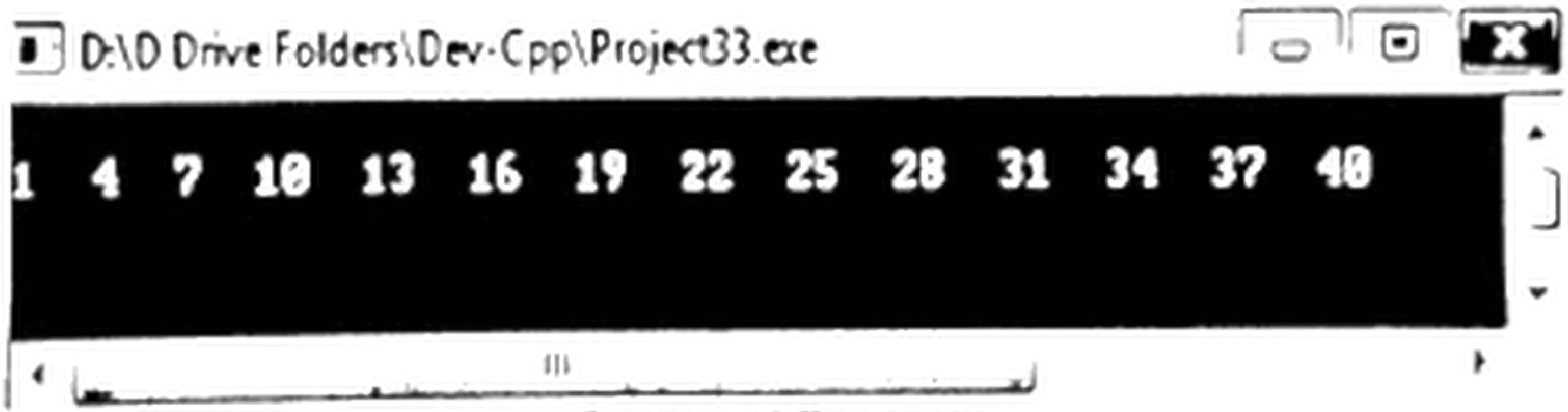
```
#include<stdio.h>
#include<conio.h>
void main(void)
{
    int n;

    printf("\n");
    for (n=1; n<=40; n=n+3)
        printf("%d  ",n);
    getch();
}
```

Program to print a sequence of numbers

Output of Program is shown in Fig.

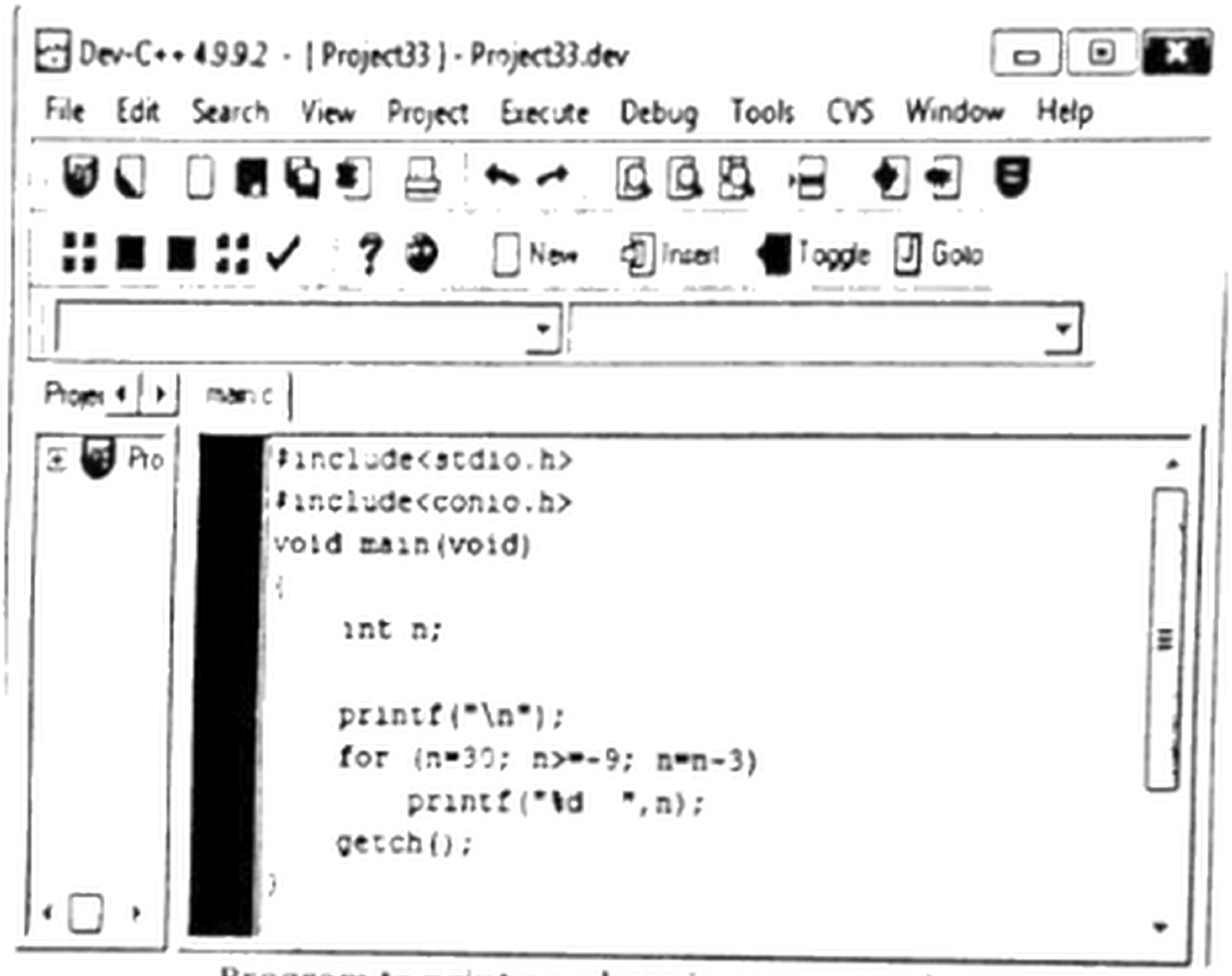


```
1  4  7  10  13  16  19  22  25  28  31  34  37  40
```

