CS1002 –Programming Fundamentals

Assignment # 05

Instructor	**Ch. Usman Ghous**
Session	**Fall 2023**
Section	**BCS 1C**

General Guidelines

1. Peer plagiarism and late submissions are strictly not allowed. In case, zero marks will be awarded for whole assignment.
2. Total Marks: 120

Submission Guidelines

1. You will upload the assignment on CLASSROOM in the given timeline.
2. Don't email your solution to the instructor or TA for submission. Submit your assignment in the given deadline, said LMS.
3. No submission will be accepted later than said deadline.

Deadline: Decemeber 18, 2023, 9:00

Q.No.1:

Write a computer program that checks if a given array is a palindrome array or not. Remember that you are not allowed to make a second array in the process.

Sample Input in array-1: ['a', 'b', 'c', 'd', 'e', 'e', 'd', 'c', 'b', 'a']

Sample Output: Palindrome

Q.No.2:

Write a C++ program that creates an array of 10 integers, then user is asked to enter prime numbers. If user entered number is a prime number then number is inserted into array; otherwise, user is asked to enter prime numbers. Once the array is full, program terminates with a message "Array is full".

Q.No.3:

Write a C++ program that create an array of length 30 characters, then you need to get input from user to get a series of characters in array. Program should tell how many unique values are present in the array. Also, the program should tell the occurrence of each unique value in the character array.

Q.No.4:

Write a computer program that creates an integer array of size 10. Asks the user to populate the array with numbers as taken input by the user(user may enter less than 10 numbers). Form an integer variable which has the list content numbers as elaborated by following:

Sample values in Array: [2, 3, 7, 5, 0, 0, 9, , ,]

Sample Integer: 2375009

Q.No.5:

Write a program to takes an array of 20 integers as input from the user and then shows minimum and maximum elements of the array.

Q.No.6:

Write a C++ program that creates an array of 15 integers, then you need to show the game winner which is the unique highest value in the array.

Sample Input: [1, 2, 3, 2, 3, 2, 3, 5, 6, 7, 5, 4, 7, 4, 6, 7]

Sample Output: 1

Q.No.7:

Write a C++ program that creates two arrays of 10 integers, takes input from user, then program should create a 3rd array of size 10 integers. 3rd array should have top 10 biggest integers from both arrays.

Sample Input: [1, 2, 3, 4, 5, 6, 6, 7, 8, 9], [4, 5, 6, 7, 8, 9, 10, 11, 12, 13]
Sample Output: [13, 12, 11, 10, 9, 9, 8, 8, 7, 7]

Q.No.8:

Write a C++ program that creates two arrays of 20 integers, takes input from user, then program should create 2 arrays(named 'even' and 'odd') each of size 20 integers. 'even' array should have all even integers from 1st array and 'odd' array should have all odd integers from 1st array.

Sample Input: [1, 2, 3, 4, 5, 6, 6, 7, 8, 9, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]
Sample Output: even = [2, 4, 6, 6, 8, 8, 4, 6, 8, 10, 12]
odd = [1, 3, 5, 7, 9, 5, 7, 9, 11, 13]

Q.No.9:

Write a C++ program that will take one input string from user without space. Then your program should remove the Vowel character from the string and print it out.

Sample Input:
HellowWorld

Output:
HllwWrld

Q.No.10:

Write a C++ program that will take one input string from user without space. Then your program should remove the Vowel character from the string and print it out.

Sample Input:
HellowWorld

Output:
HllwWrld

Q.No.11:

Write a C++ program to find value **a value** in 2D array and replace it with value = 5. Create Array of size 3 by 3 and take values from user as input. If value is not found then should be proper error handling.

Q.No.12:

Write a C++ program to take transpose of the matrix (2D array of size 4 by 4).

