Module Title

Principles of Programming

Weekly Assignment - Practical 3

Year

2025

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This assignment consists of the programming questions from practical exercises related to the topics from week 3.

Questions

1. Write, compile and run a C program to read from an input file.

   Given code :

```
/* read values from input file Practical 3, Part 2
@author your name */
#include FILE *fp;
// define a file pointer for the file to hold a disk location
int main()
{
// open the file and assign its address/disk location to file pointer
fp = fopen("inputFile.txt", "r");  //relative pathname used
// add rest of program here – use fp for the file
fclose (fp); // always close files you've opened
}
```

Answer:

Step 1: Create a folder(practical3) to store the program in this practical.

Step 2: Create a text file(inputFile.txt).

Step 3: Use the text file(inputFile.txt) as input file.

Step 4: Reading from the input file.

Step 5: Run the program

Following code for input:

```
/* read values from input file
Practical 3, Part 1 (a)
@Nirvik K.C. */

#include <stdio.h>
FILE *fp; // define a file pointer for the file to hold a disk location
int main()
{
```

```
  // open the file and assign its address/disk location to file pointer
  fp = fopen("inputFile.txt", "r"); // relative pathname used
  // declare variables for holding the values of input
  char firstWord[20];
  char secondWord[20];
  int num;
  printf("Reads two words and an integer from file \n");
  // Read two words and an integer from file
  // fscanf instead of scanf used, and file pointer needed
  fscanf(fp, "%s %s %d", firstWord, secondWord, &num);
  // display two words and an integer
  printf("Displays back what has been read from input file:\n");
  printf("%s %s \n%d \n", firstWord, secondWord, num);
 fclose(fp); // Closes the file
 return 0;
}
```

/* **Output :**

Reads two words and an integer from file

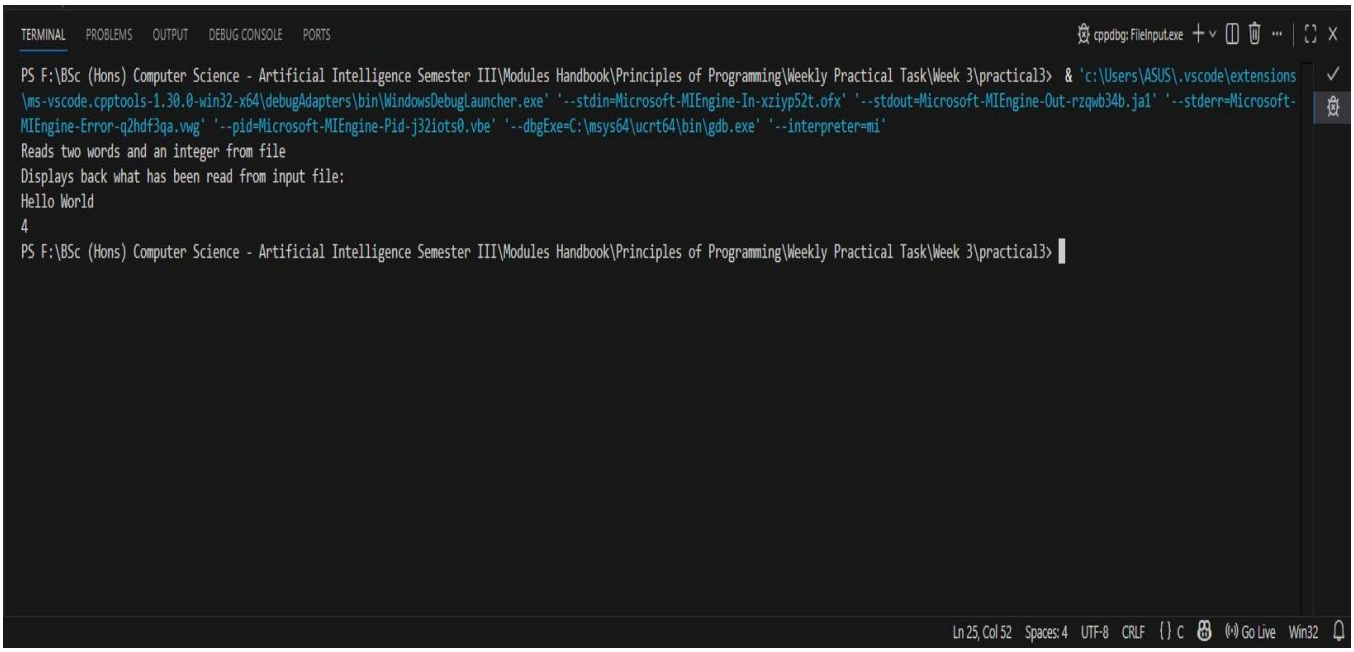
Displays back what has been read from input file:

Hello World

4

*/

Output obtained in execution:



1. **(**b) Change the layout of the values in the input file with the three input values on the same line and check whether your program still works.