Output of Program

Q8. Write a program to print the given sequence of numbers on a single line in reverse order. 30 27 24 21 18 15 12 9 6 3 0 -3 -6 -9 by using for () loop.

Ans: Program to print the given sequence of numbers on a single line in reverse order. 30 27 24 21 18 15 12 9 6 3 0 -3 -6 -9



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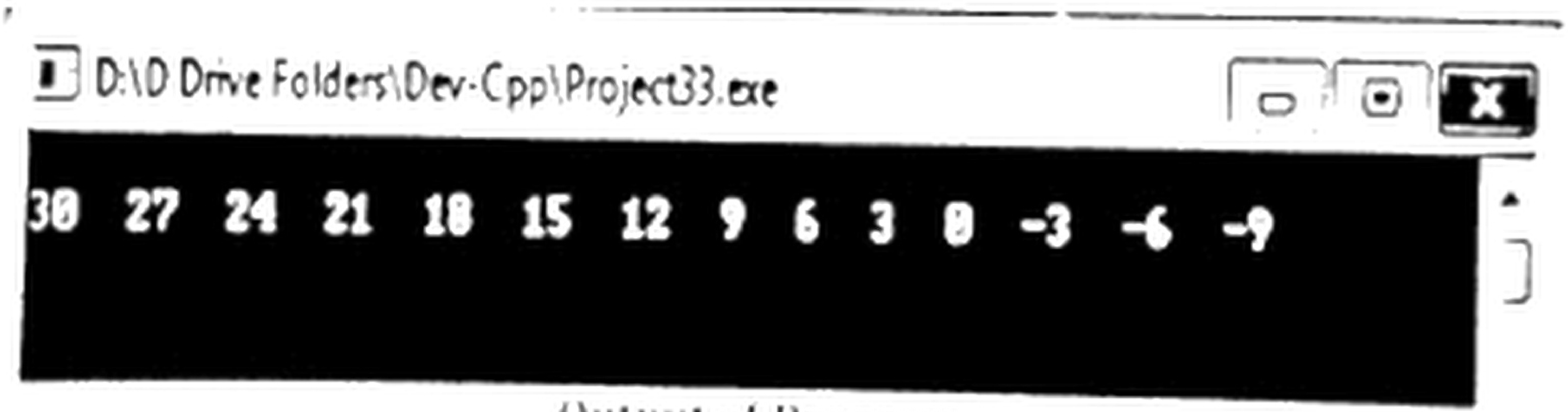
```
#include<stdio.h>
#include<conio.h>
void main(void)
{
    int n;

    printf("\n");
    for (n=30; n>=-9; n=n-3)
        printf("%d  ",n);
    getch();
}
```

Program to print numbers in reverse order

The output of program is shown in Fig.