Sample Input: (Value Taken from User then Display Like This)

1 2 2 2
1 2 4 5
1 2 5 3
7 2 3 4

Sample Output:

1 1 1 7
2 2 2 2
2 4 5 3
2 5 3 4

Q.No.13:

Consider the following code:

```
#include<iostream>
using namespace std;

void most_occurred_number(int nums[], int size)
{
  int max_count = 0;
  cout << "\nMost occurred number: ";
  for (int i=0; i<size; i++)
  {
   int count=1;
   for (int j=i+1;j<size;j++)
       if (nums[i]==nums[j])
           count++;
   if (count>max_count)
      max_count = count;
  }

  for (int i=0;i<size;i++)
  {
   int count=1;
   for (int j=i+1;j<size;j++)
       if (nums[i]==nums[j])
           count++;
   if (count==max_count)
       cout << nums[i] << endl;
  }
 }

int main()
{
    int nums[] = {4, 5, 9, 12, 9, 22, 45, 7};
    int n = sizeof(nums)/sizeof(nums[0]);
    cout << "Original array: ";
    for (int i=0; i < n; i++)
    cout << nums[i] <<" ";
    most_occurred_number(nums, n);
}
```

```
Original array: 4 5 9 12 9 22 45 7
Most occurred number: 9
```

Consider the program of figuring out most occurring number using 1-D Arrays.

In this task you only need to Replace 1-D Arrays with 2-D Arrays. And produce the same output.

Q.No.14: (void function)

Write a computer program in C++ and that calculate the area of Rectangular, Circle, Square.

You need to implement these three functions and have a menu to show user to select which he/she need to calculate, after taking input call the selected function.

Note:

Only function calls should be present in main function, logic should be implemented in these custom-built functions. All inputs of related to logic except selection menu input should also implement in concerned functions.

Q.No.15: (Functions with parameters)

Write a computer program in C++ and implement **void cube(int) & void compare(int, int)** function**.** In this program you need to take two numbers from user and then you need to call cube functions for each number to show cube of number. After this you need to call compare function to check whether these numbers are equal OR not.

Note:

Only function calls should be present in main function, logic should be implemented in these functions.

Q.No.16:

Write a computer program that has a palindrome-check function ('bool' type) which checks if a given(passed as parameter) string is a palindrome or not. Remember that you are not allowed to make a second array in the process.

Sample Input in array-1: "sobarabos"

Sample Returned Value: True

Q.No.17:

Write a C++ program that create a function which takes a character array as parameter and tells how many words are present in the array.

Q.No.18:

Write a C++ program that create a function which takes a string as parameter and returns the starting index of largest length word in the string.

Sample String passed: koi nahi bachega yahan

Returned index: 9

Q.No.19:

Write a program which has a function that is passed starting term of this series and the function returns the nth term of the series with rules similar to this one:

1, 4, 10, 22, 46, 94, 190 . . .

Int ser_term(int start, int n)

Sample input: start = 2, n = 5

Sample value returned: 62

Q.No.20:

Write a program which has function named update. This function prototype is as follows:

void update(int a, int b)

This function updates the value of a with b. Function returns nothing

Q.No.21:

Write a program which has function named mode. This function takes a string as input returns the most frequently occurring character:

Sample string: [1, 2, 6, 1, 6, 5, 8, 0, 3, 8, 2, 7, 4, 6, 1]

Returned character: 6

Q.No.22:

Write a computer program that has a function to read a piece of text from a text file (which is placed in a folder in current working directory) and store it in a string variable. The function takes the name of file as argument and returns the string.

Also write a function which stores the array back to the text file.

Q.No.23:

You are to write a program that uses functions made in program-1, program-2 and program-3 to encode/encrypt a message in text file using the key and later reconstruct the original text using the key again.

In this task, you are to provide a flow from reading file to adding key, to calculating secure message, to writing secure message to file. Then finally read the file to get the secure message from the file and lastly use the key to restore the original text.

Q.No.24:

You are to write a program that makes an array, and finds how many elements don't follow the sorted order i.e., find the inversion.

