

CONTEST STATEMENT

Introduction

Any banking interaction with clients can be simplified into two types:

- **Assets.** Primarily, these are loans that the bank issues to clients. For example, a loan for 1000 euros at 20% per annum for 1 year.
- **Liabilities.** Primarily, this is money received at interest from clients – deposits, savings accounts, and so on. For example, a deposit for 1024 euros at 10% per annum for 3 months.

Consider a simple case. Client A opens a deposit in the bank for €1000 euros at 10% per annum for one year, and client B receives a loan from the bank for €1000 at 20% per annum for one year. In this situation, the bank does not use its own money but simply transfers money from client A to client B, and at the end of the year (after the loan is repaid by client B), returns €1000 to client A. Additionally, client B will return an extra 20% at the end of the year, half of which will be given to client A, and the second half will remain with the bank as earned funds.

However, if we imagine that the terms or interest rates for the loan and deposit are different, the bank must compensate for potential risks using its own funds or attract additional clients with new deposits and loans.

To prevent any problems, the Government (by means of the Central Bank or other state financial institution) requires banks to hold a certain amount of free funds that take into account potential interest rate risks (RWA, or risk-weighted assets). Banks are interested in minimizing their free funds and therefore try to reduce their RWA.

To calculate the RWA the following algorithm is used:

1. If dates of assets and loans are close enough to each other (i.e. the term's difference ≤ 30 days and interest rate difference $\leq 0.15\%$), then RWA includes only the difference of their amounts.

For example, if asset and loan have such properties and both have an amount of €1000, then such a pair doesn't contribute to RWA (they compensate each other — *netting* in banking language).

But if an asset has a par value of €300 and loan has a par value of €100 (with similar terms and interest rate), the such a pair contribute to RWA the «rest» €200.

2. A group of transactions (assets and/or liabilities) that can be partially or fully netted against each other is called a «netting group». Let the sum of the assets in it be equal to A and the sum of the liabilities be equal to P . Then such a group contributes to RWA:

- residual asset $A - P$ (if $A > P$)
- residual loan $P - A$ (if $A < P$)

3. For any transactions which are hadn't been netted their contribution to RWA is calculated using the following formula:

$$RWA = \left(\sum_{asset} + \sum_{loan} \right) \cdot w_{gross} + \left| \sum_{asset} - \sum_{loan} \right| \cdot w_{net}$$

where $w_{gross} = 0.1$ and $w_{net} = 0.4$.

1. Mathematical Modeling

There are two situations are proposed below. Estimate the RWA value for each of the situations. In both cases, the RWA value can vary within a certain range (find its boundaries), and also indicate the average value (mathematical expectation) of the RWA that will be achieved over a large number of experiments.

- a) Let's say $2N$ clients came to a bank. N of them received a loan of €1000 for 1 month at 1% per annum, and another N deposited €1000 for 1 month.

Let's assume that the interest rate for each deposit was chosen randomly (and with equal probability) from two values: 1% or 2% per annum. Estimate the RWA for this situation.

- b) Let's say $2N$ clients come to a bank. N of them received a loan of €1000 for 1 month, and another N made a deposit of €1000 for 1 month. Suppose that the interest rate for each client's deposit and loan was chosen randomly (and equally likely) from two values: 1% or 2% per annum. Estimate the RWA for this situation.

2. Computer Modeling

Divide the set of deals provided in the files into «netting groups» that minimize the RWA value.

The files can be downloaded here:

<https://hfarm.leaders.tech/cs/extras/2026-01/SIMC/training/model.zip>

As a result, you need to fill in the [ANSWER] Group Number column with group numbers for all deals. In the solution document you have to specify the achieved RWA value and a description of the algorithm used to obtain.

- The file **2a.xls** (**2a.csv**) contains a set of banking deals with a duration of up to 30 days. In this case, obviously, the only key for dividing by groups is the difference in interest rates within each group.
- The file **2b.xls** (**2b.csv**) contains a set of banking deals with a duration of 1 to 3 months. In this case, not only the difference in interest rates becomes important, but also the difference in the terms (maturity period) of the deals.

The resulting RWA value will be taken into account when evaluating the work, but it will not be the only criterion. The provided group divisions will also be checked for correctness. Therefore, the jury asks participants not to change the format of the data files, but only to enter your answers and send them along with the text of the work.

If your partitioning method is computationally efficient on large portfolios (for example, tens and hundreds of thousands of deals), it will add points to your solution.