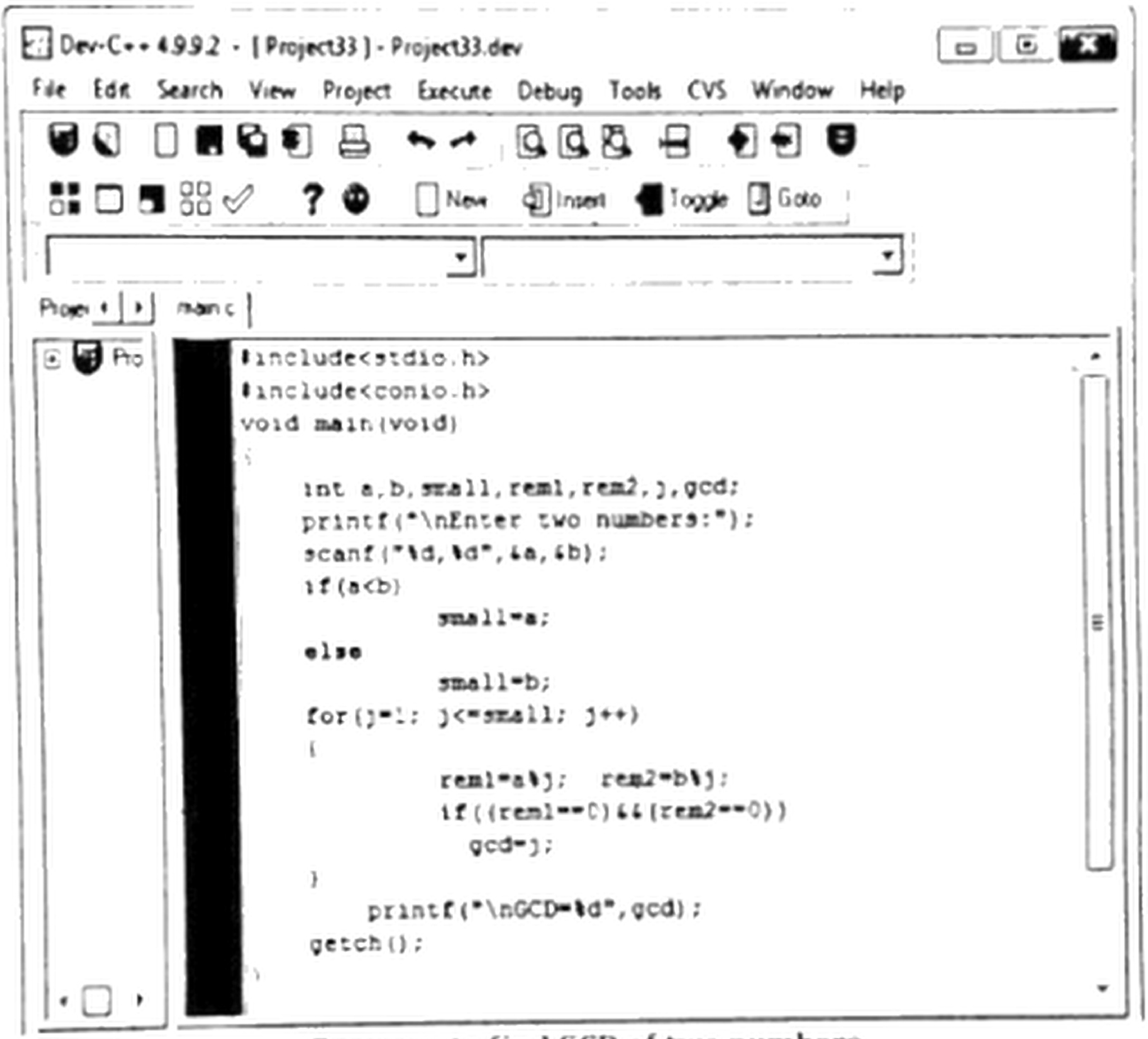


```
30  27  24  21  18  15  12  9  6  3  0  -3  -6  -9
```

Output of Program

Q9. Write a program to find the Greatest Common Divisor (GCD) of two numbers by using for () loop.