5	**0**	**1**	**2**	**4**	**3**	**9**	**8**	**6**	**7**

Unsorted_order(inversion) = 5 (5) + 0(0) +1(0) + 2(0) + 4(1) + 3(0) + 9(3) + 8(2) + 6(0) + 7(0)

= 5 + 0 + 0 + 0 + 1 + 0 + 3 + 2 + 0 + 0 = 11

Q.No.25:

Write a computer program that makes a function which takes two matrices as arguments and return their pointwise multiplication answer.

Q.No.26:

Write a computer program that makes a function which takes two matrices as arguments and return their matrix multiplication answer.

Q.No.27:

Write a computer program that makes a function which takes a matrix as arguments and performs a summation over all of its elements and returns the sum.

Q.No.28:

Write a computer program that makes a function which takes a matrix as arguments and performs a summation over all columns and calculate the product of these sums, finally returns the answer.

Q.No.29:

Write a computer program that makes a function which takes a matrix as arguments and performs a summation over all rows and calculate the product of these sums, finally returns the answer.

Q.No.30:

Write a computer program that concatenates to Matrices as shown in example below. Exhibit this on console by displaying the output:

9	8	7
6	5	4
3	2	1

+

1	2	3
4	5	6
9	7	8

=

9	8	7	1	2	3
6	5	4	4	5	6
3	2	1	9	7	8

Q.No.31:

Write a computer program that takes a 2D matrix as input from the user and write it into a text file.

Q.No.32:

Write a computer program that facilitates a teacher to enter the marks of students and write them in a text file.

The program first asks the teacher if he wants to enter the marks of a student then press 'Y' else if teacher wants to save the data, he may press 's',

if teacher pressed 'Y',

a - teacher is asked for student roll_no (int type),

b - Once the roll_no is entered, teachers is asked to enter the student_age(int type).

c - Once the student_age is entered, teacher is asked to enter the marks in Quiz-1, Quiz-2, Quiz-3 (all int types) one after the other.

Till now, one student record is entered completely.

Now system asks the teacher if he wants to enter the marks of another student,

if teacher pressed 'Y', steps 'a', 'b', 'c' are repeated.

This way the cycle continues. A teacher can enter marks of maximum of 10 students. Data is saved in a 2D array (matrix) in such manner:

Also, name of each student is also to be entered in the system and saved to the file, makes up a mechanism to perform that as well.

21-9999	20	14	29
21-9998	21	13	30
21-9997	22	18	31
21-9996	23	17	35
21-9995	24	16	39
21-9994	25	15	22
21-9993	26	12	25
21-9992	27	14	27

if user presses 's', data is saved to file.

Problem-13: sentinel menu to ask choices from the teacher.

Problem-14: Roll number entries in roll number array.

Problem-15: Storing the data of the Quizzes

Problem-16: Display the data on screen in table for as shown above.

Problem-17: Store the integer data and string data to file.

Problem-18: Loading data from the text file.

Q.No.33: File Handling

Write a computer program that takes a 2D matrix(4x4) from a text file prints the sum of all entries of principle diagonal.

Q.No.34:

Write a computer program that takes a 2D matrix(3x3) from a text file prints if the matrix is singular or not.

Hint: calculate determinant of the matrix

Q.No.35:

Write a computer program that has a character-shift function which takes a string from a text file, and a key value as arguments and performs key-many circular shifting(in forward direction) character-wise on each character of the string.

String from File: "sobarabos"

Key: 5

Shifted String: "xtgfwfgtx" (Write this to file)

Hint: 's' + 5 = 'x'

Note: Make maximum usage of string built-in functions, you will be evaluated only for this.

Q.No.36:

You are to write a program that reads a paragraph from text file named "para.txt". Program does as follows:

- Displaying number of spaces in text
- Displaying number of words with length > 4
- Reverse the order of words in string and put it in new string variable

Sample Text in file: "This is a sample piece of text that means nothing."