Answer:

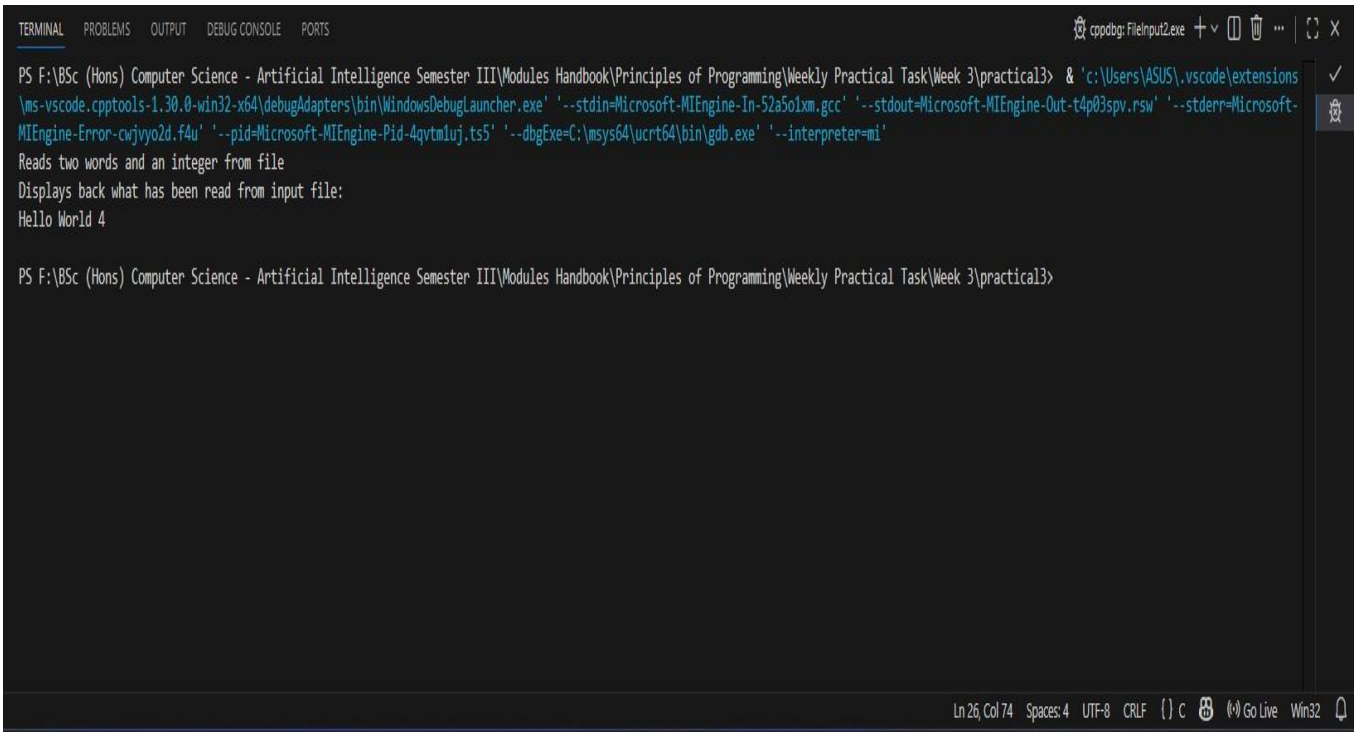
Following code for input:

```
/* read values from input file
Practical 3, Part 1 (b)
@Nirvik K.C. */

#include <stdio.h>
FILE *fp; // define a file pointer for the file to hold a disk location
int main()
{
   FILE *fp;
   // open file for reading
   fp = fopen("inputFile.txt", "r");
   if (fp == NULL)
   {
      {
         printf("Error opening the file");
         return 1;
      }
}
```

```
    // declare variables for holding the values of input
    char firstWord[20];
    char secondWord[20];
    int num;
    printf("Reads two words and an integer from file \n");
    // Changed the layout of the values in the input file - Hello World 4
    // Read two words and an integer from file
    fscanf(fp, "%s %s %d", firstWord, secondWord, &num);
    // Display two words and an integer
    printf("Displays back what has been read from input file:\n");
    printf("%s %s %d \n \n", firstWord, secondWord, num); // Display the three
input values on the same line
    fclose(fp); // Closes the file
    return 0;
}
/* Output :
Reads two words and an integer from file
Displays back what has been read from input file:
Hello World 4
*/
```

Output obtained in execution:



2. Create a text file and save it in the practica3 folder. Name the file as bill_input.txt, which contains one set of input values only as follows:
   900 800 23 5
   Save ElectricityBillA.c in the practical2 folder as ElectricityBillB.c in the same folder. Program should read the input data from input file billInput.txt instead of reading the input data from the keyboard. Add a loop into your program so that your program will run only once by looping through the 7 sets of values.