Ans: Program to print the Greatest Common Divisor (GCD) of two numbers.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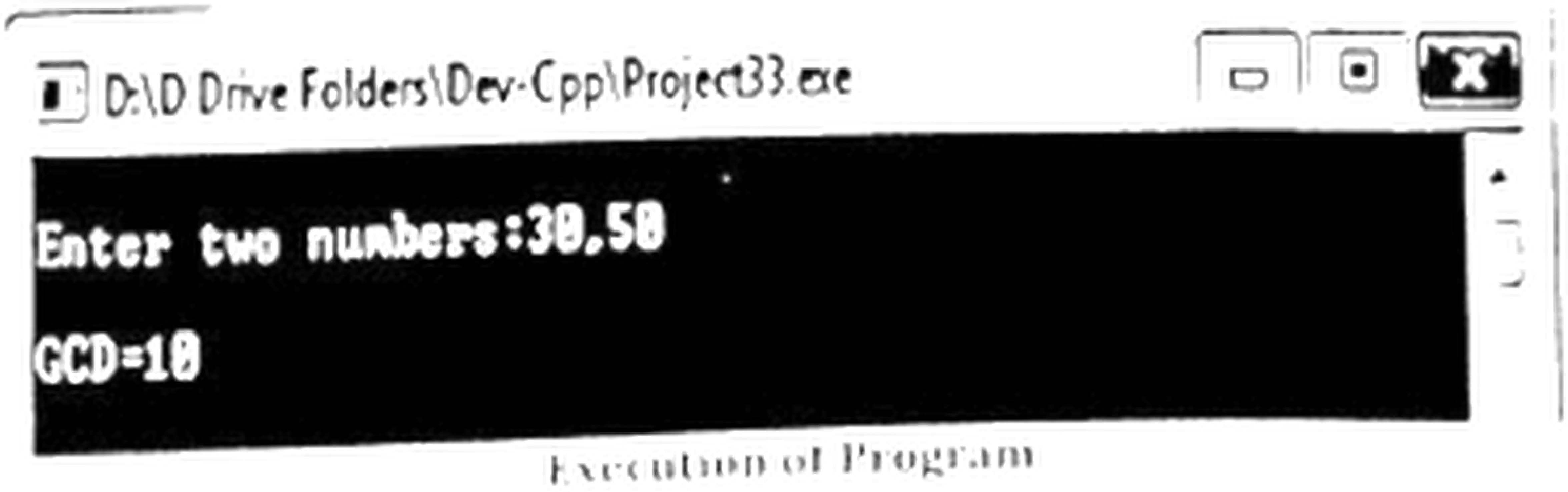
```
#include<stdio.h>
#include<conio.h>
void main(void)
{
     int a,b,small,rem1,rem2,j,gcd;
     printf("\nEnter two numbers:");
     scanf("%d,%d",&a,&b);
     if(a<b)
               small=a;
     else
               small=b;
     for(j=1; j<=small; j++)
     {
               rem1=a%j;  rem2=b%j;
               if((rem1==0)&&(rem2==0))
                 gcd=j;
     }
          printf("\nGCD=%d",gcd);
     getch();
}
```

Program to find GCD of two numbers

- In this program a and b are two variables whose GCD is required. After reading the two numbers from the keyboard, if-else statement will determine the smaller of the two numbers and assign It on the variable small.
- The GCD is in the range of 1 to the smaller number. The two variables rem1 and rem2 are used to determine whether the numbers a and b are exactly divisible j by using the remainder operator.
- The greatest value of j that exactly divides both variables without any remainder Is assigned to the variable gcd. Execution of this program is shown in Fig.

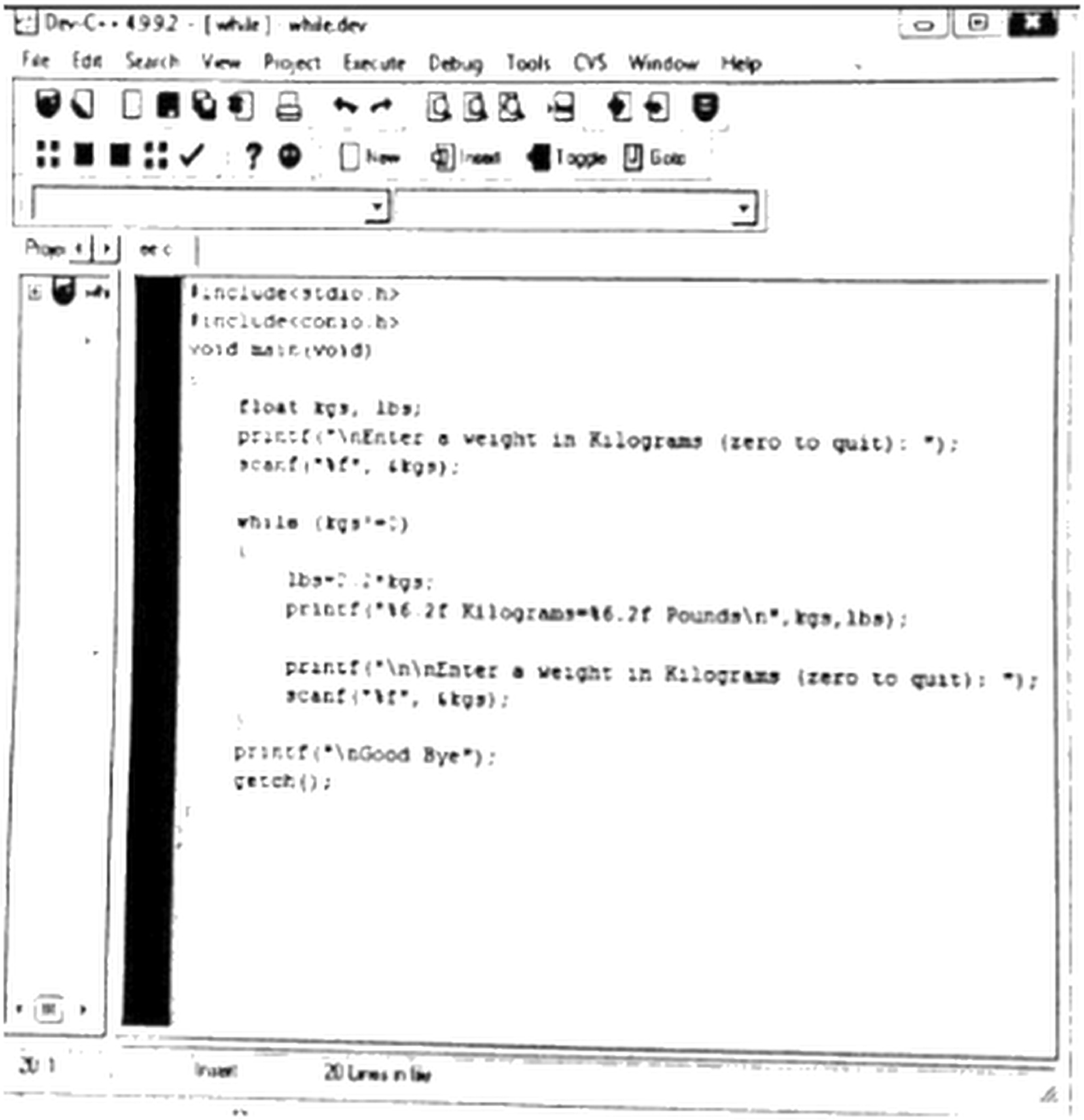


```
Enter two numbers:30,50
GCD=10
```