Corresponding Output:

- Spaces: 9
- Big Words: 4
- "nothing means that text of piece sample a is This."

Note: Make maximum usage of string built-in functions, you will be evaluated only for this.

Q.No.37:

Write two functions having the same name Add and both take two parameters. When called from main, they will print "I have been called n times" where n is the number of calls, they have received from main, and will return the sum of arguments passed.

Note: Keep taking input until the user enters -1.

Example

Output: Add(12,12);
Sum = 24, I have been called 1 time
Add(45,1254);
Sum = 1299, I have been called 2 times
Add(45.89,12.45);
Sum = 58.34, I have been called 1 time
Add(1,15);
Sum = 16, I have been called 3 times

(This was dummy output; you are supposed to take input from the user and add them until the user enters -1)

Q.No.38:

Given an array A of length N should be greater than 0 and less than 100, your task is to find the element which repeats in A maximum number of times as well as the corresponding count. In the case of ties, choose the smaller element first. Details of the input are below:

1. Function for input Array for every test case

2. Function to find count and max

Input :

The first line of input contains an integer T, denoting the number of test cases. Then follows a description of T cases. Each case begins with a single integer N, the length of A. Then following N space-separated integers in next line.

Example

Input:

2//test case

5//size of first test case

1 2 3 2 5 //first array

6

1 2 2 1 1 2

Output:

2 2

1 3

Note:

Don't get confuse with multiple test cases, you just need to repeat the working in same array for each test case.

Q.No.39:

Write a program that uses a two-dimensional array to store the highest and lowest temperatures for each month of the year. The program should output the average high, average low, and the highest and lowest temperatures for the year. Your program must consist of the following functions

1. Function getData: This function reads and stores data in the two-dimensional array
2. Function avg_High: This function calculates and returns the average high temperature for the year
3. Function avg_Low: This function calculates and returns the average low temperature for the year
4. Function indexHigh_Temp: This function returns the index of the highest high temperature in the array
5. Function indexlow_Temp: This function returns the index of the lowest low temperature in the array

At, last print this info in int main();

Q.No.40:

Tell while defining function with parameter of Two D-array which of the two rows or columns have to be (compulsory) mentioned while defining the function and why, explain?(attach the handwritten snap. Use diagrams if needed)

Void abc(int arr[5][])

Or

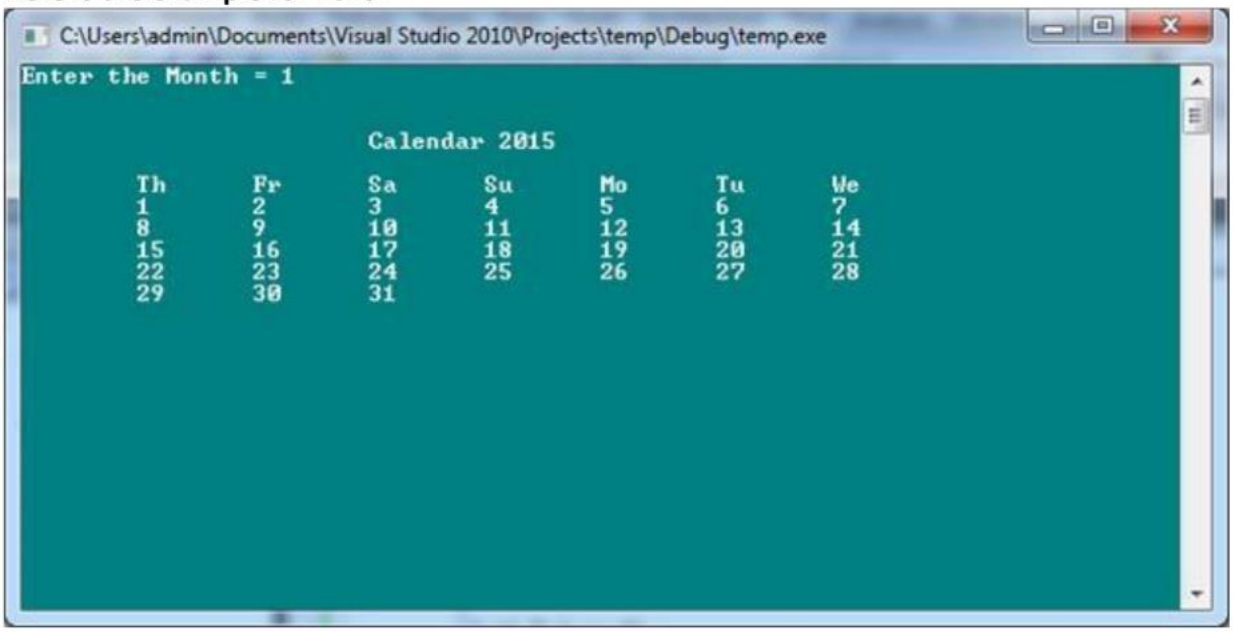
Void abc(int arr[][5])

Q.No.41:

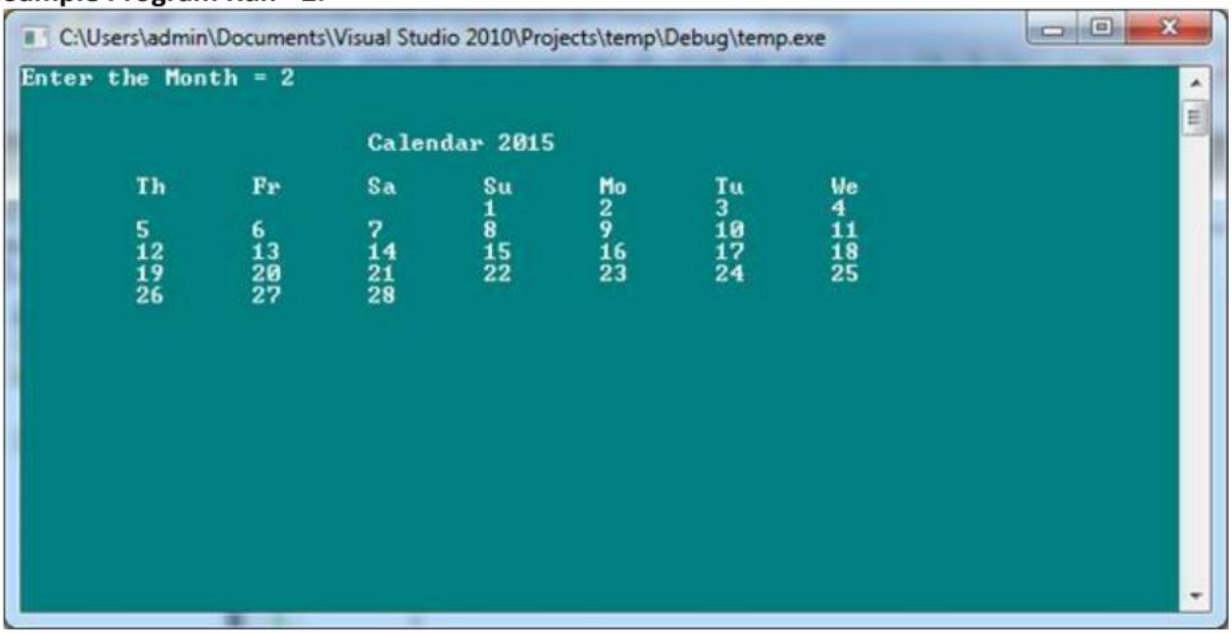
Write a program that will take a Month as input and print the calendar for the month of **2022**. Your input will be 1 for January, 2 for Feb and so on. You have to write a function getDays(month) to get the number of days for this specific month. First month (January) will be start from Friday and it will end on Sunday so next month February will start from Monday.

Hint: It is a very simple program so think simply (for use of % operator, "/t")

Sample Program Run - 1:
Here is the example for 2015.



Sample Program Run - 2:



Q.No.42:

Given an array of N elements. Get an integer K form user such that K<N. Now shift the elements of the array K positions to the right.

```
Input: Array = {1, 3, 5, 4, 9, 8, 2, 6, 7, 10} and K = 4
Output: {2, 6, 7, 10, 1, 3, 5, 4, 9, 8}
```

Q.No.43:

Given a 2-Dimensinoal Array of m*n dimensions. Get two integers R and C from user such that R<m and C<n. Now, Find the largest element in the R^{th} row and the smallest element in the C^{th} column.

For Example: if a 4*4 array is given with R = 3 and C = 3. Then find the largest element in the last row and smallest element in the last column. Note that Rows and Columns start from 0

Q.No.44:

). Take a character 2d array. Input values in them, if character '*' occurs between any two integers then you print out the product of those two. And if character '+' occurs between any two integers then print the sum of those two integers. If the user tries to enter two '*' or '+' right after another, then ask the user to enter the value again, until he/she enters an integer value

Example:

Arr[3][3]

1,2,3,*,* WRONG INPUT TRY AGAIN. 4, 5, *, 6, 7

Arr[3][3]: 1 2 3

* 4 5

* 6 7

Output: Product: 12 30

Sum: 0

Example 2:

Arr[3][3]: 1, 2, *, 3, +,4,1,*,4

Output: Product: 6 4

Sum: 7

Q.No.45:

Write a program that randomly generates a 20 x 20 two-dimensional array, board, of type int.

An element board[i][j] is a peak (either a maximum or a minimum) if all its neighbours (there should be either 3, 5, or 8 neighbours for any cell) are less than board[i][j], or greater than board[i][j]. The program should output all elements in board, with their indices, which are peak. It should also output if a peak is a maximum or a minimum.

e.g. a board of 5 x 5 is shown below and neighbors of a cell are shown.

5	10	2	3	2
7	21	3	7	5
9	8	1	2	3
4	6	8	9	1
5	2	6	3	4

Here the first element at 0,0 is a peak as all its neighbors have value greater than it. All the cells highlighted in yellow are minimum peak and the cells highlighted in green are maximum peaks.

Q.No.46:

Write a program that performs a survey tally on drinks. The program should prompt for the next person's favorite drink until a user opts to exit the survey by pressing 5. Each person participating in the survey should choose their favorite drink from the following list:

1. Coca Cola 2. Dew 3. Mirinda 4. Sprite 5. Exit the survey

Display the choices of drinks as a menu using the most appropriate repetition construct and use switch structure for multiple selection. Before terminating, your program should display the total number of people participated in the survey and number of votes given to each drink. Generate two output files named "surveyResults1.txt" (for part-a outputs) and "surveyResults2.txt" (for part-b outputs). The output files should be generated in append mode such that they contain all the output of previous program runs also.

a. Draw a horizontal histogram chart using "*" to represent the number of votes for each drink as shown in Figure 1 below.

```
No. of people participated in survey: 28
Coca Cola:      7       *******
Dew:            9       *********
Mirinda:        6       ******
Sprite:         6       ******
```

Figure 1: Horizontal Histogram Chart

b. We want to display vertical histogram chart for favorite drink survey as shown in Figure 2 below.

```
Coca Cola       Dew             Mirinda         Sprite
                *
                *
*               *
*               *               *               *
*               *               *               *
*               *               *               *
*               *               *               *
*               *               *               *
*               *               *               *
```

Figure 1: Vertical Histogram Chart

Q.No.47:

Write a program that calculates the trailing zeroes (number of zeros at the end) in the factorial of a given number N.

Sample input:	**Sample output:**
N = 10	Zeroes = 2 (as N! = 3628800)
N = 20	Zeroes = 4 (as N! = 2432902008176640000)

Q.No.48:

Mr. Hamid has recorded scores of 5 students in a file named as marks.txt each on a new line. You are required to compute the average marks of each student. Note that marks for all students may have been recorded for different number of quizzes. Create an output file for this problem.

Sample input file:	**Sample output:**
32 41 16 21	27.5
40 42	41
23 19 15 55 77	37.8
33 66 11	36.66
14 76 23	37.66

HINT: Put any sentinel value at the end of each line (in marks.txt) to determine the end of record for each student.

Q.No.49:

Write a program that performs 'find and replace a character' feature on a text file. That is, your program should prompt the user for the character he/she wishes to be replaced in the given input file (paragraphIn.txt) and generates an output file with the whole text as originally in the input file with replaced character. Your program should also display that which character is being replaced by the original character and the total count of character replacements.

Sample program:

Please enter the character that you want to replace: t
Please enter the new character: T
The output file has been generated successfully.

paragraphIn.txt

This is a sample file text. You can write any text in your input file. The file can contain any number of lines. Your program would read each character at a time. DO NOT USE string data type.

paragraphOut.txt

This is a sample file TexT. You can wriTe any TexT in your inpuT file. The file can conTain any number of lines. Your program would read each characTer aT a Time. DO NOT USE sTring daTa Type.
Original character: t
Replaced with: T
Total number of replacements: 13

Q.No.50:

There are n bikes, and each can cover 100 km when fully fueled. What is the maximum amount of distance you can go using n bikes? You may assume that all bikes are similar, and a bike takes 1 litre to cover 1 km. You have n bikes and using one bike you can only cover 100 km. so if n bikes start from the same point and run simultaneously you can go only 100 km. Let's think a bit differently, trick is when you want to cover the maximum distance, you should always try to waste minimum fuel. Minimum wastage of fuel means to run a minimum number of bikes. Instead of the

parallel running of n bikes, you can think of serially running them. That means if you transfer some amount of fuel from the last bike to other bikes and throw the last bike i.e., don't run the last bike after a certain point. But the question is, after what distance the fuel transfer must be done so that the maximum distance is covered, and the fuel tank of the remaining bikes do not overflow.

Let us take the following base cases and then generalize the solution.

- **Base Case 1:** There is one bike: This is simple, we can cover 100 km only.
- **Base Case 2:** There are two bikes: What is the maximum distance we can cover when there are 2 bikes? To maximize the distance, we must drop the second bike at some point and transfer its fuel to the first bike. Let us do the transfer after x km.

Total distance covered = Distance covered by 100 ltr in first bike + Distance covered by fuel transferred from the first bike.

The remaining fuel in the second bike is 100 – x. If we transfer this much fuel to the first bike, then the total distance would become 100 + 100 – x which is 200 – x. So, our task is to maximize 200-x. The constraint is, 100 – x must be less than or equal to the space created in the first bike after x km, i.e., 100 – x <= x. The value of 200 - x becomes maximum when x is minimum. The minimum possible value of x is 50. So, we can travel 150 km.

- **Base Case 3:** There are three bikes: Let the first transfer is done after x km.

After x distance, all bikes contain the 100 - x amount of fuel. If we take 100 - x amount of fuel from 3rd bike and distribute it among 1st and 2nd bike so that fuel tanks of 1st and 2nd bikes get full. So 100-x <= 2*x; or, x=33.333 so we should transfer the remaining fuel of the third bike and distribute that amount of fuel among the 1st and 2nd bike after exactly 33.33 km. Let us generalize it. If we take a closer look at the above cases, we can observe that if there are n bikes, then the first transfer is done (or a bike is dropped) after 100/n km. To generalize it more, when we have x litre remaining fuel in every bike and n remaining bikes, we drop a bike after x/n km.

Your program must have the following functions

- Input function for taking input (input is number of bikes, and amount of fuel (let's say 100 initially))
- Output function (display the max distance covered)
- Double MaxDistance(int &n, int fuel)

Example Output:
The maximum distance possible with 5 bikes is 1141.666667.