Given code:

```
//loop begins
for (int i = 1; i <= 7; i++)
{
//Adapt the existing block of code for reading and validating one set of input values (i.e. use fscanf with a file pointer)
} //loop ends
```

Update the input file, bill_input.txt, with the following input data, save it, run it, and test it :

900 800 23 5

9000 9999 12 2

9999 10005 14 6

500 6000 26 7

10000 10100 10 9

6000 6890 30 2

590 829 31 9

Answer:

Following code for input:

```
/* read values from input file

Practical 3, Part 2

@Nirvik K.C. */
```

```
#include <stdio.h>
FILE *fp; // define a file pointer for the file to hold a disk location
int main()
{
   // open file for reading
   fp = fopen("bill_input.txt", "r");
   if (fp == NULL)
   {
      printf("Error opening the file");
      return 1;
   }
   // Declare variables to store input values
   int previous, current, day, month;
   int units;
   printf("Starting validation of electricity bill readings from the file\n\n");
   // Loop to read set of input values from the file
   for (int i = 1; i <= 7; i++)
```

```
{
    printf("The Electricity Bill Set %d\n", i);
    fscanf(fp, "%d %d %d %d", &previous, &current, &day, &month);
    // Display the read values
    printf("Input read: Previous Reading= %d, Current Reading= %d, Day= %d,
Month= %d\n", previous, current, day, month);
    // Validation checks
    if (current < 0 || current > 9999)
    {
       printf("Error: Current meter reading out of range (0-9999)\n");
    }
    if (previous < 0 || previous > 9999)
    {
       printf("Error: Previous meter reading out of range (0-9999)\n");
    }
```

```
if (current - previous > 1000)
    {
       printf("Error: Electricity used more than 1000 units\n");
    }

    if (previous > current)
    {
       printf("Error: Previous reading is greater than current reading\n");
    }

    if (month < 1 || month > 12)
    {
       printf("Error: Month out of range (1-12)\n");
    }
    // Check days in month
    if ((month == 1 || month == 3 || month == 5 || month == 7 || month == 8 ||
month == 10 || month == 12) && (day < 1 || day > 31))
```

```
        {
            printf("Error: Day out of range for the given month (1-31)\n");
        }
        if ((month == 4 || month == 6 || month == 9 || month == 11) && (day < 1 ||
day > 30))
        {
            printf("Error: Day out of range 1 to 30\n");
        }
        if (month == 2 && (day < 1 || day > 29))
        {
            printf("Error: Day out of range 1 to 29\n");
        }
        printf("\n");
    }
    fclose(fp); // Closes the file
    return 0;
}
```

/* Output :

Starting validation of electricity bill readings from the file

The Electricity Bill Set 1

Input read: Previous Reading= 900, Current Reading= 800, Day= 23, Month= 5

Error: Previous reading is greater than current reading

The Electricity Bill Set 2

Input read: Previous Reading= 9000, Current Reading= 9999, Day= 12, Month= 2

The Electricity Bill Set 3

Input read: Previous Reading= 9999, Current Reading= 10005, Day= 14, Month= 6

Error: Current meter reading out of range (0-9999)

The Electricity Bill Set 4

Input read: Previous Reading= 500, Current Reading= 6000, Day= 26, Month= 7

Error: Electricity used more than 1000 units

The Electricity Bill Set 5

Input read: Previous Reading= 10000, Current Reading= 10100, Day= 10, Month= 9

Error: Current meter reading out of range (0-9999)

Error: Previous meter reading out of range (0-9999)

