

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY  
DELHI-NCR CAMPUS, MODINAGAR, U.P  
DSA PROJECT REPORT (2023-2024) ODD SEM  
ON  
“BANK CASH FLOW MINIMIZER SYSTEM”**

**Submitted by:**

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# Project Report: Cashflow Minimizer System

- Abstract:

Cashflow Minimizer System is a comprehensive software solution designed to streamline and optimize financial operations for businesses and organizations. This project aims to develop a user-friendly, efficient and adaptable system that automates various financial processes, including expense tracking, revenue management, budgeting and cash flow forecasting. With its intuitive user interface, real-time access to financial data and reporting capabilities, the Cashflow Minimizer System enables businesses to minimize costs, maximize revenue and maintain healthy cash flow while making informed financial decisions. This project uses advanced financial algorithms and technologies to create a robust and flexible solution to meet the diverse financial management needs of various industries.

- Introduction:

This project aims to minimize the number of financial transactions among multiple banks that use different payment methods. To achieve this, we introduce a "World Bank" that supports all payment methods. When banks need to transfer money and don't share a common payment method, they go through the World Bank as an intermediary.

Let's take an example. say we have the following banks:

Bank\_of\_America (World bank)

State Bank India

Axis Bank

Kotak Mahindra Bank

Punjab\_National\_Bank

Following are the payments to be done:

Debtor Bank	Creditor Bank	Amount
Bank_of_America	Kotak	500
Punjab_National_Bank	Axis_bank	400
SBI	Axis_bank	1000
Axis_bank	Kotak	340
Axis_bank	SBI	500
Punjab_National_Bank	Bank_of_America	5000
Axis_bank	Bank_of_America	500
Kotak	SBI	320
Kotak	Punjab_National_Bank	400
Punjab_National_Bank	Axis_bank	350

But there's a catch!! Each Bank only supports a set of modes of payments and can make or receive payments only via those. Only World Bank supports all modes of payments. In our current example we have only three payment modes :

Google\_Pay

PhonePe

Paytm

Following is the list of Banks and their supported payment modes:

Bank_of_America	- Paytm, Google_pay, PhonePe
State Bank Of India	- Paytm, Google_pay
Axis_bank	- Paytm
Kotak	- Paytm, PhonePe
Punjab_National_Bank	- Google_pay

### **How It Works:**

To minimize transactions, we follow these steps:

1. Calculate the "net amount" for each bank using this formula:  
$$\text{Net Amount} = (\text{Sum of all money to be received}) - (\text{Sum of all money to be paid}).$$
2. Find the bank with the largest debt (the most negative net amount). This bank (let's call it Bank X) needs to pay the most.
3. Find a bank with the largest credit (the most positive net amount) and shares a payment method (let's say M1) with Bank X (let's call it Bank Y).
4. Calculate the amount to transfer, which is the minimum of the absolute values of X's debt and Y's credit. Let's call it "Z."

5. Bank X pays Z to Bank Y.

6. Three cases may arise:

- ☐ If the absolute value of X's debt is less than Y's credit ( $|X| < Y$ ), Bank X is fully settled and removed from the list.
- ☐ If the absolute value of X's debt is greater than Y's credit ( $|X| > Y$ ), Bank Y is fully settled and removed from the list.
- ☐ If the absolute value of X's debt equals Y's credit ( $|X| = Y$ ), both banks are fully settled and removed from the list

7. Repeat this process for the remaining banks.

## • Code Snippets:

```
void minimizeCashFlow(int numBanks, bank input[], unordered_map<string, int>& indexOf, int numTransactions, vector<vector<int>> & graph, int maxNumTypes){

    //Find net amount of each bank has
    bank listOfNetAmounts[numBanks];

    for(int b=0; b<numBanks; b++){
        listOfNetAmounts[b].name = input[b].name;
        listOfNetAmounts[b].types = input[b].types;

        int amount = 0;
        //incoming edges
        //column travers
        for(int i=0; i<numBanks; i++){
            amount += (graph[i][b]);
        }

        //outgoing edges
        //row traverse
        for(int j=0; j<numBanks; j++){
            amount += ((-1) * graph[b][j]);
        }

        listOfNetAmounts[b].netAmount = amount;
    }

}

void printAns(vector<vector<pair<int, string>> > ansGraph, int numBanks, bank input[]){

    cout<<"\n\nThe transactions for minimum cash flow are as follows : \n\n";
    for(int i=0; i<numBanks; i++){
        for(int j=0; j<numBanks; j++){

            if(i==j) continue;

            if(ansGraph[i][j].first != 0 && ansGraph[j][i].first != 0){

                if(ansGraph[i][j].first == ansGraph[j][i].first){
                    ansGraph[i][j].first=0;
                    ansGraph[j][i].first=0;
                }
                else if(ansGraph[i][j].first > ansGraph[j][i].first){
                    ansGraph[i][j].first -= ansGraph[j][i].first;
                    ansGraph[j][i].first = 0;

                    cout<<input[i].name<<" pays Rs" << ansGraph[i][j].first<< " to " <<input[j].name<<" via " <<ansGraph[i][j].second<<endl;
                }
                else{
                    ansGraph[j][i].first -= ansGraph[i][j].first;
                    ansGraph[i][j].first = 0;

                    cout<<input[j].name<<" pays Rs " << ansGraph[j][i].first<<" to " <<input[i].name<<" via " <<ansGraph[j][i].second<<endl;
                }
            }
            else if(ansGraph[i][j].first != 0){
                cout<<input[i].name<<" pays Rs " <<ansGraph[i][j].first<<" to " <<input[j].name<<" via " <<ansGraph[i][j].second<<endl;
            }
            else if(ansGraph[j][i].first != 0){
                cout<<input[j].name<<" pays Rs " <<ansGraph[j][i].first<<" to " <<input[i].name<<" via " <<ansGraph[j][i].second<<endl;
            }

            ansGraph[i][j].first = 0;
            ansGraph[j][i].first = 0;
        }
    }
    cout<<"\n";
}
```

## • Output:

\*\*\*\*\* Welcome to CASH FLOW MINIMIZER SYSTEM \*\*\*\*\*

This system minimizes the number of transactions among multiple banks in the different corners of the world that use different modes of payment. There is one world bank (with all payment modes) to act as an intermediary between banks that have no common mode of payment.

```
Enter the number of banks participating in the transactions:
5
Enter the details of the banks and transactions as stated:
Bank name ,number of payment modes it has and the payment modes.
Bank name and payment modes should not contain spaces
World Bank : Bank_of_America 3 Paytm Google_pay PhonePe
Bank 1 : SBI 2 Paytm Google_pay
Bank 2 : Axis_bank 1 Paytm
Bank 3 : Kotak 2 Paytm PhonePe
Bank 4 : Punjab_National_Bank 1 Google_pay
Enter number of transactions.
10
Enter the details of each transaction as stated:Debtor Bank , creditor Bank and amount
The transactions can be in any order
0 th transaction : Bank_of_America Kotak 500
1 th transaction : Punjab_National_Bank Axis_bank 400
2 th transaction : SBI Axis_bank 1000
3 th transaction : Axis_bank Kotak 340
4 th transaction : Axis_bank SBI 500
5 th transaction : Punjab_National_Bank Bank_of_America 5000
6 th transaction : Axis_bank Bank_of_America 500
7 th transaction : Kotak SBI 320
8 th transaction : Kotak Punjab_National_Bank 400
9 th transaction : Punjab_National_Bank Axis_bank 350

The transactions for minimum cash flow are as follows :

SBI pays Rs 50 to Bank_of_America via Google_pay
Punjab_National_Bank pays Rs 4950 to Bank_of_America via Google_pay
SBI pays Rs 10 to Axis_bank via Paytm
SBI pays Rs 120 to Kotak via Paytm
```

```
Enter the number of banks participating in the transactions:
5
Enter the details of the banks and transactions as stated:
Bank name ,number of payment modes it has and the payment modes.
Bank name and payment modes should not contain spaces
World Bank : Bank_of_America 3 Paytm Google_pay PhonePe
Bank 1 : SBI 2 Paytm Google_pay
Bank 2 : Axis_bank 1 Paytm
Bank 3 : Kotak 2 Paytm PhonePe
Bank 4 : Punjab_National_Bank 1 Google_pay
Enter number of transactions.
10
Enter the details of each transaction as stated:Debtor Bank , creditor Bank and amount
The transactions can be in any order
0 th transaction : Bank_of_America Kotak 500
1 th transaction : Punjab_National_Bank Axis_bank 400
2 th transaction : SBI Axis_bank 1000
3 th transaction : Axis_bank Kotak 340
4 th transaction : Axis_bank SBI 500
5 th transaction : Punjab_National_Bank Bank_of_America 5000
6 th transaction : Axis_bank Bank_of_America 500
7 th transaction : Kotak SBI 320
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The transactions for minimum cash flow are as follows :

SBI pays Rs 50 to Bank_of_America via Google_pay
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SBI pays Rs 10 to Axis_bank via Paytm
SBI pays Rs 120 to Kotak via Paytm
```

- System Specifications:

- Processor: 12th Gen Intel(R) Core(TM) i7-12650H 2.30 GHz
- Installed RAM: 16.0 GB (15.6 GB usable)
- System type: 64-bit operating system, x64-based processor
- Edition: Windows 10 or Windows 11
- Version: 22H2
- OS build: 22621.2283



- Objectives:

The primary goal of the Cashflow Minimizer System is to develop an effective financial management tool that optimizes data processing for businesses and organizations. Its goal is to streamline financial operations and ensure quick access to essential financial information for effective decision-making.

Streamlining financial processes: The Cashflow Minimizer System aims to simplify financial tasks related to tracking expenses, managing income, budgeting and forecasting cash flows. It reduces manual effort by automating financial data entry, analysis and management, thereby streamlining financial processes.

Improving the availability and accuracy of financial data: The goal is to improve the availability of critical financial data while maintaining accuracy and consistency. This system ensures that the right financial information is immediately accessible to authorized personnel, improving decision-making and financial stability within the organization.

By achieving these goals, the Cashflow Minimizer System enables businesses to make informed financial decisions, minimize costs, maximize revenue and maintain healthy cashflow, ultimately contributing to the financial well-being and sustainability of the organization.

- Advantages:

1. Improved Financial Control: The Cashflow Minimizer System provides businesses with a powerful tool to gain better control over their financial operations, helping to minimize costs and optimize revenue.
2. Real-time insights: Businesses using this system have access to real-time financial data and insights, enabling them to make informed decisions quickly and respond to changing financial conditions.
3. Simplified financial management: The system automates various financial processes, simplifying expense tracking, revenue management, budgeting and cash flow forecasting, resulting in more efficient financial management.
4. Improved budgeting and planning: With Cashflow Minimizer, businesses can more effectively create and manage budgets and align their financial goals with strategic goals.
5. Reduced financial risks: The system's comprehensive financial analysis and forecasting features help identify potential financial risks and take proactive measures to mitigate them.

- Disadvantages:

1. Learning curve: For organizations and users new to financial management software or complex financial analysis, there may be a learning curve that may require additional training and affect initial effectiveness.
2. Resource overhead: The system may have more overhead in terms of memory and disk space compared to simpler, lightweight financial tools, potentially increasing hardware requirements.
3. Compatibility issues: Ensuring seamless integration with existing financial systems and processes can present challenges leading to potential compatibility issues that need to be addressed during implementation.

## □ REFERENCES

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2. <https://en.cppreference.com/w/cpp/header>
3. <https://github.com/tushar1999-coder/Cash-Flow-Minimizer-System>