Advanced C Lab assignment 2 Ex3

Name: Sankalp Mukim

Registration Number: 20BDS0128

Course Code: CSE2010

Slot: L27+L28

Table of Contents

Question 1

Write a function to convert any given year into its roman equivalent. Use these roman equivalents for decimal numbers: 1-I, 5-V, 10-X,50-L, 100-C, 500-D, 1000-M Example: Roman equivalent of 1988 is MDCCCCLXXXVIII

Code

```c
// Write a recursive function to convert any given year into its roman
equivalent. Use these roman equivalents for decimal values:
// 1 = I, 5 = V, 10 = X, 50 = L, 100 = C, 500 = D, 1000 = M.
#include <stdio.h>

void convertToRoman(int year, char *roman, int length)
{
    if (year > 1000)
    {
        roman[length] = 'M';
        length++;
        year -= 1000;
```

```
        convertToRoman(year, roman, length);
    }
    else if (year > 500)
    {
        roman[length] = 'D';
        length++;
        year -= 500;
        convertToRoman(year, roman, length);
    }
    else if (year > 100)
    {
        roman[length] = 'C';
        length++;
        year -= 100;
        convertToRoman(year, roman, length);
    }
    else if (year > 50)
    {
        roman[length] = 'L';
        length++;
        year -= 50;
        convertToRoman(year, roman, length);
    }
    else if (year > 10)
    {
        roman[length] = 'X';
        length++;
        year -= 10;
        convertToRoman(year, roman, length);
    }
    else if (year > 5)
    {
        roman[length] = 'V';
        length++;
        year -= 5;
        convertToRoman(year, roman, length);
    }
    else if (year > 1)
    {
        roman[length] = 'I';
        length++;
        year -= 1;
        convertToRoman(year, roman, length);
    }
    else if (year == 1)
    {
        roman[length] = 'I';
        length++;
```

```c
    }
    else if (year == 5)
    {
        roman[length] = 'V';
        length++;
    }
    else if (year == 10)
    {
        roman[length] = 'X';
        length++;
    }
    else if (year == 50)
    {
        roman[length] = 'L';
        length++;
    }
    else if (year == 100)
    {
        roman[length] = 'C';
        length++;
    }
    else if (year == 500)
    {
        roman[length] = 'D';
        length++;
    }
    else if (year == 1000)
    {
        roman[length] = 'M';
        length++;
    }
    else if (year == 0)
    {
        roman[length] = '\0';
    }
}

int main()
{
    int year;
    printf("Enter a year: ");
    scanf("%d", &year);
    char roman[100];
    convertToRoman(year, roman, 0);
    printf("%s\n", roman);
    return 0;
}
```

Output

```
➜ Lab git:(main) X cd Ex4
➜ Ex4 git:(main) X pwd
/mnt/c/Users/sanka/OneDrive/Documents/.SEM4/CSE2010 - Advanced C Programming/Lab/Ex4
➜ Ex4 git:(main) X gcc -o q1.exe q1.c
➜ Ex4 git:(main) X ./q1.exe
Enter a year: 1988
MDCCCCLXXXVIII
➜ Ex4 git:(main) X ./q1.exe
Enter a year: 2001
MMI
➜ Ex4 git:(main) X ./q1.exe
Enter a year: 2088
MMLXXXVIII
➜ Ex4 git:(main) X
```

Question 2

A positive integer is entered through the keyboard. Write a function to obtain the prime factors of this number. Example: prime factors of 24 are 2,2,2 and 3

Code

```c
// A positive integer is entered through the keyboard. Write a function to obtain the prime factors of this number.
// Example: prime factors of 24 are 2, 2, 2 and 3.
#include <stdio.h>

void primeFactors(int num)
{
    int i;
    for (i = 2; i <= num; i++)
    {
        while (num % i == 0)
        {
            printf("%d ", i);
            num = num / i;
        }
    }
}

int main()
{
    int num;
    printf("Enter a number: ");
    scanf("%d", &num);
    primeFactors(num);
    return 0;
}
```