The Electricity Bill Set 6

Input read: Previous Reading= 6000, Current Reading= 6890, Day= 30, Month= 2

Error: Day out of range 1 to 29

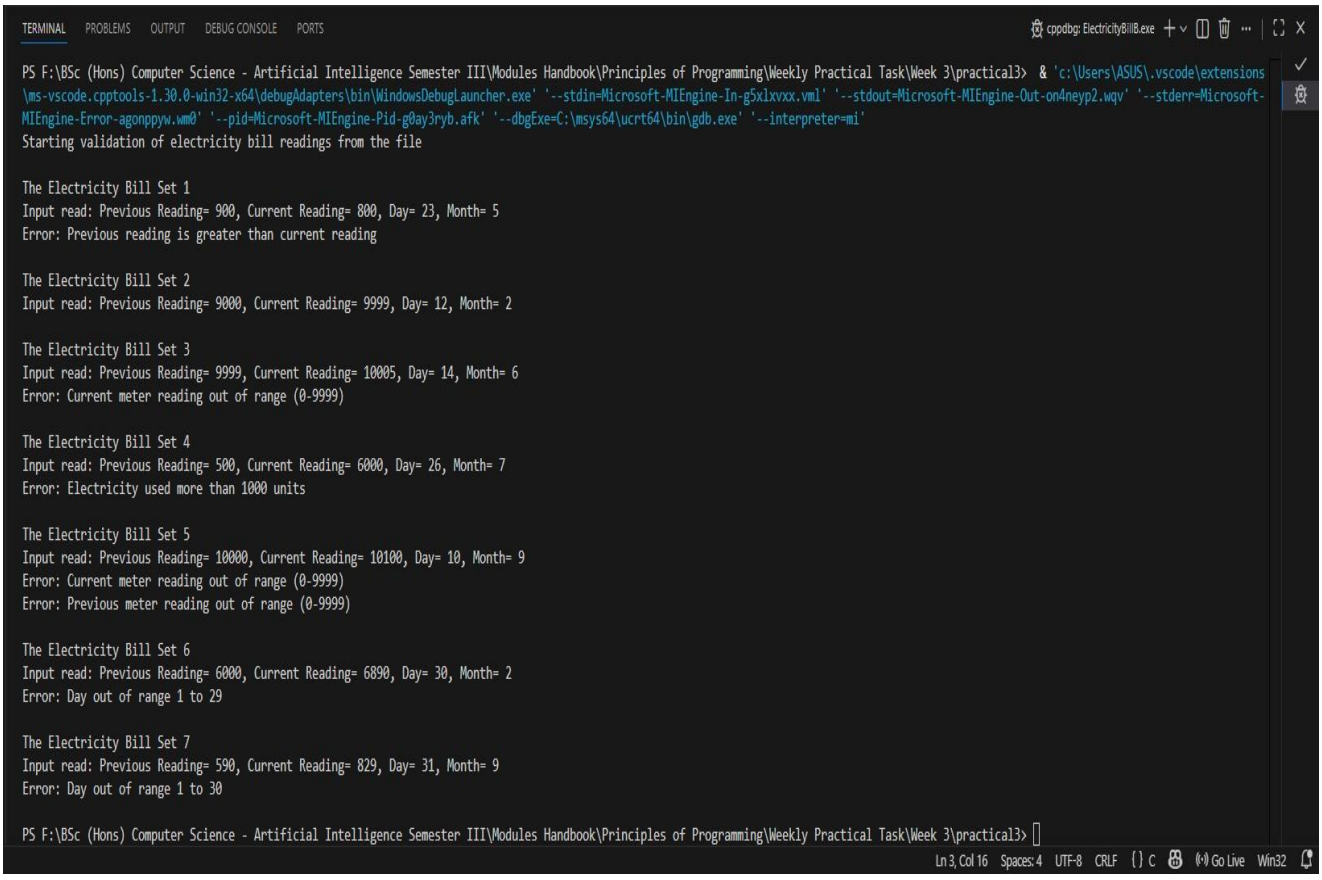
The Electricity Bill Set 7

Input read: Previous Reading= 590, Current Reading= 829, Day= 31, Month= 9

Error: Day out of range 1 to 30

*/

Output obtained in execution:



3. An electricity company keeps the metre readings of their customers in a text file, which should consist of an integer (which is the number of lines in the file) followed by a series of lines each of which consists of a customer number, the previous metre reading and the current metre reading (separated by a space). A program is required to take the text file as an input file, read a set of input values from the input file at a time, calculate the number of units the customer has used over the period, classify the user as follows:

   Above 1000 units – heavy user
   500 – 1000 units – regular user
   Below 500 units – light user
   The program should produce statistics for each category of users and display the statistics on the screen.

   For example,
   Heavy users 20
   Regular users 105
   Light users 54

Step 1: Create a text file named testInput.txt, and save it to the practical3 folder. The text file should contain following input data:

5

1078 9000 9999

1234 10000 10100

1134 6000 6890

4511 590 829

8122 500 2000

Step 2: Now, create a C program named CustomerStatistics.c in the same folder.

Step 3: Also, produce a program outline/pseudocode before creating the C program.

Step 4: Write the C program to implement your program outline.

Step 5: Run and test your program.