Execution of Program

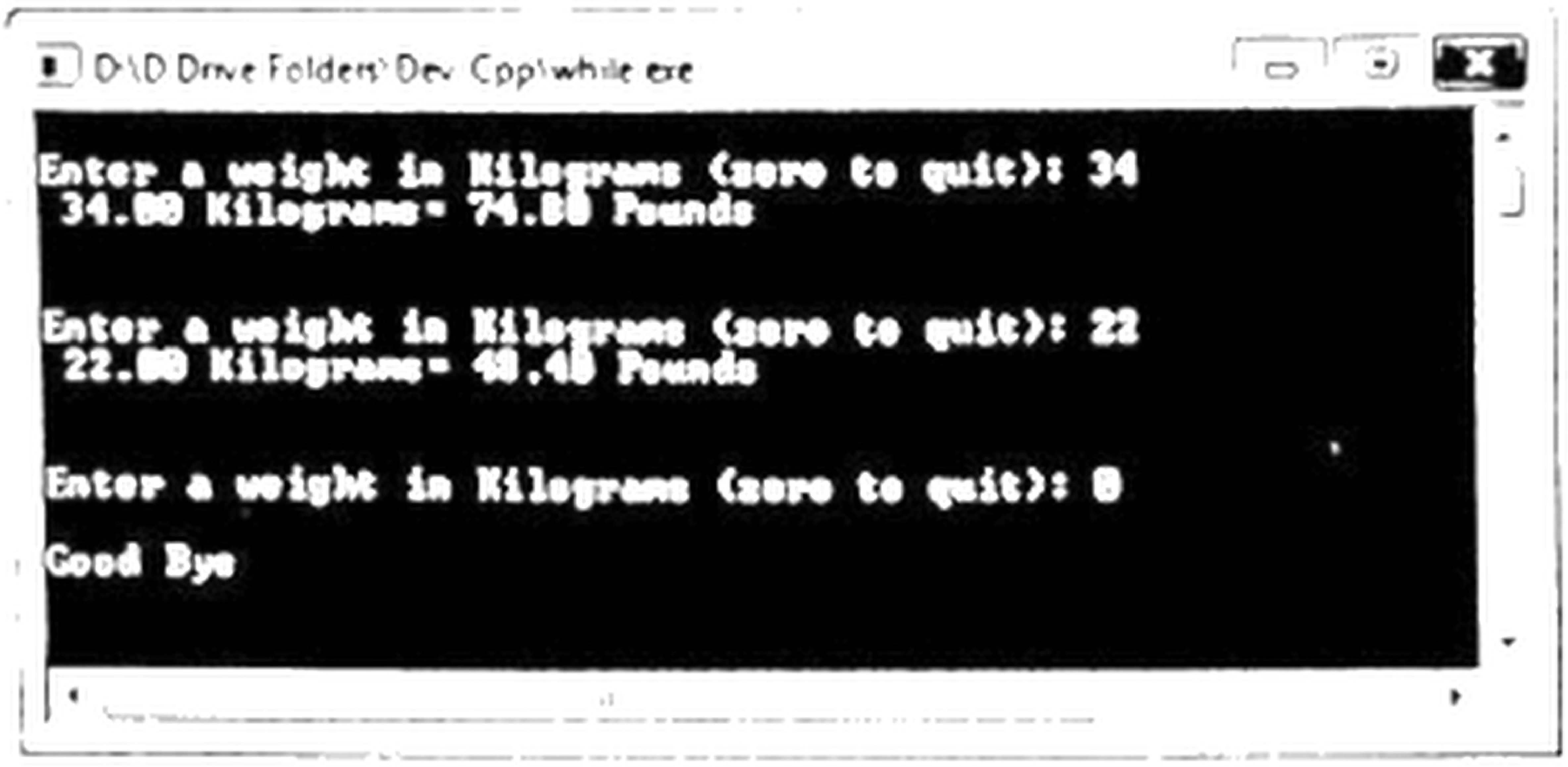
Q10. Write a program to convert kilograms to pounds using while loop.

Ans: Program to convert kilograms to pounds using while loop:



```
#include<stdio.h>
#include<conio.h>
void main(void)
{
    float kgs, lbs;
    printf("\nEnter a weight in Kilograms (zero to quit): ");
    scanf("%f", &kgs);

    while (kgs!=0)
    {
        lbs=2.2*kgs;
        printf("%6.2f Kilograms=%6.2f Pounds\n",kgs,lbs);

        printf("\n\nEnter a weight in Kilograms (zero to quit): ");
        scanf("%f", &kgs);
    }
    printf("\nGood Bye");
    getch();
}
```

Execution of the programs is shown in Fig.

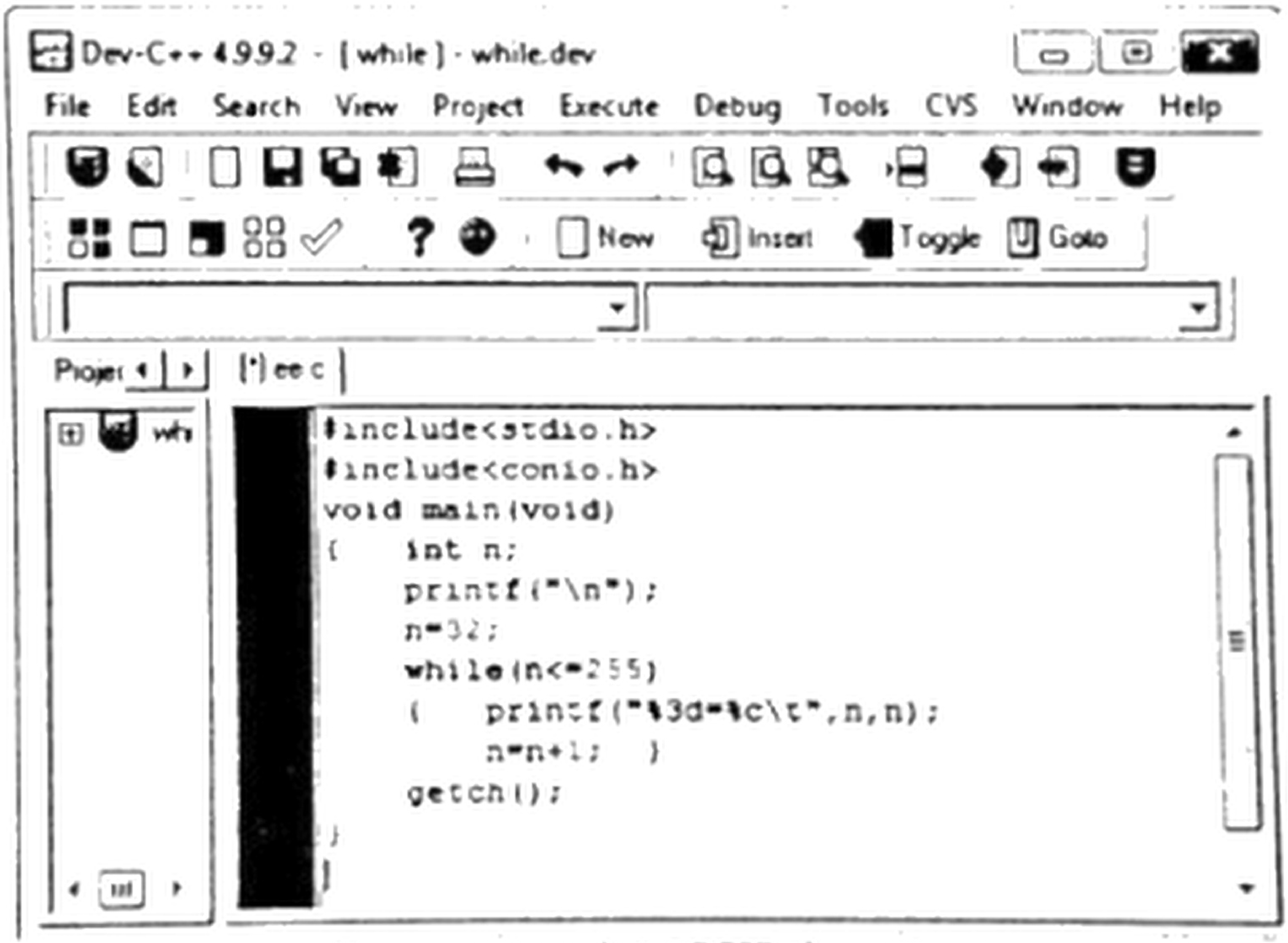


```
Enter a weight in Kilograms (zero to quit): 34
 34.00 Kilograms= 74.80 Pounds


Enter a weight in Kilograms (zero to quit): 22
 22.00 Kilograms= 48.40 Pounds


Enter a weight in Kilograms (zero to quit): 0

Good Bye
```