Output

```
→ Ex4 git:(main) X pwd
/mnt/c/Users/sanka/OneDrive/Documents/.SEM4/CSE2010 - Advanced C Programming/Lab/Ex4
→ Ex4 git:(main) X gcc -o q2.exe q2.c
→ Ex4 git:(main) X ./q2.exe
Enter a number: 123
3 41 %
→ Ex4 git:(main) X ./q2.exe
Enter a number: 12
2 2 3 %
→ Ex4 git:(main) X ./q2.exe
Enter a number: 192
2 2 2 2 2 2 3 %
→ Ex4 git:(main) X
```

Question 3

Write a program and the following functions to compute the average rainfall for the year. Use an array to store pointers to the first day of each month and another array to store the number of days in each month.

a. A function to input the average rainfall data of each day of the year into a one-dimensional array.

b. A function to compute the average rainfall for the year or any month.

c. A function to output the average rainfall for each month and the yearly average rainfall.

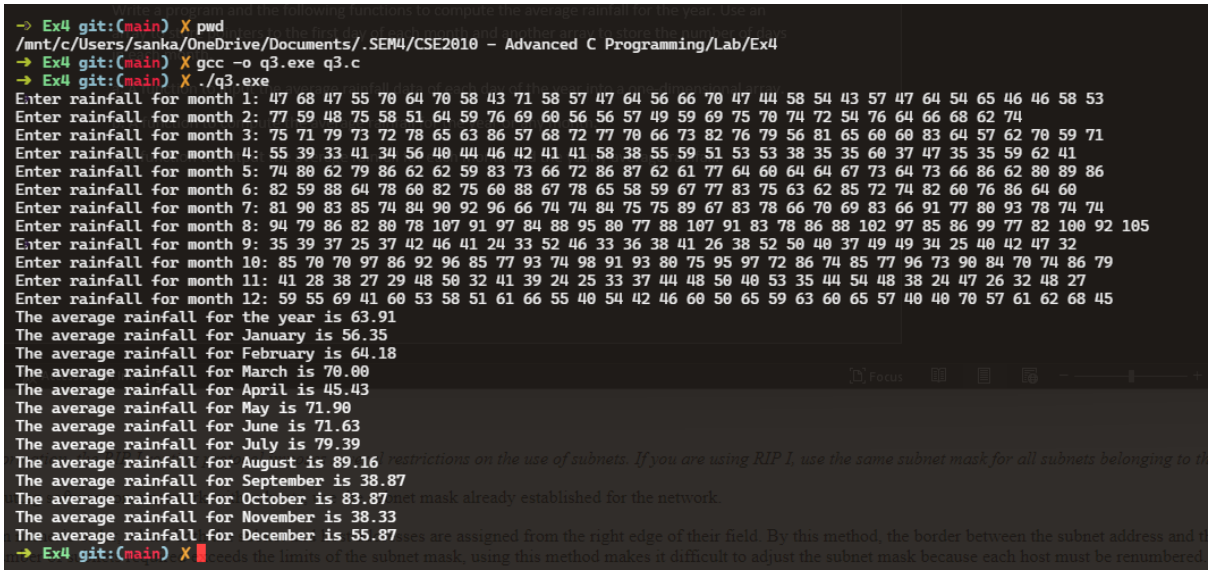
Code

```c
// Write a program and the following functions to compute the average rainfall for the year. Use an array to store pointers to the first day of each month and another array to store the number of days in each month.
// a. A function to input the average rainfall data of each day of the year into a one dimensional
// array.
// b. A function to compute the average rainfall for the year or any month.
// c. A function to output the average rainfall for each month and the yearly average rainfall.
#include <stdio.h>
#include <stdlib.h>

double **inputRainfall();
double averageRainfall(double **rainfall);
double averageRainfallByMonth(double **rainfall, int month);
void outputRainfall(double **rainfall);

// array to store the number of days in each month
int days[] = {31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31};

int main()
{
    double **rainfall = inputRainfall();
    outputRainfall(rainfall);
```

```c
    return 0;
}

// input all rainfall month by month
double **inputRainfall()
{
    // rainfall is the array to store pointers to the first day of each
month
    double **rainfall = (double **)malloc(12 * sizeof(double *));
    int i;
    for (i = 0; i < 12; i++)
    {
        rainfall[i] = (double *)malloc(days[i] * sizeof(double));
    }
    for (i = 0; i < 12; i++)
    {
        int j;
        printf("Enter rainfall for month %d: ", i + 1);
        for (j = 0; j < days[i]; j++)
        {
            scanf("%lf", &rainfall[i][j]);
        }
    }
    return rainfall;
}

void outputRainfall(double **rainfall)
{

    double average = averageRainfall(rainfall);
    printf("The average rainfall for the year is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 1);
    printf("The average rainfall for January is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 2);
    printf("The average rainfall for February is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 3);
    printf("The average rainfall for March is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 4);
    printf("The average rainfall for April is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 5);
    printf("The average rainfall for May is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 6);
    printf("The average rainfall for June is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 7);
    printf("The average rainfall for July is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 8);
    printf("The average rainfall for August is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 9);
```

```
    printf("The average rainfall for September is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 10);
    printf("The average rainfall for October is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 11);
    printf("The average rainfall for November is %.2f\n", average);
    average = averageRainfallByMonth(rainfall, 12);
    printf("The average rainfall for December is %.2f\n", average);
}

double averageRainfall(double **rainfall)
{
    double average = 0;
    int i, j;
    for (i = 0; i < 12; i++)
    {
        for (j = 0; j < days[i]; j++)
        {
            average += rainfall[i][j];
        }
    }
    average /= 365;
    return average;
}

double averageRainfallByMonth(double **rainfall, int month)
{
    double average = 0;
    int i;
    for (i = 0; i < days[month - 1]; i++)
    {
        average += rainfall[month - 1][i];
    }
    average /= days[month - 1];
    return average;
}
```

Output



Question 4

Write a program and the following functions to compute the average value for the following data values stored in a two-dimensional array.

a. A function to input the data into a two-dimensional array.

b. A function to compute the row averages and store them in a one-dimensional array.

c. A function to compute the column averages and store them in a one-dimensional array.

d. A function to compute the average of all the values in the array.

e. A function to output the array, row averages, column averages, and the overall average.

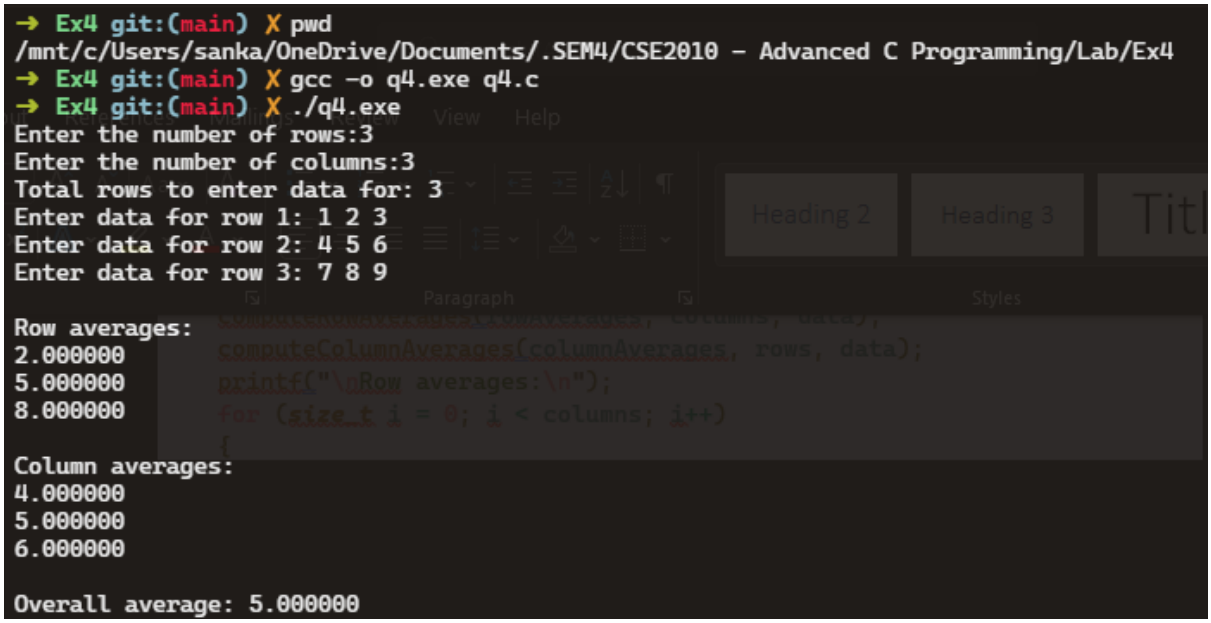
Code

```c
// Write a program and the following functions to compute values for the
following data values stored in a two dimensional array.
#include <stdio.h>
#include <stdlib.h>

// A function to input the data into a two dimensional array.
double **input2DData(int rows, int columns);

// A function to compute the row averages and store them in a one
dimensional array.
void computeRowAverages(double *rowAverages, int columns, double **data);

// A function to compute the column averages and store them in a one
dimensional array.
void computeColumnAverages(double *columnAverages, int rows, double
**data);

// A function to compute the average of all the values in the array.
double fullAverage(double **data, int rows, int columns);
```

```c
// A function to output the array, row averages, column averages, and the
overall average.
void outputData(double **data, int rows, int columns);

int main()
{
    int rows, columns;
    printf("Enter the number of rows:");
    scanf("%d", &rows);
    printf("Enter the number of columns:");
    scanf("%d", &columns);
    double **data = input2DData(rows, columns);
    outputData(data, rows, columns);
}

double **input2DData(int rows, int columns)
{
    // allocate space
    double **data = (double **)malloc(rows * sizeof(double *));
    printf("Total rows to enter data for: %d\n", rows);
    // input data
    for (size_t i = 0; i < rows; i++)
    {
        printf("Enter data for row %ld: ", (i + 1));
        data[i] = (double *)malloc(sizeof(double));
        for (size_t j = 0; j < columns; j++)
        {
            scanf("%lf", &data[i][j]);
        }
    }
    return data;
}

void computeRowAverages(double *rowAverages, int columns, double **data)
{
    for (size_t i = 0; i < columns; i++)
    {
        double sum = 0;
        for (size_t j = 0; j < columns; j++)
        {
            sum += data[i][j];
        }
        rowAverages[i] = sum / columns;
    }
}

void computeColumnAverages(double *columnAverages, int rows, double
**data)
```

```
{
    for (size_t i = 0; i < rows; i++)
    {
        double sum = 0;
        for (size_t j = 0; j < rows; j++)
        {
            sum += data[j][i];
        }
        columnAverages[i] = sum / rows;
    }
}

double fullAverage(double **data, int rows, int columns)
{
    double sum = 0;
    for (size_t i = 0; i < rows; i++)
    {
        for (size_t j = 0; j < columns; j++)
        {
            sum += data[i][j];
        }
    }
    return sum / (rows * columns);
}

void outputData(double **data, int rows, int columns)
{
    double *rowAverages = (double *)malloc(sizeof(double) * columns);
    double *columnAverages = (double *)malloc(sizeof(double) * rows);
    computeRowAverages(rowAverages, columns, data);
    computeColumnAverages(columnAverages, rows, data);
    printf("\nRow averages:\n");
    for (size_t i = 0; i < columns; i++)
    {
        printf("%f\n", rowAverages[i]);
    }
    printf("\nColumn averages:\n");
    for (size_t i = 0; i < rows; i++)
    {
        printf("%f\n", columnAverages[i]);
    }
    printf("\nOverall average: %f\n", fullAverage(data, rows, columns));
}
```

Output


➜ Ex4 git:(main) X pwd
/mnt/c/Users/sanka/OneDrive/Documents/.SEM4/CSE2010 - Advanced C Programming/Lab/Ex4
➜ Ex4 git:(main) X gcc -o q4.exe q4.c
➜ Ex4 git:(main) X ./q4.exe
Enter the number of rows:3
Enter the number of columns:3
Total rows to enter data for: 3
Enter data for row 1: 1 2 3
Enter data for row 2: 4 5 6
Enter data for row 3: 7 8 9
Row averages:
2.000000
5.000000
8.000000
Column averages:
4.000000
5.000000
6.000000
Overall average: 5.000000