

**Computer Science 3307A Object-Oriented Design and Analysis**  
**C++ Assignment: The Banking System**

Name: Jameel Kaba  
Student #: 250796017  
Last 4 digits of student #: 6017  
Email: jkaba@uwo.ca  
October 2016

## **Deliverable 1 – Minimum Set of Requirements**

### **Customer**

- id 0: Customer can sign in with a secure id/pin and display client options
- id 1: Open one additional account (Chequing or Savings whichever is not open)
- id 2: Close an account (Chequing or Savings – cannot close both as a user needs one account to be a client at the bank. Can't close unless \$0 in account)
- id 3: Customer can deposit funds into their account
- id 4: Customer can withdraw funds from their account (includes \$2 surcharge from chequing when necessary)
- id 5: Customer can transfer funds between accounts (chequing and savings)
- id 6: Customer can display account balances
- id 7: Account information/balances will be saved and loaded for access on next visit (Account data is saved and loaded between uses)

### **Manager**

- id 8: Manager can open either a chequing or savings account for a client
- id 9: Manager can close either a chequing or savings account for a client
- id 10: Manager can see critical details of a particular customer
- id 11: Manager can see critical details of all customers
- id 12: Manager can login to program with a secure id/pin and display manager functions (User ID: manager PIN: 1111)
- id 13: Manager can obtain data on the funds in the bank

### **Maintenance**

- id 14: Login to maintenance system with a secure id/pin displaying maintenance options (User ID: maintenance PIN: 1111)
- id 15: Turn on/off execution trace
- id 16: When execution trace is on, write the traces into a file

## **Deliverable 2 – Enhancement Requirements**

### **Customer**

id 17: A client can transfer funds to another user's chequing/savings account

id 18: Any user can sign up for an account through the app

id 19: A client can display their transaction history

### **Manager**

id 20: The Manager can view a list of all clientele

**Deliverable 4 - Scenarios****Scenario 1: *Withdrawing funds from chequing account***

- Client logs into the ATM
- Client views their balance
- The client attempts to withdraw \$50 from their chequing account and is told a surcharge of \$2 must be paid
- The client accepts the surcharge and withdraws money
- The client logs out

```
Welcome, enter:

0 to sign in
1 to sign up
q to quit

0

Enter your user ID: jkaba

Enter your pin or x to cancel: 1111

You are now logged in as jkaba.

Enter:
0 to open a chequing or savings account
1 to close an account
2 to check balance
3 to deposit money
4 to withdraw money
5 to transfer funds
6 to display transaction history
x to logout

2

Your chequing account balance is : $100
```

```
Enter:
0 to open a chequing or savings account
1 to close an account
2 to check balance
3 to deposit money
4 to withdraw money
5 to transfer funds
6 to display transaction history
x to logout

4
```

```
Enter:
0 to withdraw from your chequing account
1 to withdraw from your savings account
x to cancel

0

How much would you like to withdraw?

50

Your balance after withdraw will be less than 1000 and subject to a $2.00 charge
Press Y to continue or any other key to cancel request: Y/N?
Y
Transaction successful. Thank you!

Your chequing account balance is now: $48
```

```
Enter:
0 to open a chequing or savings account
1 to close an account
2 to check balance
3 to deposit money
4 to withdraw money
5 to transfer funds
6 to display transaction history
x to logout

x
Welcome, enter:

0 to sign in
1 to sign up
q to quit
```

**Scenario 2:** *Transferring funds to another account*

- The client signs in
- The client checks their account balance
- The client decides to transfer funds from their savings account into their chequing account
- The client displays their transaction history
- The client logs out

Welcome, enter:

0 to sign in  
1 to sign up  
q to quit

0

Enter your user ID: jkaba

Enter your pin or x to cancel: 1111

You are now logged in as jkaba.

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

2

Your chequing account balance is : \$548

Your savings account balance is : \$3200

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

5

Enter:

0 to transfer from your chequing account to your savings account  
1 to transfer from your savings account to your chequing account  
2 to transfer from your chequing account to another user's account  
3 to transfer from your savings account to another user's account  
x to cancel

1

How much would you like to transfer?

200

Transaction successful. Thank you!

Your chequing account balance is : \$748

Your savings account balance is : \$3000

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

6

Transaction history for chequing account:

Withdraw of \$52 (\$2 surcharge included). Current balance: \$48

Deposit of \$500. Current balance: \$548

Deposit of \$200. Current balance: \$748

Transaction history for savings account:

Withdraw of \$200. Current balance: \$3000

```
Enter:
0 to open a chequing or savings account
1 to close an account
2 to check balance
3 to deposit money
4 to withdraw money
5 to transfer funds
6 to display transaction history
x to logout

x
Welcome, enter:

0 to sign in
1 to sign up
q to quit
```



**Scenario 3: *Opening and Closing an account***

- The client signs up for a chequing account
- The client then opens a new savings account
- The client then tries to close their savings account
- The client withdraws half of their money from their savings account
- The client transfers the rest to a friend
- The client closes their savings account
- The client logs out

Welcome, enter:

0 to sign in  
1 to sign up  
q to quit

1

Enter the user ID for your new account: jameel

Enter the 4 character pin for your new account: 1234

To finish creating your new account, you must open either a chequing or savings account  
Are you opening a chequing or savings account?

Enter:  
0 for Chequing  
1 for Savings  
x to Cancel

0

Enter the initial balance for the account:

1000

Your account has been successfully opened.

Account with user ID jameel was successfully created.

You are now logged in as jameel.

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

0

Are you opening a chequing or savings account?

Enter:

0 for Chequing  
1 for Savings  
x to Cancel

1

Enter the initial balance for the account:

1000

Your account has been successfully opened.

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

1

Enter:

0 to close your chequing account  
1 to close your savings account  
x to cancel

1

Savings Account still has money in it. Failed to close Savings Account.

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

4

Enter:

0 to withdraw from your chequing account  
1 to withdraw from your savings account  
x to cancel

1

How much would you like to withdraw today?

500

Transaction successful. Thank you!

Your savings account balance is now: \$500

Enter:

0 to open a chequing or savings account  
1 to close an account  
2 to check balance  
3 to deposit money  
4 to withdraw money  
5 to transfer funds  
6 to display transaction history  
x to logout

5

Enter:  
0 to transfer from your chequing account to your savings account  
1 to transfer from your savings account to your chequing account  
2 to transfer from your chequing account to another user's account  
3 to transfer from your savings account to another user's account  
x to cancel

3

Enter the user ID you wish to transfer money to:  
jkaba

Enter:  
0 to transfer to their chequing account  
1 to transfer to their savings account  
x to cancel

0

How much would you like to transfer?  
500  
Transaction successful. Thank you!

Your chequing account balance is : \$1000  
Your savings account balance is : \$0

```
Enter:
0 to open a chequing or savings account
1 to close an account
2 to check balance
3 to deposit money
4 to withdraw money
5 to transfer funds
6 to display transaction history
x to logout
```

```
1
```

```
Enter:
0 to close your chequing account
1 to close your savings account
x to cancel
```

```
1
```

```
Closed Savings account
```

```
Enter:
0 to open a chequing or savings account
1 to close an account
2 to check balance
3 to deposit money
4 to withdraw money
5 to transfer funds
6 to display transaction history
x to logout
```

```
x
```

```
Welcome, enter:
```

```
0 to sign in
1 to sign up
q to quit
```

**Scenario 4:** *Manager decides to view info about the bank*

- The manager logs in
- The manager views a list of all clientele
- The manager views the info for all clientele
- The manager views the total funds in the bank
- The manager logs out

```
Welcome, enter:
```

```
0 to sign in  
1 to sign up  
q to quit
```

```
0
```

```
Enter your user ID: manager
```

```
Enter your pin or x to cancel: 1111
```

```
You are now logged in as the bank manager.
```

```
Enter:
```

```
0 to view the list of clients  
1 to view a client's information  
2 to view the information of all clientele  
3 to view total bank funds  
4 to open an account  
5 to close an account  
x to logout
```

```
0
```

```
List of clients:
```

```
jkaba  
jameel
```

```
Enter:
0 to view the list of clients
1 to view a client's information
2 to view the information of all clientele
3 to view total bank funds
4 to open an account
5 to close an account
x to logout

2
Clientele information:

ID: jkaba          Pin: 1111 Chequing: $748 Savings: $3000
ID: jameel         Pin: 1234 Chequing: $1000
```

```
Enter:
0 to view the list of clients
1 to view a client's information
2 to view the information of all clientele
3 to view total bank funds
4 to open an account
5 to close an account
x to logout
```

3

```
Total money in chequing: $1748
Total money in savings: $3000
Total money: $4748
```

```
Enter:
0 to view the list of clients
1 to view a client's information
2 to view the information of all clientele
3 to view total bank funds
4 to open an account
5 to close an account
x to logout
```

x

Welcome, enter:

```
0 to sign in
1 to sign up
q to quit
```

0

**Scenario 5:** Maintenance worker uses the tracer

- Maintenance worker logs in
- The maintenance worker turns the tracer on
- The maintenance worker logs out for now
- The maintenance worker comes back later and logs in again
- The maintenance worker turns the tracer off
- The maintenance person logs out

Welcome, enter:

0 to sign in  
1 to sign up  
q to quit

0

Enter your user ID: maintenance

Enter your pin or x to cancel: 1111

You are now logged in as the maintenance man.

Enter:

0 to turn on the execution tracer  
1 to turn off the execution tracer  
x to logout

0

Execution tracer has been turned on

Enter:

0 to turn on the execution tracer  
1 to turn off the execution tracer  
x to logout

x

Welcome, enter:

0 to sign in  
1 to sign up  
q to quit



Welcome, enter:

0 to sign in  
1 to sign up  
q to quit

0

Enter your user ID: maintenance

Enter your pin or x to cancel: 1111

You are now logged in as the maintenance man.

Enter:

0 to turn on the execution tracer  
1 to turn off the execution tracer  
x to logout

1

Execution tracer has been turned off

Enter:

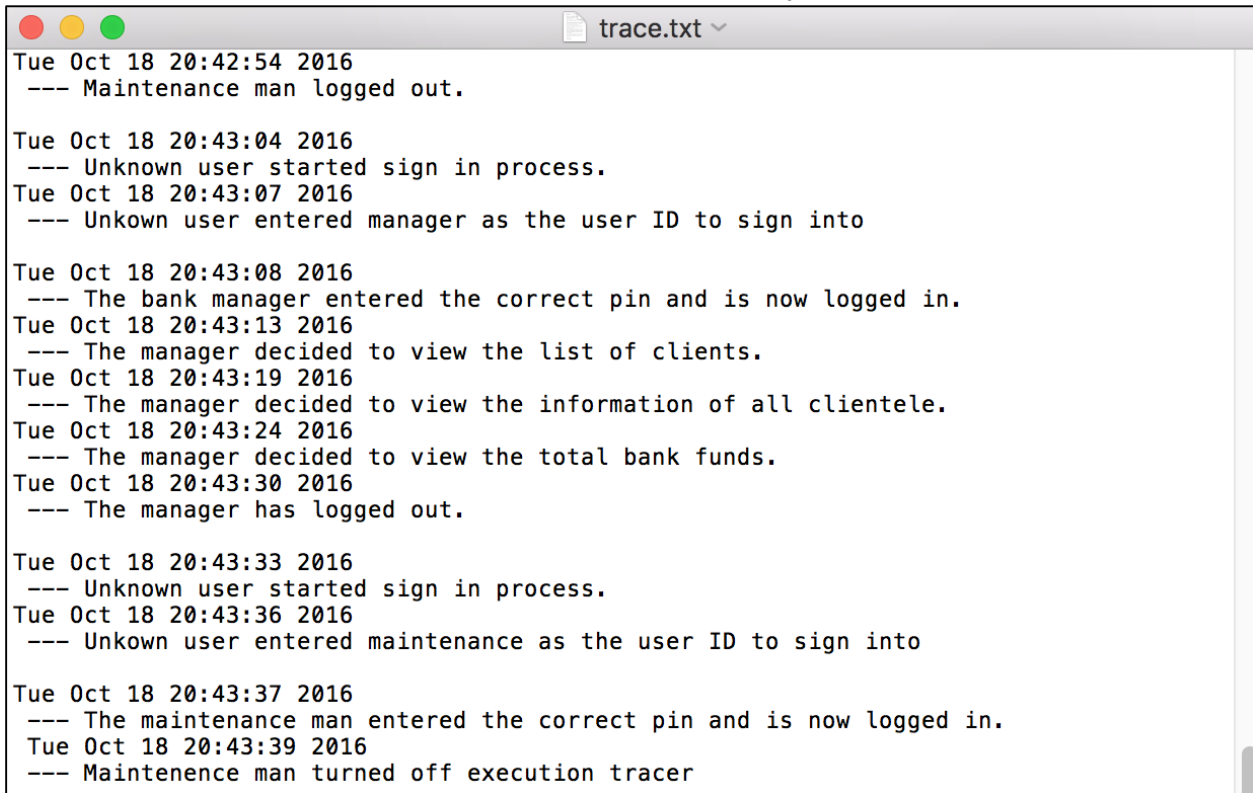
0 to turn on the execution tracer  
1 to turn off the execution tracer  
x to logout

x

Welcome, enter:

0 to sign in  
1 to sign up  
q to quit

## A Portion of the Trace output



```
Tue Oct 18 20:42:54 2016
--- Maintenance man logged out.

Tue Oct 18 20:43:04 2016
--- Unknown user started sign in process.
Tue Oct 18 20:43:07 2016
--- Unkown user entered manager as the user ID to sign into

Tue Oct 18 20:43:08 2016
--- The bank manager entered the correct pin and is now logged in.
Tue Oct 18 20:43:13 2016
--- The manager decided to view the list of clients.
Tue Oct 18 20:43:19 2016
--- The manager decided to view the information of all clientele.
Tue Oct 18 20:43:24 2016
--- The manager decided to view the total bank funds.
Tue Oct 18 20:43:30 2016
--- The manager has logged out.

Tue Oct 18 20:43:33 2016
--- Unknown user started sign in process.
Tue Oct 18 20:43:36 2016
--- Unkown user entered maintenance as the user ID to sign into

Tue Oct 18 20:43:37 2016
--- The maintenance man entered the correct pin and is now logged in.
Tue Oct 18 20:43:39 2016
--- Maintenance man turned off execution tracer
```

## **Deliverable 5 – Implementation of the Enhanced Requirements**

### **id 17: Transfer funds to another user's account (Method created)**

To transfer funds between user's, I've created a method known as `transferToUser` which is called when the client enters either '2' or '3' in the transfer method. The method takes 3 inputs, 2 integers and 1 string. The integers on the list represent the location on the `clientList` for the client and the recipient. The string represents the type of account, either chequing or savings.

#### **How the method works:**

The method starts out by asking which account the user is sending funds to. It then checks if the recipient has a chequing/savings account (whichever is applicable), if not then it returns an error message and brings the user back to the transfer menu. The user is then asked how much they're transferring, the account their sending money from then gets checked to ensure there are enough funds, this is done using the `withdrawCheck` method in `main.cpp`. If there are enough funds, the money is sent; else, the user gets an error message and brings them back to the transfer menu. If transfer was successful, then the new account balance will be printed before returning the user to the main menu.

### **id 18: Any user can sign up for an account through the app (Method created)**

Anyone can sign up; all they have to do is press '1' on the main menu of the app. This will run the `signUp` method, which takes an integer as input. The integer for input is mainly used to determine whether a manager is opening an account for someone, or if a user is opening the account on the app.

#### **How the method works:**

The method asks the user to enter a `userID` to be assigned to the account. It will then check to see if that `userID` already exists, if so then it provides an error message. Next the user will be asked to provide a pin for the account, the pin has to be 4 characters long. If the pin is not 4 characters long, then the user is asked to enter a new pin. The method then creates a new client object with the given details and pushes the client onto the `clientList`. The method then redirects the user to the `openAccount` method to finish creating an account. Once completed the user is redirected to the appropriate menu.

### **id 19: Display transaction history (Block of code)**

The client can view their transaction history by entering '6' in their options menu. This will run through two 'if' statements which print out the transaction history for either chequing or savings account, or both if applicable. There is a method exclusive to the `Account` class which gets the history of an account, this is used to print out the account history.

### **id 20: Manager can view a list of all clientele (Block of code)**

To view a list of clientele (no other information other than their `userID`), the manager needs to enter 0 in their options menu. This will run through a for loop that prints out the `userID` for each client on the `clientList` starting at position 2. Position 0 and 1 are reserved for the manager and maintenance worker.

**Deliverable 6**

- I've learned that unlike C, I can actually make classes and constructors in C++.
  - o This makes things so much easier instead of using typeDef and making structures.
- I've learned that making use of the "using namespace std" helps simplify things a lot when it comes to Input and Output.
  - o It also helps make the code cleaner
    - cout VS. std::cout
- I've learned that reading and writing to a file, is so much easier and straightforward in C++ than it is in Java
  - o At least that's how I feel about it