Answer:

Following pseudocode:

```
START
Open testInput.txt for reading
IF file cannot be opened
    Display "Error: Cannot open file testInput.txt"
    Stop program
  END IF
Read number_of_customers from file
  Set heavyCount = 0
  Set regularCount = 0
  Set lightCount = 0
FOR i = 1 to number_of_customers
    Read customer_number, previous_reading, current_reading
    unitsUsed = current reading - previous reading
IF unitsUsed > 1000
    heavyCount = heavyCount + 1
```

```
ELSE IF unitsUsed >= 500
        regularCount = regularCount + 1
 ELSE
        lightCount = lightCount + 1
END FOR
```

Following code for input:

```
/* read values from input file
Practical 3, Part 3
@Nirvik K.C. */

#include <stdio.h>
int main()
{
   FILE *fp;
   int total_customers, customer_num, previous_read, current_read;
   int units_used;
```

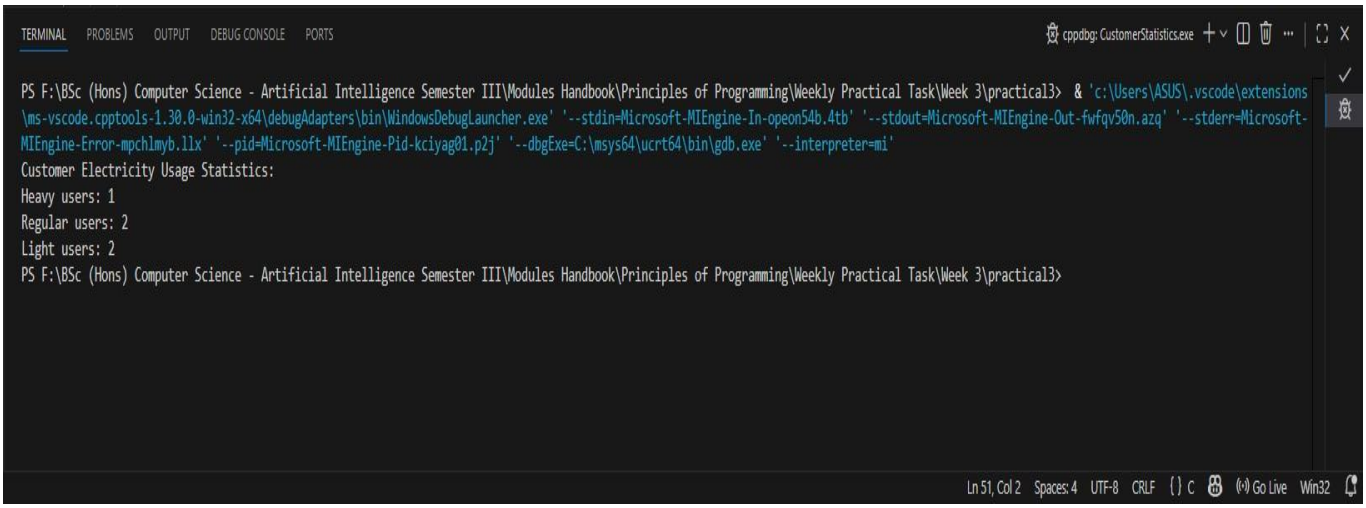
```
    int heavy_users = 0;
    int regular_users = 0;
    int light_users = 0;
    fp = fopen("testInput.txt", "r");
if (fp == NULL)
    {
        printf("Error opening the file");
        return 1;
    }
    fscanf(fp, "%d", &total_customers);
    int i;
    for (i = 0; i < total_customers; i++)
    {
        fscanf(fp, "%d %d %d", &customer_num, &previous_read, &current_read);
        units_used = current_read - previous_read;
```

```
    if (units_used > 1000)
    {
        heavy_users++;
    }
    else if (units_used >= 500)
    {
        regular_users++;
    }
    else if (units_used < 500)
    {
        light_users++;
    }
    else
    {
        printf("Meter reading error for customer %d\n", customer_num);
    }
}
```

```
    printf("Customer Electricity Usage Statistics:\n");
    printf("Heavy users: %d\n", heavy_users);
    printf("Regular users: %d\n", regular_users);
    printf("Light users: %d\n", light_users);

   fclose(fp);
   return 0;
}
/* Output:
Customer Electricity Usage Statistics:
Heavy users: 1
Regular users: 2
Light users: 2
*/
```

Output obtained in execution:



4. More Programming exercises

Use nested loops that display the following patterns in four separate programs:

4. (a) Display Pattern A:

1

1 2

1 2 3

1 2 3 4

1 2 3 4 5

1 2 3 4 5 6

Answer:

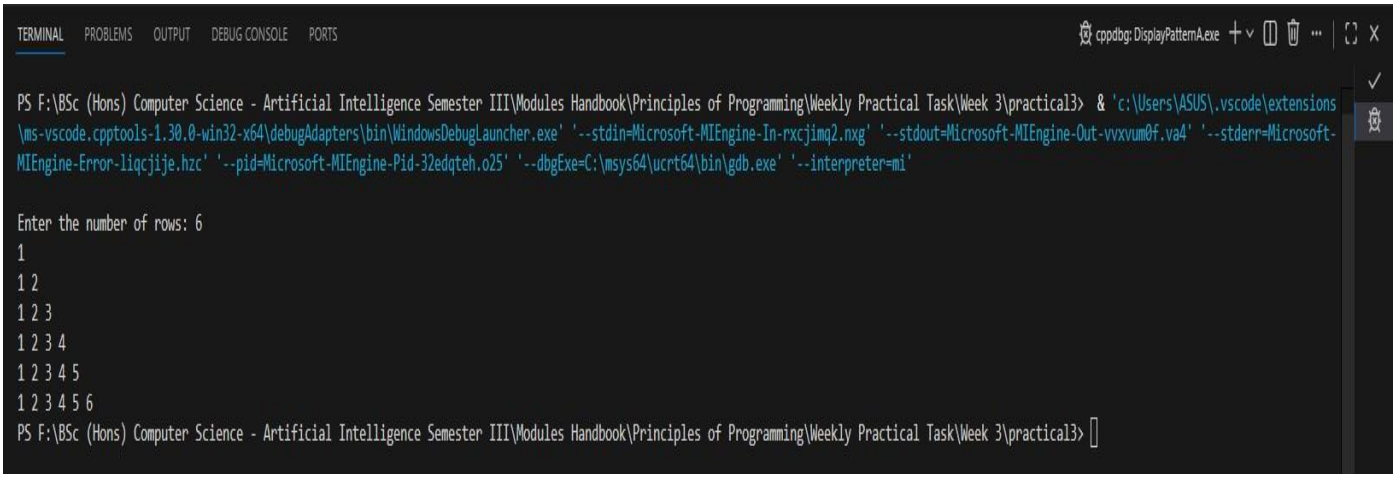
Following code for input:

```
/* read values from input file
Practical 3, Part 4 - 3.1, Display Pattern A
@Nirvik K.C. */


#include <stdio.h>
int main()
{
   int i, j, rows;
   // Prints number of lines (rows of numbers)
   printf("\nEnter the number of rows: ");
   scanf("%d", &rows);
   for (int i = 1; i <= rows; i++) // for number of rows
   {
      for (int j = 1; j <= i; j++) // for printing numbers in each row
```

```
        {
            printf("%d ", j);
        }
        printf("\n"); // go to next line after printing each row
    }
    return 0;
}
```

Output obtained in execution:



4. (b) Display Pattern B

1 2 3 4 5 6

1 2 3 4 5

1 2 3 4

1 2 3

1 2

1

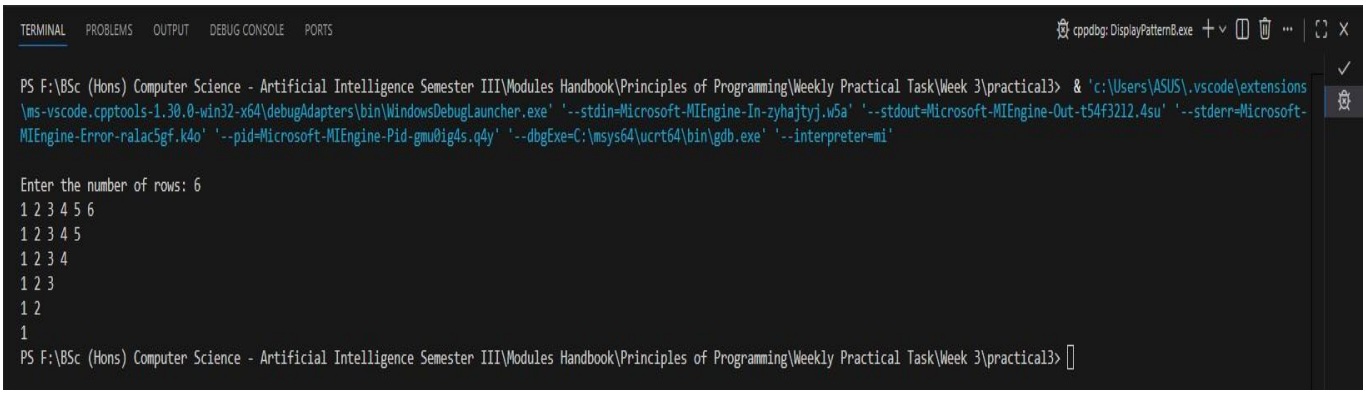
Answer:

Following code for input:

```
/* read values from input file
Practical 3, Part 4 - 3.1, Display Pattern B
@Nirvik K.C. */
#include <stdio.h>
int main()
{
   int i, j, rows;
   // Prints number of lines (rows of numbers)
```

```
    printf("\nEnter the number of rows: ");
    scanf("%d", &rows);
    for (i = rows; i >= 1; i--) // for number of rows
    {
        for (j = 1; j <= i; j++) // for printing numbers from 1 to current row value (i)
        {
            printf("%d ", j);
        }
        printf("\n"); // go to next line after printing each row
    }
    return 0;
}
```

Output obtained in execution:



4. (c) Display Pattern C

```
    1
   2 1
  3 2 1
 4 3 2 1
5 4 3 2 1
6 5 4 3 2 1
```

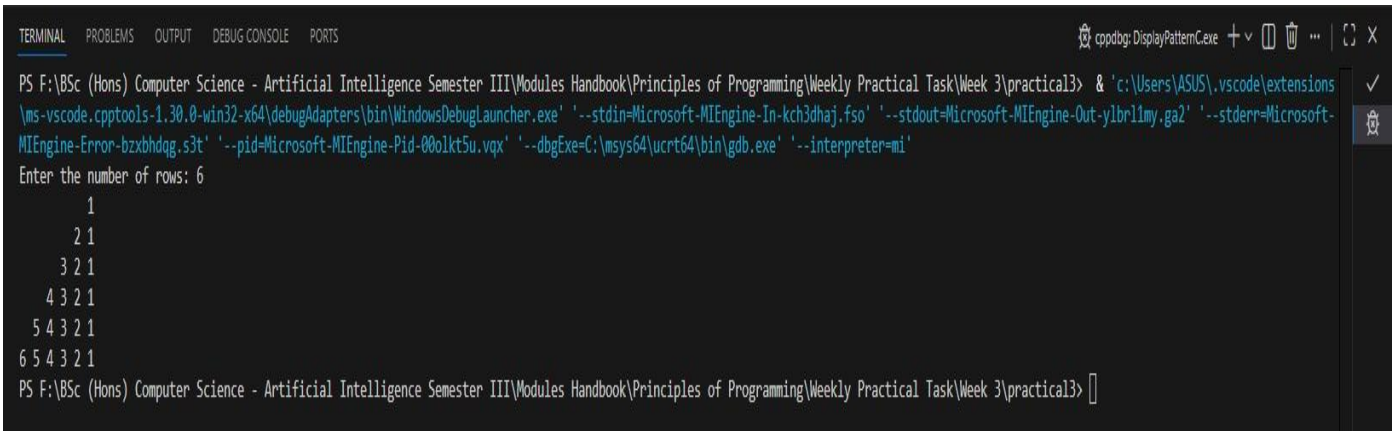
Answer:

Following code for input:

```
/* read values from input file
Practical 3, Part 4 - 3.1, Display Pattern C
@Nirvik K.C. */
#include <stdio.h>
int main()
{
   int rows;
   int i, j, k;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
```

```
    for (int i = 1; i <= rows; i++)
   {
      for (int j = 1; j <= (rows - i); j++) // calculating spaces
     {
         printf("  "); // printing two spaces
      }
      // Print descending numbers from i to 1
      for (int k = i; k >= 1; k--)
      {
         printf("%d ", k);
      }
      printf("\n"); // go to next line after printing each row
   }
   return 0;
}
```

Output obtained in execution:



4. (d) Display Pattern D

```
1 2 3 4 5 6
  1 2 3 4 5
    1 2 3 4
      1 2 3
        1 2
          1
```

Answer:

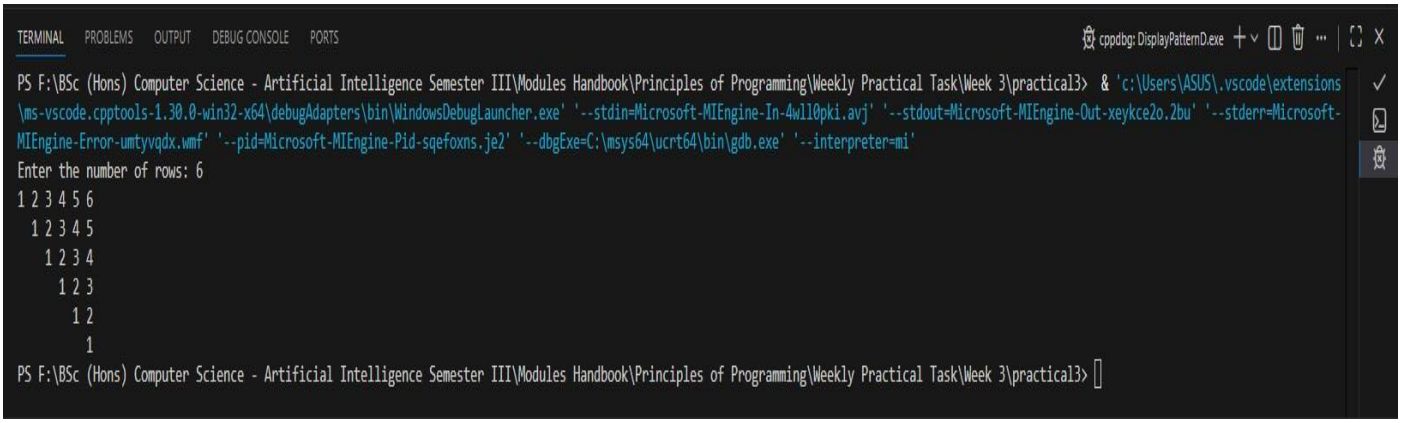
Following code for input:

```
/* read values from input file
Practical 3, Part 4 - 3.1, Display Pattern D
@Nirvik K.C. */

#include <stdio.h>
int main()
{
   int rows;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (int i = rows; i >= 1; i--) // for number of rows
   {
      for (int j = 1; j <= (rows - i); j++) // calculating spaces
      {
         printf("  "); // printing two spaces
      }
      // Print descending numbers from i to 1
```

```
        for (int k = 1; k <= i; k++)
        {
            printf("%d ", k);
        }
        printf("\n"); // go to next line after printing each row
    }
    return 0;
}
```

Output obtained in execution:



5. (Occurrence of max numbers) Write a program that reads integers, finds the largest of them, and counts its occurrences. Assume that the input ends with number 0. Suppose that you entered 3 5 2 5 5 5 0; the program finds that the largest is 5 and the occurrence count for 5 is 4.

Answer:

Following code for input:

```
/* read values from input file

Practical 3, Part 4 - 3.2  (Occurrence of max numbers)

@Nirvik K.C. */

#include <stdio.h>

int main()

{

   int num;

   int number;

   int max;

   int count = 0;
```

```
printf("Enter numbers (type 0 to stop):\n");

// Read the first number

scanf("%d", &number);

while (number != 0)

{

   if (number > max)

   {

      max = number;

      count = 1; // starting a new count

   }

   else if (number == max)

   {

      count++;

   }
```

```
    scanf("%d", &number); // Read the next number
  }
  // Display the maximum number and its occurrence after 0 is entered at last
  if (max == 0)
  {
    printf("No numbers were entered.\n");
  }
  else
  {
    printf("The largest number is %d.\n", max);
    printf("The occurrence of the largest number is %d times.\n", max, count);
  }
  return 0;
}
```

/* Output:

Enter numbers (type 0 to stop):

3 5 2 5 5 5 0

The largest number is 5.

The occurrence of the largest number is 5 times.*/

Output obtained in execution:

6. (Count vowels and consonants) Assume letters A, E, I, O, and U as the vowels. Write a program that prompts the user to enter a string and displays the number of vowels and consonants in the string.

Output to display:

Enter a string: Programming is fun

The number of vowels is 5

The number of consonants is 11

Answer:

Following code for input:

/* read values from input file

Practical 3, Part 4 - 3.3 (Count vowels and consonants)

@Nirvik K.C. */

```
#include <stdio.h>
#include <string.h>
int main()
{
   char str[100];
   int vowels = 0, consonants = 0;
   int i, j;
   char vowel_list[10] = {'A', 'E', 'I', 'O', 'U', 'a', 'e', 'i', 'o', 'u'};

   printf("\nEnter a string: ");
   // To read the whole line including spaces
   fscanf(stdin, "%[^\n]", str); // using %[^\n] to read string with spaces
   for (int i = 0; i < strlen(str); i++)
   {
      char ch = str[i];
```

```
// Check if the character is a letter (A-Z or a-z)
if ((ch >= 'A' && ch <= 'Z') || (ch >= 'a' && ch <= 'z'))
{
   int isVowel = 0;
   for (int j = 0; j < 10; j++)
   {
      if (ch == vowel_list[j])
      {
         isVowel = 1;
         break;
      }
   }
   if (isVowel)
   {
      vowels = vowels + 1;
   }
```

```
        else
            {
                consonants = consonants + 1;
            }
        }
    }
    printf("The number of vowels is %d\n", vowels);
    printf("The number of consonants is %d\n", consonants);
    return 0;
}

/* Output:
Enter a string: Programming is fun
The number of vowels is 5
The number of consonants is 11 */
```

Output obtained in execution: