	INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Programming in C and C++ (CSC-101)	

Assignment 5 60 marks

Note : (No function / matrix/ array are allowed to be used)

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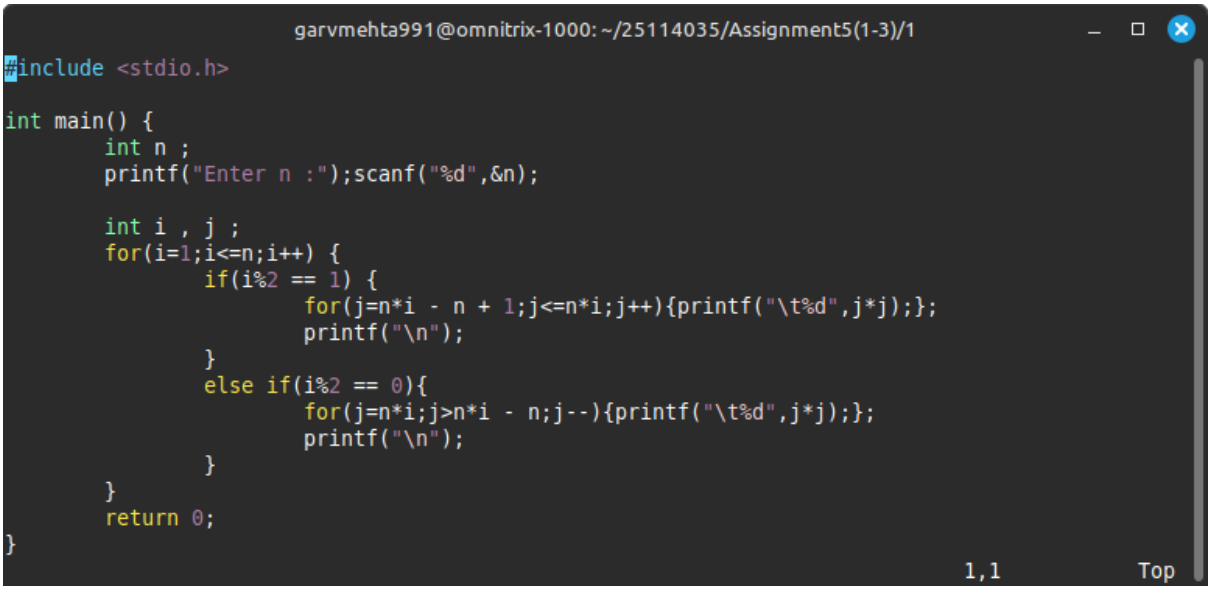
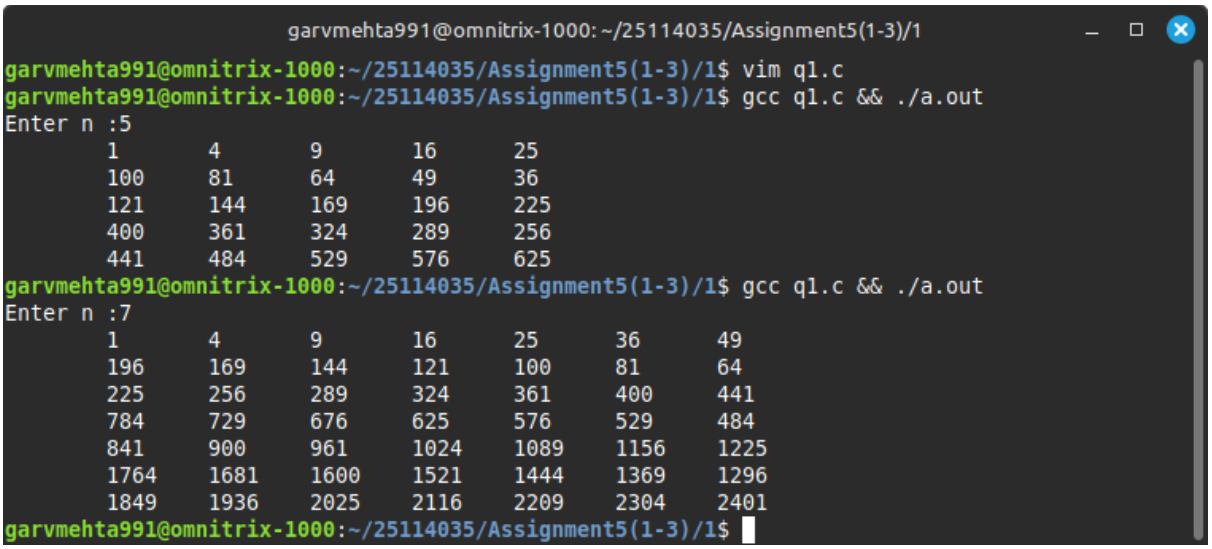
Q-1) Print the square of numbers in a zigzag pattern, where even-numbered rows go left to right and odd-numbered rows go right to left. User gives the value of N which is the number of rows and columns

```
Enter n: 5
    1    4    9   16   25
  100   81   64   49   36
  121  144  169  196  225
  400  361  324  289  256
  441  484  529  576  625
```





