Indian Institute of Technology, Kharagpur

CS19001 Programming and Data Structures Laboratory, Autumn 2019

Assignment for Week 3 (August 19, 2019)

Total Marks: 40 **Submission Deadline:** 17:45

INSTRUCTIONS

1. Submit a separate C file for each of the problems. The solution for problem i should be named **[rollno]-prob$i$.c** where '[rollno]' is your roll number.
2. You are not allowed to use arrays for any of the problems.
3. You may consult your notes, books or manual pages.

PROBLEMS

1. Write a C function that takes as input two non-negative integers and returns their *greatest common divisor* (gcd). Described below is Euclid's algorithm used to compute gcd.

   function Euclid(a, b)
   if $a = 0$, return b
   if $b = 0$, return a
   while $b \neq 0$, do
   $r \leftarrow a$ rem b
   $a \leftarrow b$
   $b \leftarrow r$
   return a

   Here, a, b, r are integers and a rem b denotes the remainder obtained when a is divided by b. In the `main()` function, input two integers, check whether they are non-negative. If so, use the function to compute gcd and print the result.

   Sample Input/Output

   - `Enter two non-negative integers: -55 35`
     `Invald input. Enter non-negative integers only.`
   - `Enter two non-negative integers: 10 0`
     `GCD(10,0) is 10`
   - `Enter two non-negative integers: 646 1020`
     `GCD(646,1020) is 34`

   Marks: 16

2. Let $S = \{P_1, P_2, \ldots, P_n\}$ be a set of people. A *giant* is one who is simultaneously the tallest and heaviest among the people in S, that is, $P_i \in S$ is a giant if $height(P_i) >= height(P_j)$ and $weight(P_i) >= weight(P_j)$ for all $j \in \{1, \ldots, n\}, j \neq i$. Write a program that enters a loop and in each iteration inputs the height and weight of a new person; checks if (s)he is a giant; if so, records the corresponding height and weight; and prints the current giant (if any). Assume all heights and weights are non-negative floating point numbers. The program terminates when a negative height or weight is entered.

Sample Input/Output

```
Enter the height and weight of a new person: 4.5 50
Giant is person 1 with height = 4.5 and weight = 50.

Enter the height and weight of a new person: 5.8 90
Giant is person 2 with height = 5.8 and weight = 90.

Enter the height and weight of a new person: 5.6 81
Giant is person 2 with height = 5.8 and weight = 90.

Enter the height and weight of a new person: 5.7 100
There is no giant.

Enter the height and weight of a new person: 6 102
Giant is person 5 with height = 6 and weight = 102.

Enter the height and weight of a new person: -1 -1
Bye.
```

Marks: 16

3. Write a program that inputs an odd positive integer n and prints an X-shaped pattern of * (star) symbols spanning n lines (see examples below).

Sample Input/Output

- ```
  Enter an odd positive integer: 8
  Please enter odd positive integers only.
  ```
- ```
  Enter an odd positive integer: -9
  Please enter odd positive integers only.
  ```
- ```
  Enter an odd positive integer: 9

  *       *
   *     *
    *   *
     * *
      *
     * *
    *   *
   *     *
  *       *
  ```
- ```
  Enter an odd positive integer: 5

  *   *
   * *
    *
   * *
  *   *
  ```

Marks: 8