COL100 Assignment 9
2^{nd} Semester Semester : 2021-2022

Deadline: 11:59 pm, 5 June, 2022

General Instructions

You should attempt this assignment without taking help from your peers or referring to online resources except for documentation (we will perform a **plagiarism check** amongst all submissions). Any violation of above will be considered a breach of the honor code, and the consequences would range from **zero marks** in the assignment to a **disciplinary committee action**.

Submission Instructions

1. **If you are solving the i^{th} question, code in a file named `<EntryNo>-qi.c`.** For eg. solution code for the 2^{nd} question goes inside a file named `2021MCS2168-q2.c` , **Please ensure this point, otherwise 0 will be given.**
2. You must submit the lab question mentioned in the assignement as "In Lab Component". The question evaluation for a lab will be done in the lab only and evaluations not done for the in-lab component for a student in his/her lab slot will be marked 0. It is your duty to get them evaluated.
3. **Submit your code in a `.zip` file named in the format `<EntryNo>.zip`. Make sure that when we run unzip `<EntryNo>.zip`, a folder `<EntryNo>` should be produced in the current working directory.** For eg. if your entry number is `2021CS5XXXX`, then your zip file would be `2021CS5XXXX.zip` and upon unzipping, it should produce a folder `2021CS5XXXX` containing files `<EntryNo>-q1.c`, `<EntryNo>-q2.c`, `<EntryNo>-q3.c` and so on. We have provided a zip that contain the skeleton code with this directory structure and similar naming convention.**Please ensure this point, otherwise 0 will be given.**
4. Your submissions will be **auto-graded**. Make sure that your code follows the specifications (including directory structure, input/output, importing libraries, submission `.zip` file) of the assignment precisely.
5. You have to write all your code in C only

Some Clarifications

1. Every problem description is followed by some examples showing how exactly input and output is being expected. Please refer to them for more clarity. **Please ensure this point is followed otherwise 0 will be given.**
2. If you still have any more doubts, feel free to shoot them at Piazza.
3. You can use array to store the data in the questions.
4. Write your code only in skeleton code provided.
5. Do not change function names, argument order, and input-output statements , etc already in the skeleton code.
6. Do not comment the main function. Just implement the function.
7. Do not include anything except "stdio.h" and "conio.h".

1 Setting Up The Great C (5 marks) (In-Lab Component)

According to a famous saying - Give me six hours to chop down a tree and I will spend the first four sharpening the axe.
So **yours first task is to download and install C compiler and setting up the path variable.** You can consult these websites regarding same

1. https://www.scaler.com/topics/c/c-compiler-for-windows/
2. https://www.scaler.com/topics/c/how-to-compile-c-program-in-linux/
3. https://www.scaler.com/topics/c/c-compiler-for-mac/
4. https://www.geeksforgeeks.org/installing-mingw-tools-for-c-c-and-changing-environment-variable
5. https://www.rose-hulman.edu/class/csse/resources/MinGW/installation.htm
6. https://www.geeksforgeeks.org/setting-c-development-environment/

Some important background information and definitions:

1. GNU is an extensive collection of free software which can be used as an operating system or can be used in parts with other operating systems.
2. The GNU Compiler Collection, commonly known as GCC, is a set of compilers and development tools available for Linux, Windows, various BSDs, and a wide assortment of other operating systems. It includes support primarily for C and C++ and includes Objective-C, Ada, Go, Fortran, and D.
3. MinGW stands for "Minimalist GNU for Windows" It is essentially a tool set that includes some GNU software, including a port of GCC. In summary, MinGW contains GCC which is in the collection of GNU free software.
4. We recommend you to right click on every option in minGW installation manager and mark it for installation - if you do not know, what they do.
5. You can also download IDE of yours choice with or without C compiler. But make sure to follow instruction and not use IDE for compiling and running the program.
6. A funny and easy way to install C compiler on Windows is using Chocolatey Package Manager. Consult these videos regarding same -
   (a) https://www.youtube.com/watch?v=t6YQ8MousWo
   (b) https://www.youtube.com/watch?v=OEIyk80XuDU

Yours Second task is to write a C program which is equivalent to python program given below.

```
a = 200
b = 100
print(a*b if b else 0)
```

Yours Third task is to Compile and run the above C program, you have made, using command prompt/ bash terminal, or any other terminal. Do not use IDE for running the program. Make sure to get the same answer as you may get in python.

2 Clock (10 marks)

You have a wall clock which shows time in the format XX:YY, here XX denotes the hours and YY denotes the Minutes. You have to calculate the angle between the hour hand and minute hand of the wall clock.

As there will be 2 angles the small and large between both hands, such that large + small = 360. You have to return the **smaller** one as a result. The time given to you is in 24 hrs format, you have to convert it into 12hrs format then find the angle.

For example If time is 00:30 then the time in 12 hrs format will be 12:30 and the angle between hour hand and minute hand is 165 degrees.

We have provided a skeleton code which takes input from standard input and calls the **function** `time_angle()` and prints the returned output which you have to return from function `time_angle()`. You have to write your code, in function `time_angle()` only and **return your output.** You cannot print anything in function.

Input: The first line of input will contain value of XX as an integer. The second line of input will contain value of YY as an integer type.

Return Output : Only return the float value as asked in the question. Result should be positive only.

Some important points to note:

1. You have to write your code in C
2. In this question, we will be checking ONLY your Output, so make sure to return the correct format. Any output format mismatch will result in 0.
3. Follow skeleton code, otherwise you can loose marks. You can make your own functions which can be called from function `time_angle()`
4. We will be converting your float output to int with the help of typecasting
5. Do not consider sign while calculating angle i.e. do not consider direction while calculating angle.

Input Constraints: All valid 24hrs format from 00:00 to 23:59.

Example 1:
`INPUT`:

```
06
00
```

`OUTPUT`: 180

Example 2:
`INPUT`:

```
12
20
```

`OUTPUT`: 110
`EXPLANATION`:

If we assume the 12 on the clock as the reference point i.e. it is considered to be at 0 degrees .The minute hand is at 20 minutes which corresponds to an angle of 120 degrees and the hour hand will be at 10 degrees w.r.t. the reference point. So the angle difference between the minute and the hour hand will be 120-10 = 110

3 Food Delivery (15 marks)

Mr John, works as a full time food delivery partner at Zomato. Currently he is at location with coordinates as $(0, 0)$ and wants to take food from a restaurant which is at coordinate (x, y). After that he wants to deliver that food to the coordinate (m, n).

We assume that $0 < x < m$ and $0 < y < n$.

If Mr John is currently at the location (a, b) then he can move to the location $(a + 1, b)$ or $(a, b + 1)$ in one step i.e Mr John either moves one unit distance horizontally or vertically.

To Do: Find the number of distinct paths which Mr John can take to reach (m, n) from $(0, 0)$ via (x, y) in minimum number of steps.

For example if (x,y) is (2,2) and (m,n) is (3,3) then

1. 1^{st} path can be $(0, 0), (0, 1), (0, 2), (1, 2), (2, 2), (2, 3), (3, 3)$
2. 2^{nd} path can be $(0, 0), (0, 1), (0, 2), (1, 2), (2, 2), (3, 2), (3, 3)$
3. 3^{rd} path can be $(0, 0), (1, 0), (1, 1), (1, 2), (2, 2), (3, 2), (3, 3)$
4. so on...

In the above example Mr. John has to pick up food from (x, y) and then deliver to (m, n) after starting from $(0, 0)$.

We have provided a skeleton code which takes input, calls the **function `food()`** and prints the returned output which you will return from function `food()`. You have to only implement the function `food()` and **return your answer without printing anything in the function.**

Input: The first line of input will contain value of x. The second line of input will contain value of y. The third line of input will contain value of m. The fourth line of input will contain value of n. (only integer, follow skeleton code.).

Return Output : Only return the integer as asked in the question. The return type is an integer

Some points to note:

1. You have to write your code in C
2. In this question, we will be checking ONLY your output, so make sure to return correct format. Any output format mismatch will result in 0.
3. Use simple permutation and combination formula to solve this.

Input Constraints: $0 < x < m$ and $0 < y < n$.

Example 1:
`INPUT`:

```
2
2
3
3
```

`OUTPUT`:

```
12
```

Example 2:
`INPUT`:

```
1
1
4
4
```

`OUTPUT`:

```
40
```

4 Birthdays (20 marks)

Mr. Sam was born on XX-YY-ZZZZ which happened to be a Saturday. If he died on AA-BB-CCCC, how many birthdays would he celebrate that fall on a Monday?

Assume, the year which is divisible by 4 are leap years and February has 29 days in a leap year. Also, rest of the calendar months have same days as in original calendar.

For example If Sam was born on 28-05-2022 and died on 28-05-2023 then number of birthdays he would have celebrated that fall on a Monday is 0 .

We have provided a skeleton code which takes input from standard input and calls the **function** `birt()` and prints the returned output which you have to return from function `birt()`. You have to write your code, in function `birt()` only and **return your output.** You cannot print anything in function.

Input:

1. The first line of input will contain value of XX as an integer type.
2. The second line of input will contain value of YY as an integer type.
3. The third line of input will contain value of ZZZZ as an integer type.
4. The fourth line of input will contain value of AA as an integer type.
5. The fifth line of input will contain value of BB as an integer type.
6. The sixth line of input will contain value of CCCC as an integer type.

Return Output : Only return the integer value as asked in the question.

Some important points to note:

1. You have to write your code in C
2. In this question, we will be checking ONLY your Output, so make sure to return the correct format. Any output format mismatch will result in 0.
3. Follow skeleton code, otherwise you can loose marks. You can make your own functions which can be called from function `birt()`
4. Do not include day of birth and day of death in the number of birthdays he would have celebrated on Monday.
5. If birthday falls on 29th Feb then he will celebrate his birthday on 1st March for every non leap year and on 29th Feb for every leap year.

Input Constraints: All valid Date such that date of death comes after the date of birth.

Example 1:
INPUT:

```
28
05
2022
05
05
2030
```

OUTPUT: 1

Example 2:
INPUT:

```
28
05
2020
02
02
2034
```

OUTPUT: 2
EXPLANATION:
We have got 28 May as Monday in the year 2022 and 2033