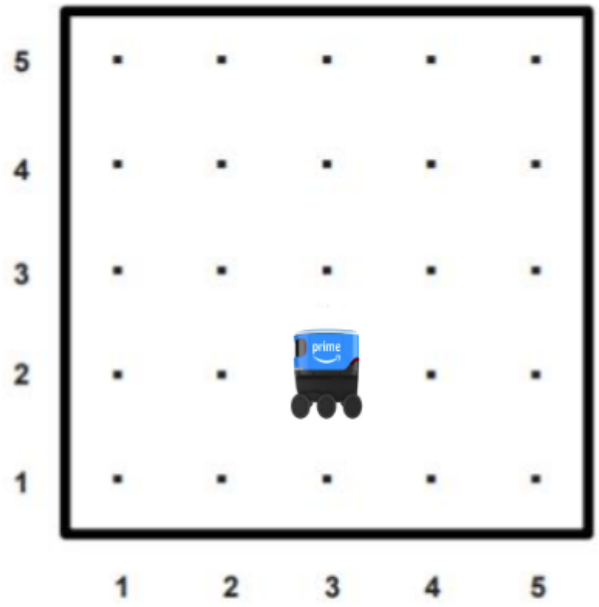
CSE 102 Spring 2024 – Computer Programming Assignment 11

Due on May 22, 2024 at 23:59

Hand in: A student with number 20240000001 should hand in a file named 20240000001.c for this homework and compress it into a .zip file.

Part 1. [20pts] Smart City Navigation

Robot Courier Amazon Scout needs to collect packages to be delivered from various points in the city and deliver them to the dispatch centre as quickly as possible. Suppose Scout picks up a package at the intersection of 2nd Street and 3rd Avenue, as shown in the diagram in the picture, and wants to return to the dispatch centre at the intersection of 1st Street and 1st Avenue. Although the Scout wants to avoid going off the road, there are equally short routes.



For example, in this diagram there are three possible paths as follows:

- First left, then left, then down.
- First left, then down, then left.
- First down, then left, then left.

Given that Scout is only capable of moving west and south (left or down in the diagram) and wants to travel in the most efficient way, you should write **a recursive function** that returns the number

of paths that can be used to return to the dispatch centre from the starting position specified by the user **[Solutions without the recursive function will not be considered!]**

```
int numPathsHome(int street, int avenue)
```

```
Enter the street number: 2
street:2
Enter the avenue number: 3
avenue:3
Number of optimal paths to take back home: 3
```

Part 2. [50pts] Sustainable Health Services

Global health crises require healthcare services to be more accessible and sustainable. The World Health Organization plans to establish health centres that can serve the maximum number of people with a certain budget. In the feasibility studies conducted for this purpose, a list of potential hospital sites was prepared. The cost of setting up each hospital has been calculated and each hospital will be able to provide coverage to some nearby cities. Each potential hospital is shown as a struct as follows:

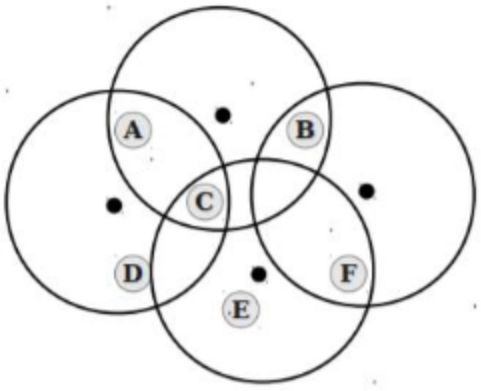
Although it is desirable to provide healthcare to all people, unfortunately there are not enough funds to build an unlimited number of hospitals. **Using a recursion function**, we want to show whether it is possible to provide quality healthcare to every city if a limit is set on the number of hospitals that can be built. **[Solutions without recursion will not be considered!]**

```
struct Hospital
{
        char* name;
        char citiesServed[3];
};
```

Suppose we are given a char array representing the names of all cities. Also provided is a list of all proposed hospital locations, each represented by the set of cities that the hospital can serve. Given funding constraints, a maximum of numHospital total hospitals can be built.

Write a function that accepts as input the set of all cities and the list of cities to be covered by each hospital, and the maximum number of hospitals that can be built, and returns whether it is possible to provide coverage to all cities using a limited number of hospitals. If possible, your function should update the result parameter to include such a selection of hospitals.