Execution of Program

Q11. Write a program to print ASCII table using while loop.

Ans: Program to print ASCII table using while loop:



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```
#include<stdio.h>
#include<conio.h>
void main(void)
{   int n;
    printf("\n");
    n=32;
    while(n<=255)
    {   printf("%3d=%c\t",n,n);
        n=n+1;   }
    getch();
}
```

Program to print ASCII characters

In ASCII table each of the numbers from 0 to 255 represents a separate character.

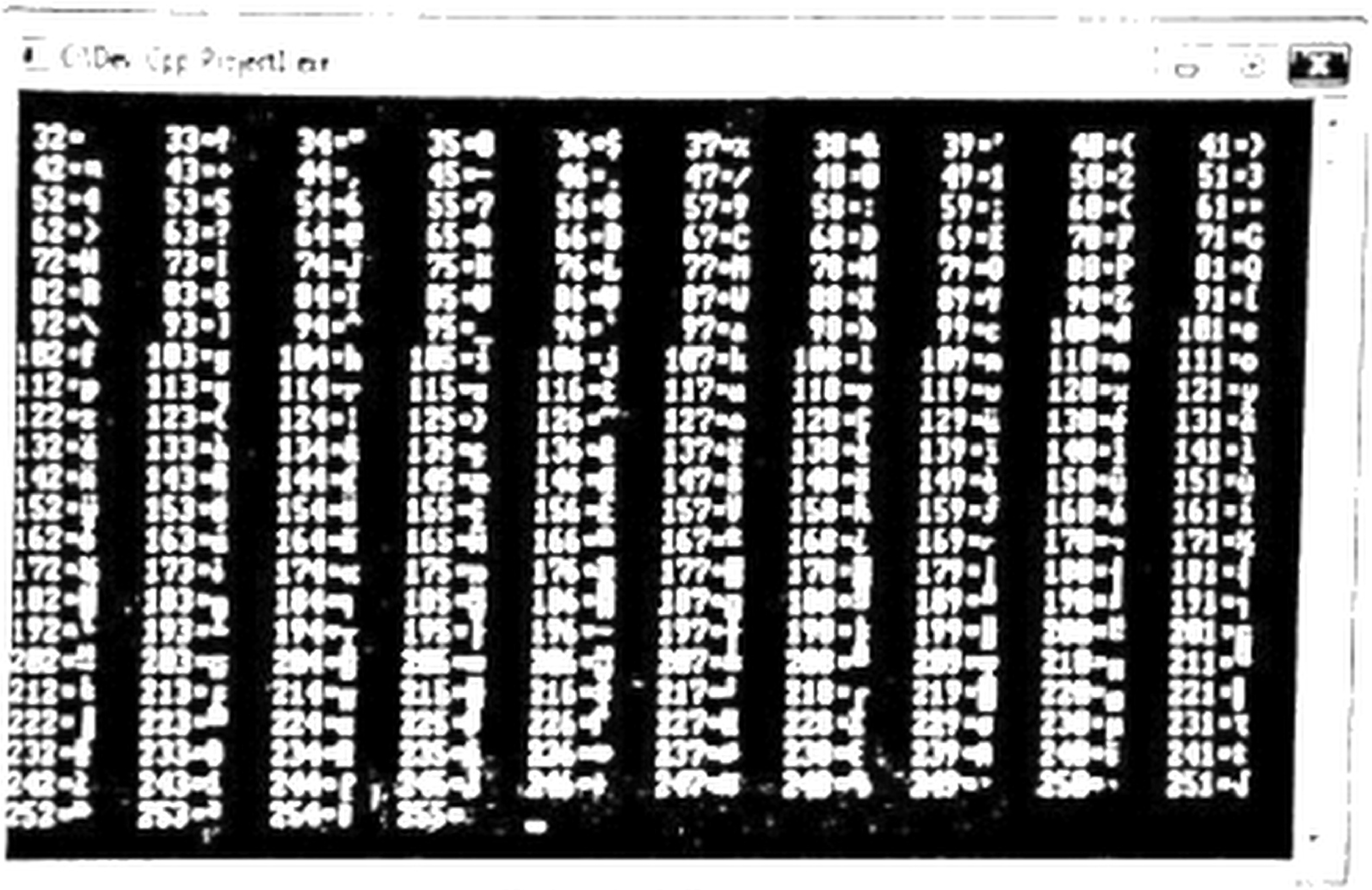
Following are the types of characters included in ASCII table

0~31 control codes such as tab carriage return and bell

32~127 usual printing characters

128~255 graphics and foreign language characters

Output of the program is shown in Fig.



