Assignment 1

Course Instructor: Dr. Nazar Khan
Course Title: Analysis Of Algorithms
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Course Code: DC312

Total Marks: 50
Deadline: 11:59 PM, Friday, March 22

Question 1:

The city of Lahore has some of the finest medical institutions and hospitals in Pakistan. Many aspiring medical students will be graduating next month (aspiring medical students are called residents). It is always a hassle when it comes to matching residents with hospitals due to the competitive nature of the field as well as both medical residents and hospitals having their own preferences. Moreover, the costly process of hiring a resident can lead to instability within hospitals if residents are inclined to leave for better opportunities later on. This turnover disrupts the continuity of care and can create instability in hospital staffing.

To resolve this problem, the chairman of the Pakistan Medical Association (PMA) came up with an interesting idea, he decided to conduct a unique event called "Residency Matchmaking Gala" where hospitals and aspiring medical students came together to form partnerships that would shape the future of healthcare in Lahore.

The organizers of this gala decided to hire a skilled programmer, someone with the ability to solve the problem of producing stable matches between medical students and hospitals. You have been chosen for this critical task, entrusted with the responsibility of creating a program that will generate stable matches given the preferences between hospitals and students.

You are given a set of hospitals and residents. Each hospital has preferences for certain residents, and each resident has preferences for certain hospitals. The goal is to find a stable allocation of residents to hospitals such that no resident-hospital pair prefers each other over their assigned partners.

Examples Input:

In Lahore, three hospitals (H1, H2, H3) are gearing up for the annual Residency Matchmaking Gala. At the same time, three medical residents (R1, R2, R3) are eager to find their ideal healthcare partners.

The hospitals have their preferences:

- H1 prefers R1, R2, R3
- H2 prefers R2, R1, R3
- H3 prefers R3, R2, R1

Likewise, the residents have their preferences:

- R1 prefers H2, H1, H3
- R2 prefers H1, H3, H2
- R3 prefers H3, H2, H1

Expected Output:

One Possible Stable Matching for the given input would be:

- H1 and R2, H2 and R1, H3 and R3

Note:

- Use functions to write modular code.
- Use comments to improve code readability.
- Give time and space complexity of your code in comments at the top of the code file.
- You can submit code in either C++ or python.

Submission:

- You have to submit a single source file (.cpp or .py) on the google classroom.
- Do not include any executables (.exe) files.
- The name of your file should have the following format: **BCSF21M001-A1.cpp**