

# .NET Challenge - Final Round

Delen Private Bank

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## Introduction

In the exciting world of private banking, there is a fundamental truth: Success hinges on the connections we forge, the conversations we share and the passions we ignite. At the core of **Delen Private Bank**, this is what it is all about; we focus on our relationship with the client, and we put their interests first. In this challenge, you will tackle the complexity of those relations, and make sure you create your own successful private bank!

## Summary

You have been provided with a roster of clients, each with a designated set of interests that they like to discuss during meetings. Additionally, you will be given a list of client managers, who possess expertise in specific topics that align with the interests of these clients. Your responsibility is to identify clients, match them with suitable client managers, and cultivate a strong and enduring rapport between them over the course of several years. From the moment we first meet with a client, they must be nurtured and serviced until the end of the assignment.

## Problem Description

### Client Managers

There are  $R$  client managers. Each client manager is described by:

- their name
- how many different clients they can maintain in a year
- a list of topics they have sufficient knowledge about

## Clients

There are  $C$  clients. Each client is described by the following parameters:

- their name
- their wealth class (number between 1 and 100)
- their earliest year when they want to have their first meeting (first year = 0)
- a list of their interests

A full example can be found in the first data input file.

## Matching clients with a client manager

The central focus of this assignment revolves around the pairing of clients with their respective client managers. To assess the quality of this match, we employ the following formula  $S = \frac{M}{T}$ , where  $M$  represents the number of shared interests between the client and their manager and  $T$  denotes the total number of interests attributed to the client. As our paramount concern is the client's satisfaction, we use the square of this result in our scoring function.

Once a client first meets with a client manager, that client remains a part of our clientele for the entire duration of the assignment. While clients have the option to switch to different client managers, once they attain client status, they maintain that status throughout the subsequent years.

## Input data sets

For each assignment, we give you all the necessary details in a JSON file. Additionally, we offer a set of C# tools to help you read the information from these files and organize your results. You have the option to modify these tools, but be cautious not to change how the final results look, as this could cause errors when you submit your solution.

### Top level data

- **YearsToSimulate:** The period of time you need to simulate
- **ClientManagers:** The list of client managers and their info
- **Clients:** The list of clients and their info

### Client Manager

- **Name:** The unique name for a client manager
- **ClientsPerYear:** The number of different clients this specific client manager can maintain
- **Interests:** A list of unique topic names about which the client manager has sufficient knowledge

### Client

- **Name:** The unique name for a client
- **WealthClass:** The amount of capital the client could bring, expressed in a class bucket
- **StartYear:** From what year the client becomes interested in your bank
- **Interests:** A list of unique topics about which the client wants to talk about

A small example can be found in the first assignment, which has in total 2 client managers and 5 clients

## Scoring

The score is calculated as a combination of the interest match between client and manager, and their associated wealth class.

Here's the step-by-step process: Each year, we compute an intermediate score for each client. This intermediate score is the result of taking the square of the client's match with their manager and then multiplying it by their wealth class. For instance, if a client has a matching score of 90% and has a wealth class of 10, their yearly intermediate score would be calculated as follows:  $\text{Intermediate Score} = (0.9)^2 * 10 = 8.1$  The final score is determined by summing up all these yearly intermediate scores for all clients.

## Output validation

Your output file will be invalid if one of the following statements is true:

- You have used a client or client manager name that can not be found in the assignment
- You have a client manager that has some year data missing
- You have a client manager that has multiple lines for a single year
- You have a client manager that has more clients listed than is allowed by the *ClientsPerYear* parameter

- You have a year in your solution that exceeds the years to simulate
- You have a meeting between client and manager before the *StartYear* of the client
- You have met with a client in a certain year, but not in all the subsequent years
- You have a client that had meetings with more than one client manager in the same year

## Example

To provide a clearer understanding of the task at hand, we'll walk through an illustrative assignment with a detailed, step-by-step solution. This is also the first input file provided in the assignment. In this example, we will be simulating a scenario spanning two years, where we have two client managers and five clients. Beware that the walkthrough will not handle the most optimal solution for this assignment.

### Year 0

For this particular assignment, we have two employees: Alice and Bob. Alice's capacity allows her to manage one client per year. She possesses interests in topics t2, t3, t4, and t5. In this scenario, the *StartYear* for all clients is 0, meaning they are available to meet from the beginning. These clients differ in their *WealthClass* and *Interests* lists.

We decided to pair Alice with Alison, yielding a total score of approximately 3.38. We can find this score by finding the number of matching interests (3 - t2, t4 and t5), divide this by the total number of interests of Alison (4), take the square root of the result, and multiply this by the Wealth Class of Alison (6). The final score for this combination is  $(\frac{3}{4})^2 \times 6$

Finally, for year 0, we still have to find some matches for our employee Bob. Bob has time to see three clients per year, but for the sake of this assignment, we decide that Bob will meet with 2 clients this year: Charlie and Dawson. When we quickly go over the scores, we get a score of  $(\frac{2}{2})^2 \times 3 = 3$  for Charlie and  $(\frac{2}{3})^2 \times 7 \approx 3.11$ . This brings our total for Year 0 to be  $3.11 + 3 + 3.38 \approx 9.49$

### Year 1

Now we reiterate the same process. Before we do that, we have to take into account some details:

- We might have new clients (not the case in this example)
- We have to make sure we keep managing all the previous clients

In year 0, Alison, Charlie and Dawson became clients at our bank. Clients are allowed to swap client managers, but it is adamant that we maintain all previous relations. This means that whatever we do, Alison, Charlie and Dawson needs to be in the list of clients for either Alice or Bob.

We decide to keep all previous relations, resulting in a temporary score of 9.49. Remember that we purposely left a spot open for Bob in year 0. We now fill this spot with Eric, resulting in another  $(\frac{3}{5})^2 \times 10 = 3.60$ . This give a total of 13.09 for year 1.

### **Final Score**

To recuperate, the final score of the assignment is the sum of the scores for all years. We submit this solution, resulting in a final score of  $9.49 + 13.09 = 22.58$  for this submission.