Q-2) Write a C program to print a hollow pyramid with its reflection below. The program should take an integer n as input, representing the height of the pyramid. The output should look like this:

Input: n = 5

Output

```
Enter the height of the pyramid: 5
    *
   * *
  *   *
 *     *
*********
 *     *
  *   *
   * *
    *
```

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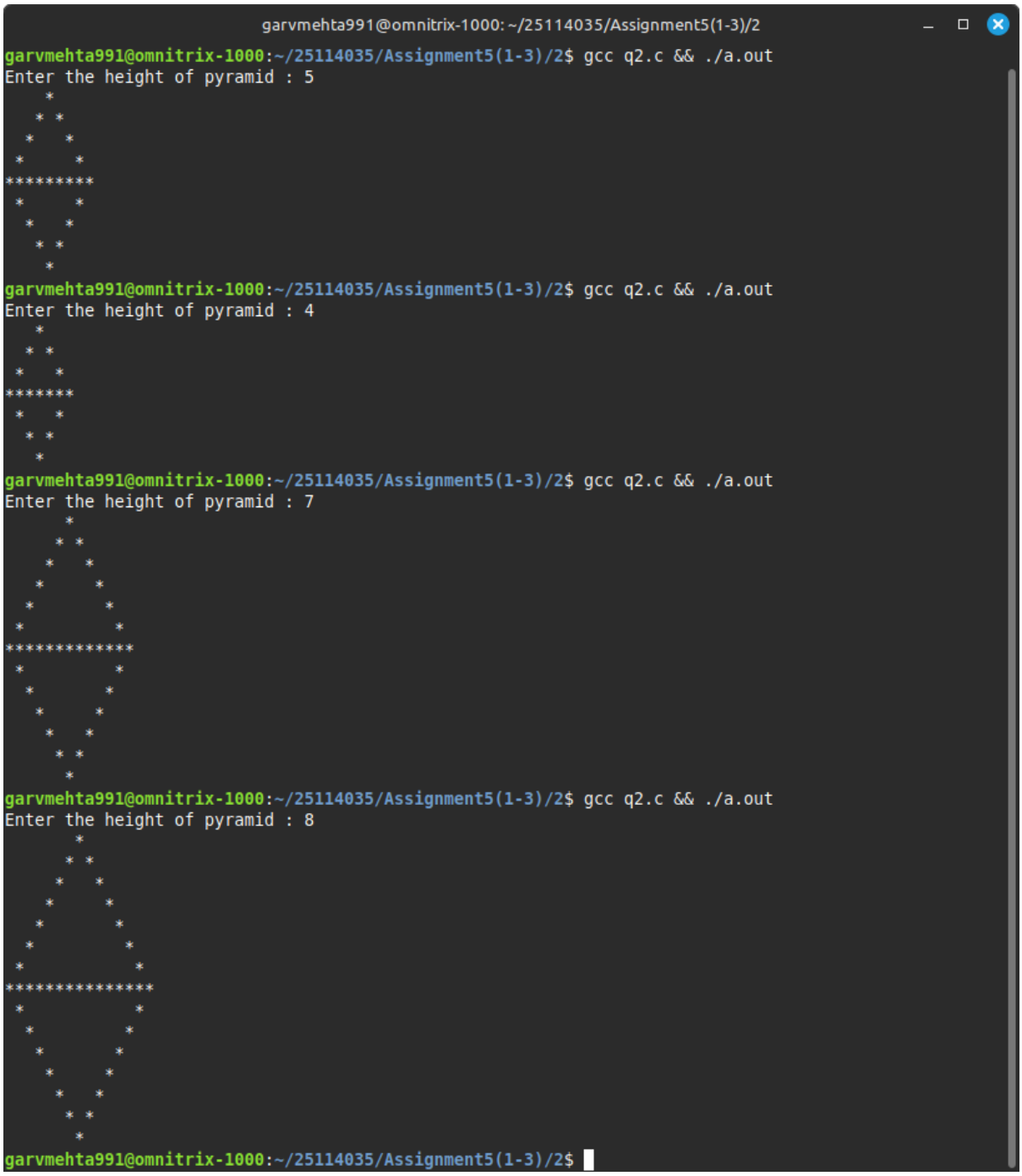
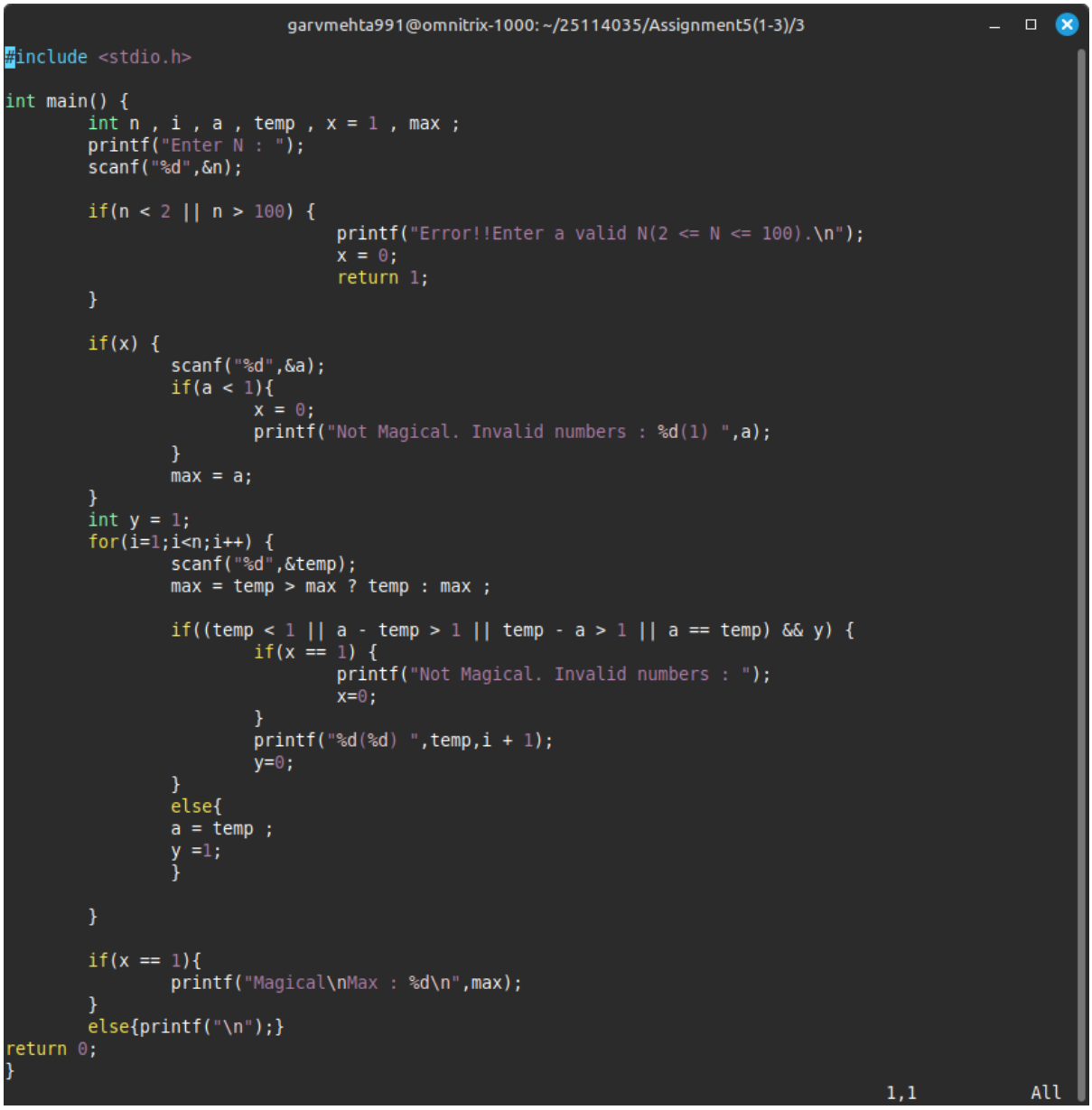
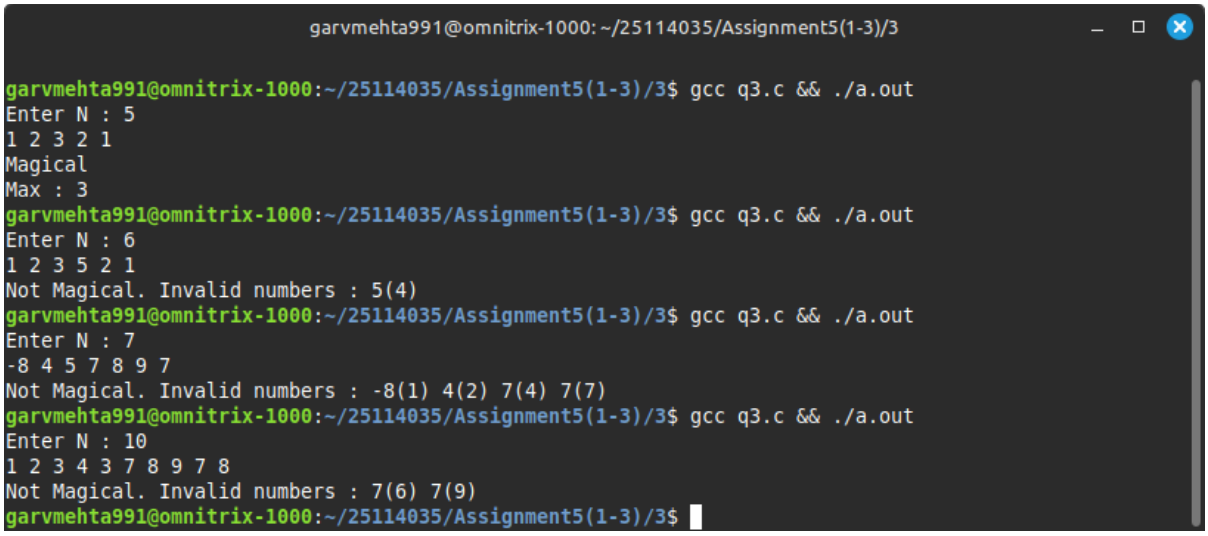
```c
#include <stdio.h>

int main() {
        int n;
        printf("Enter the height of pyramid : ");scanf("%d",&n);

        int i , j;
        for(i=1;i<2*n - 1;i++) {
                if(i%2 == 0){
                        printf("\n");
                }
                else if(i%2 == 1) {
                        for(j=n - (i+1)/2;j>0;j--){
                                printf(" ");
                        }
                        printf("*");
                        for(j=i-2;i>1 && j>0;j--){
                                printf(" ");
                        }
                        if(i>1){
                                printf("*");
                        }
                }
        }


        for(i=2*n - 1;i>0;i--){
                printf("*");
        }

        printf("\n");
        for(i=2*n - 3;i>0;i--) {
                if(i%2 == 0){
                        printf("\n");
                }
                else if(i%2 == 1) {
                        for(j=n - (i+1)/2;j>0;j--){
                                printf(" ");
                        }
                        printf("*");
                        for(j=i-2;i>1 && j>0;j--){
                                printf(" ");
                        }
                        if(i>1){
                                printf("*");
                        }
                }
        }
printf("\n");

        return 0;
}
```