```
 32=     33=!    34="    35=#    36=$    37=%    38=&    39='    40=(    41=)
 42=*    43=+    44=,    45=-    46=.    47=/    48=0    49=1    50=2    51=3
 52=4    53=5    54=6    55=7    56=8    57=9    58=:    59=;    60=<    61==
 62=>    63=?    64=@    65=A    66=B    67=C    68=D    69=E    70=F    71=G
 72=H    73=I    74=J    75=K    76=L    77=M    78=N    79=O    80=P    81=Q
 82=R    83=S    84=T    85=U    86=V    87=W    88=X    89=Y    90=Z    91=[
 92=\    93=]    94=^    95=_    96=`    97=a    98=b    99=c   100=d   101=e
102=f   103=g   104=h   105=i   106=j   107=k   108=l   109=m   110=n   111=o
112=p   113=q   114=r   115=s   116=t   117=u   118=v   119=w   120=x   121=y
122=z   123={   124=|   125=}   126=~   127=⌂   128=Ç   129=ü   130=é   131=â
132=ä   133=à   134=å   135=ç   136=ê   137=ë   138=è   139=ï   140=î   141=ì
142=Ä   143=Å   144=É   145=æ   146=Æ   147=ô   148=ö   149=ò   150=û   151=ù
152=ÿ   153=Ö   154=Ü   155=¢   156=£   157=¥   158=₧   159=ƒ   160=á   161=í
162=ó   163=ú   164=ñ   165=Ñ   166=ª   167=º   168=¿   169=⌐   170=¬   171=½
172=¼   173=¡   174=«   175=»   176=░   177=▒   178=▓   179=│   180=┤   181=╡
182=╢   183=╖   184=╕   185=╣   186=║   187=╗   188=╝   189=╜   190=╛   191=┐
192=└   193=┴   194=┬   195=├   196=─   197=┼   198=╞   199=╟   200=╚   201=╔
202=╩   203=╦   204=╠   205=═   206=╬   207=╧   208=╨   209=╤   210=╥   211=╙
212=╘   213=╒   214=╓   215=╫   216=╪   217=┘   218=┌   219=█   220=▄   221=▌
222=▐   223=▀   224=α   225=ß   226=Γ   227=π   228=Σ   229=σ   230=µ   231=τ
232=Φ   233=Θ   234=Ω   235=δ   236=∞   237=φ   238=ε   239=∩   240=≡   241=±
242=≥   243=≤   244=⌠   245=⌡   246=÷   247=≈   248=°   249=∙   250=·   251=√
252=ⁿ   253=²   254=■   255=
```

Output of Program

- In this program tab(\t) caused the next item printed to start eight spaces from the start of the last item. Therefore, on an 80 column standard screen. 10 items can be displayed so the screen is divided into ten columns. The printf() function used a field-width specifier of %3d so that each ASCII code is printed in a space of 3 characters and the numbers are properly aligned in columns.

- The printf() statement in the above program in printing both the character code and its ASCII code. In C language, we can use the same variable, n for both displaying number and character. This is done by changing the format specifier, that is %d prints the number and %c prints the character.

KEY POINTS

- A **loop** is a statement in a programming language that allows one or more statements to be repeatedly executed as many times as required.
- The **for** statement is used to executed a set of statements repeatedly for a fixed number of times in a program.
- The **while** statement is used to implement repetition structure in a program when the number of iterations is not known in advance and the repetition continues until some conditions remains true.
- The **do while** statement is used to implement loop structure in a program when it is required to execute the loop at least once
- The **break** statements is used to exit from a loop as soon as certain condition occurs within the loop and program execution continues from the next statement.
- The **continue** statement causes the loop to be continued with the next iteration after skipping the remaining statement in a loop.