As an example, consider the country below, where each city is represented by a letter and each potential hospital location is represented with a black dot:



Here, each hospital is can cover all the cities within their circle of coverage. This would represented as follows:

- **cities = { "A", "B", "C", "D", "E", "F" }**
- **locations = { {"A", "B", "C"}, {"A", "C", "D"}, {"B", "F"}, {"C", "E", "F"} }**

The topmost hospital would serve cities A, B, and C. The hospital on the left would cover A, C, and D. The hospital on the right covers just B and F, and the hospital on the bottom covers C, E, and F. If you can only purchase two hospitals, then there is no way to guarantee coverage to everyone. However, if you can purchase three hospitals, then you can cover everyone – purchase the top hospital to cover A, B, and C, the bottom hospital to cover C, E, and F, and the leftmost hospital to cover A, C, and D.

```
Enter the maximum number of hospitals that can be constructed:3

Yes, can offer health care to all!

Hospital - 1
Hospital locations: acd
Hospital - 2
Hospital locations: bf
Hospital - 3
Hospital locations: cef
```

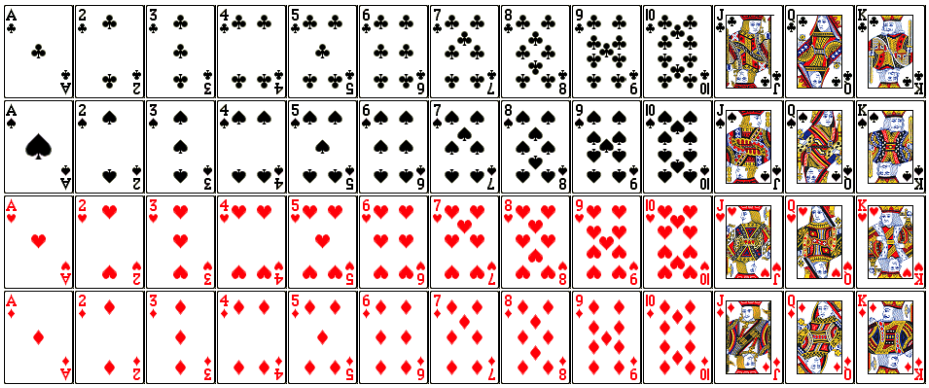
```
Enter the maximum number of hospitals that can be constructed:2
No, some cities are not covered.
```

Part 3. [30pts] Virtual Card Game Mixer

With the increased interest in virtual social gatherings, card games have regained popularity in digital formats. Your task is to write a program that shuffles a virtual deck of cards and displays the shuffled order, adhering strictly to the specifications of digital representation and randomization.

The deck of cards contains 52 cards which have 4 basic suits. These suits:
“Hearts”, “Diamonds”, “Clubs”, “Spades”

There are 13 faces belonging to each suit from 4 suits. These are:
"Ace", "Deuce", "Three", "Four", "Five", "Six", "Seven", "Eight", "Nine", "Ten", "Jack", "Queen", "King"



We should represent each card as a struct as follows:

struct card {

const char *face;
const char *suit;

};

<u>The steps to be taken are listed below:</u>

- You must place strings in Card structures.
- Cards in the deck must be replaced randomly so that the deck is shuffled.
- The elements of the mixed deck should be printed on the screen as in the format below.

IMPORTANT NOTES:

- Submit your homework as a zip file named as your student id (StudentID.zip) and this file should include:
  - YourStudentID.c file
  - A pdf file named "YourStudentID.pdf" including a YouTube link and screenshots of your program outputs. In the video, you are expected to provide a demo of your assignment. For each requested functionality, you must explicitly explain your solution approach and also execute and display the outputs. The video should not exceed 4 minutes. Please ensure that your camera is turned on during the recording.
- The output format must be as given, do not change it.
- Compile your work with given command “gcc --ansi your_program.c -o your_program”.
- Your work will be evaluated using gcc version 11.4.0.
- For any questions and problems, you can always contact me **via email** (bbuluz@gtu.edu.tr), or you can find me in Room 215 during scheduled office hours on May 09 and May 16, 2024, between 13:30 and 14:30.