garvmehta991@omnitrix-1000: ~/25114035/Assignment5(1-3)/2
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/2$ gcc q2.c && ./a.out
Enter the height of pyramid : 5
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/2$ gcc q2.c && ./a.out
Enter the height of pyramid : 4
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/2$ gcc q2.c && ./a.out
Enter the height of pyramid : 7
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/2$ gcc q2.c && ./a.out
Enter the height of pyramid : 8
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/2$

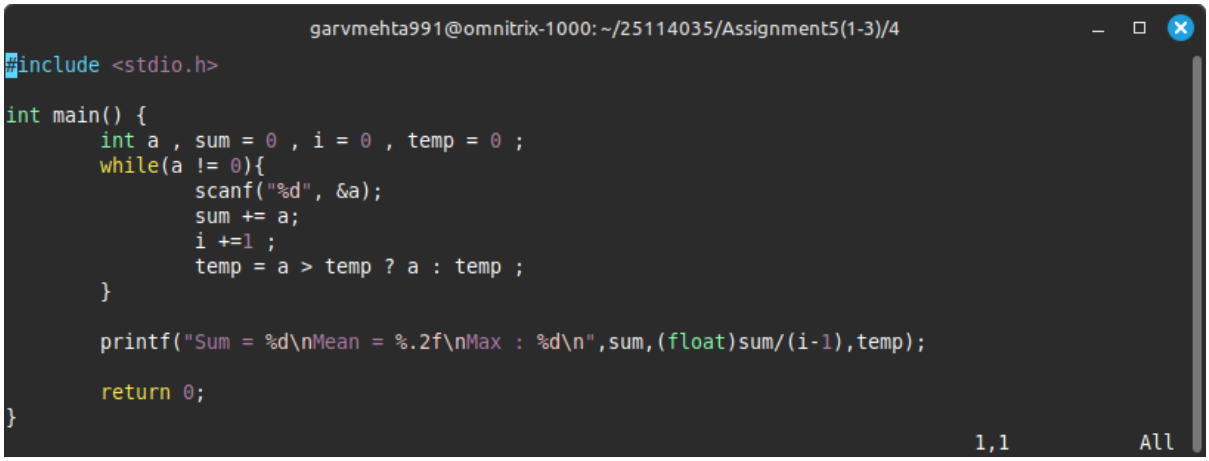
Q-3)A sequence of integers is called “magical” if the absolute difference between every pair of consecutive numbers is exactly 1, and none of the numbers in the sequence is less than 1. Your task is to write a program that first accepts an integer N representing the length of the sequence (where 2 ≤ N ≤ 100), then reads N integers that form the sequence. The program should determine whether the sequence is magical according to the rules described. If the sequence is magical, it should print the maximum number found in the sequence. If the sequence is not magical, the program should identify and print all the numbers that violate the magical conditions.

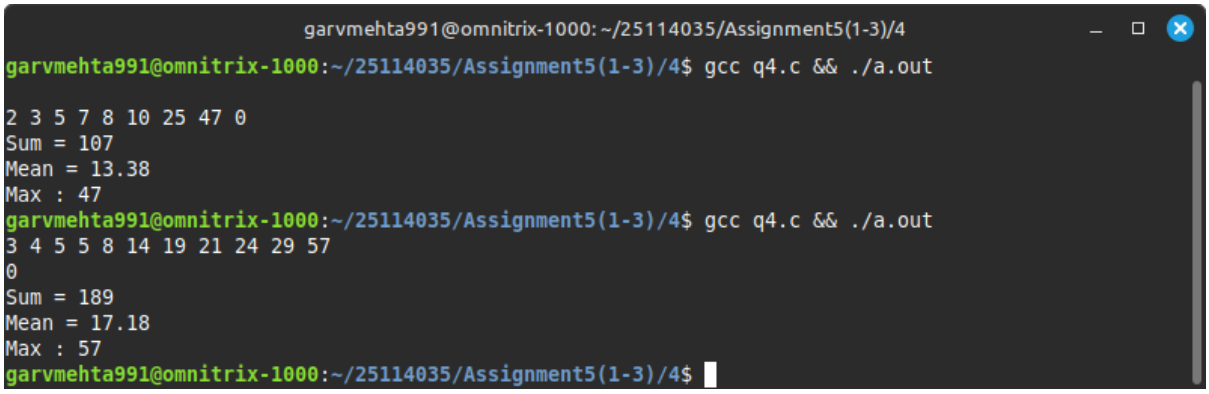
For example, given the input sequence 1 2 3 2 1, the output should indicate the sequence is magical and print the maximum number, 3. For the input sequence 1 2 3 5 2 1, the output should indicate the sequence is not magical and print the number 5 that breaks the sequence.




garvmehta991@omnitrix-1000: ~/25114035/Assignment5(1-3)/3
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/3$ gcc q3.c && ./a.out
Enter N : 5
1 2 3 2 1
Magical
Max : 3
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/3$ gcc q3.c && ./a.out
Enter N : 6
1 2 3 5 2 1
Not Magical. Invalid numbers : 5(4)
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/3$ gcc q3.c && ./a.out
Enter N : 7
-8 4 5 7 8 9 7
Not Magical. Invalid numbers : -8(1) 4(2) 7(4) 7(7)
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/3$ gcc q3.c && ./a.out
Enter N : 10
1 2 3 4 3 7 8 9 7 8
Not Magical. Invalid numbers : 7(6) 7(9)
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/3$

Q-4)Write a C program to calculate mean, median, sum, and maximum of integers entered by the user. The user continues to enter the numbers in ascending order and when it wants to stop it presses “0”. You are not allowed to use arrays or functions other than main.





Q-5)Write a C program that first reads two integers: the number of elements n and the spacing integer k. Then, it reads n integers one by one from the user. Your program should calculate the maximum sum of a non-empty subsequence of the given integers such that any two selected numbers in the subsequence are at least k indices apart in the original sequence.

You are not allowed to use arrays or functions other than main. The program should use only a single for loop and primitive variables to compute the answer efficiently.

Input:

n=4 k=2

3 2 7 10

Maximum sum = 13

In the example above, the sequence is [3, 2, 7, 10] and spacing k = 2. Valid subsequences where every chosen pair of elements are at least 2 indices apart include {3,7}, {3,10}, and {2,10}. Among these, {3,10} gives the maximum sum 13.

Q-6). Write a C program to print Pascal's Triangle up to n rows. Pascal's Triangle is a triangular array where each number is the sum of the two numbers directly above it.

The first few rows of Pascal's Triangle look like this:

Output

```
Enter number of rows: 7
                1
              1   1
            1   2   1
          1   3   3   1
        1   4   6   4   1
      1   5  10  10   5   1
    1   6  15  20  15   6   1
```

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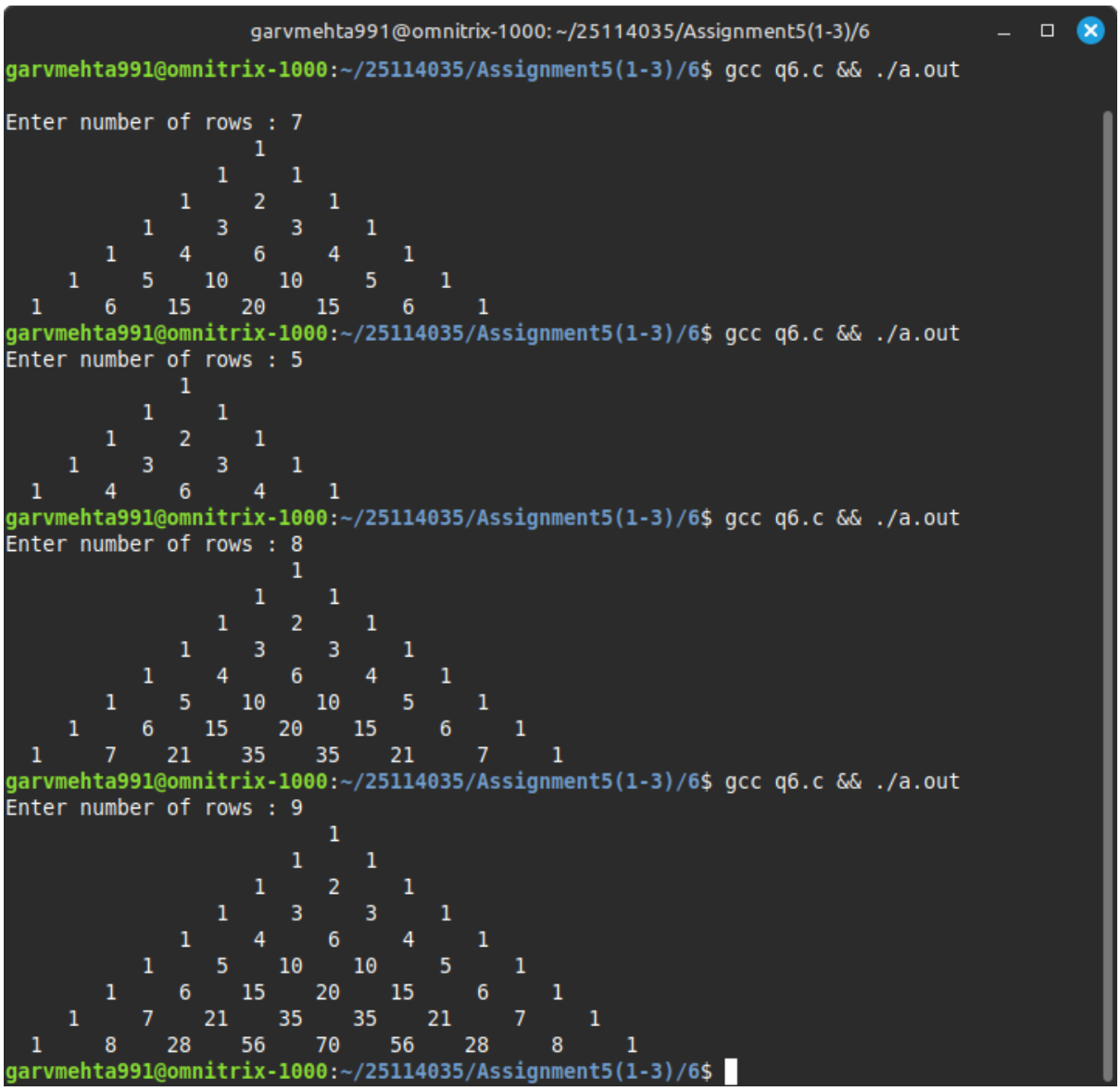
```c
#include <stdio.h>

int main() {
        int n ;
        printf("Enter number of rows : ");
        scanf("%d",&n);

        int i ;

        for(i=1 ;i<=n;i++) {
                int j;
                for(j=3*(n-i);j>0;j--){printf(" ");}
                if(i != 1){printf("%3d   ",1);}
                for(j=2;j<i;j++){
                        int a = 1 , b = 1 , k , d = i-1 , e = 1 ;
                        for(k=j-1;k>0;k--){
                                a*=d;
                                d--;
                                b*=e;
                                e++;
                        }
                        printf("%3d   ",a/b);
                }
                printf("%3d\n",1);
        }
                return 0;
}
```

1,1 All


garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/6
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/6$ gcc q6.c && ./a.out
Enter number of rows : 7
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/6$ gcc q6.c && ./a.out
Enter number of rows : 5
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/6$ gcc q6.c && ./a.out
Enter number of rows : 8
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/6$ gcc q6.c && ./a.out
Enter number of rows : 9
1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1
1 8 28 56 70 56 28 8 1
garvmehta991@omnitrix-1000:~/25114035/Assignment5(1-3)/6$