PROJECT 2

SUMMARY

Function:

To simulate a Bank with 5 customers, 2 Bank Tellers and a Loan Officer.

Working:

Takes no input. The number of customers, Bank Tellers and Loan Officers are hard-coded in source code. Platform – java language.

Classes, Functions and variables:

The source file 'Customer.java' is well commented with information about the classes, variables and the functions. The comments in the source file can be referred for understanding the working of various functions and variables declared. There are three classes in the program namely Customer, Bankteller and LoanOfficer. The Customer class contains the main function and the customer thread implementation. The Bankteller and LoanOfficer classes contain their respective thread implementations.

Simulation:

The Simulation Steps are as follows –

- Create Bank Teller and Loan Officer threads
- Create Customer threads
- Customers enter the bank
- Assign random task out of three tasks (deposit, withdrawal and loan) to Customer.
- Depending on the task customer is added to the respective queue.
- The bank teller or the loan officer threads take out customers from the queues in order to serve them as and when they get free.
- The bank teller or the loan officer serves the customer.
- The customer gets serviced a total of three times and then departs the bank.
- Customer is then joined by main.
- All customers and Bank Tellers are referred by their thread numbers.
- After all customers are joined a summary of the balances and the loans of each customer is displayed.

The simulation is done exactly as given I the project specification. The waiting time are such that 1 minute is 100ms and 4 minutes is 400ms.

Difficulties:

The main difficult part of the project was the design part. Some challenges faced were writing the pseudo-code with lowest mutual exclusion and best possible concurrency. Another difficulty I faced was, how to stop the continuously running threads like BankTeller and LoanOfficer. I solved this by making these threads to be Daemon threads. Most difficult part was the debugging, which became easier by using numerous print statements to check where the execution was going wrong. Overall the code was not difficult to write but working understanding of semaphores and the concept of mutual exclusion was of utmost important.

Learning:

This project helped me understand the concepts of semaphores and the mutual exclusion in a practical and detailed manner. This project also helped me learn about threads, their creation, joining, synchronizing, etc. This project was a great hands-on experience. Multithreading and synchronizing them with semaphores is the focus of this project and I think I have greatly enhanced my knowledge on these topics by doing this project. It was a great feeling to see the project running effectively according to the specifications.

Result:

A successful implementation of bank simulation is done. The project specification is completely followed to get the output. Output obtained for a run is as follows -

```
Loan Officer created
Teller 0 created
Teller 1 created
Customer 0 created
Customer 1 created
Customer 2 created
Customer 3 created
Customer 4 created
Teller 0 Begins serving Customer 0
Teller 1 Begins serving Customer 1
Loan Officer Begins serving Customer 4
Customer 1 requests of teller 1 to make a deposit of $100
Customer 0 requests of teller 0 to make a deposit of $400
Customer 4 requests of Loan Officer to apply for a loan of $500
Teller 0 processes deposit for Customer 0
Teller 1 processes deposit for Customer 1
Loan Officer approves loan for Customer 4
Customer 4 gets loan from Loan Officer
Customer 0 gets receipt from teller 0
Customer 1 gets receipt from teller 1
Teller 0 Begins serving Customer 0
Loan Officer Begins serving Customer 3
```

```
Teller 1 Begins serving Customer 1
Customer 3 requests of Loan Officer to apply for a loan of $100
Customer 0 requests of teller 0 to make a withdrawal of $100
Customer 1 requests of teller 1 to make a withdrawal of $300
Teller 1 processes withdrawal for Customer 1
Teller 0 processes withdrawal for Customer 0
Loan Officer approves loan for Customer 3
Customer 3 gets loan from Loan Officer
Customer 0 gets cash and receipt from teller 0
Customer 1 gets cash and receipt from teller 1
Teller 0 Begins serving Customer 3
Loan Officer Begins serving Customer 2
Customer 3 requests of teller 0 to make a deposit of $500
Teller 1 Begins serving Customer 0
Customer 2 requests of Loan Officer to apply for a loan of $200
Customer 0 requests of teller 1 to make a deposit of $100
Loan Officer approves loan for Customer 2
Teller 0 processes deposit for Customer 3
Teller 1 processes deposit for Customer 0
Customer 3 gets receipt from teller 0
Customer 2 gets loan from Loan Officer
Teller 0 Begins serving Customer 1
Loan Officer Begins serving Customer 4
Customer 1 requests of teller 0 to make a withdrawal of $400
Customer 4 requests of Loan Officer to apply for a loan of $400
Customer 0 gets receipt from teller 1
Customer 0 departs the bank
Teller 1 Begins serving Customer 3
Customer 0 joined by main
Customer 3 requests of teller 1 to make a deposit of $200
Loan Officer approves loan for Customer 4
Teller 0 processes withdrawal for Customer 1
Teller 1 processes deposit for Customer 3
Customer 1 gets cash and receipt from teller 0
Customer 4 gets loan from Loan Officer
Customer 1 departs the bank
Teller 0 Begins serving Customer 4
Loan Officer Begins serving Customer 2
Customer 4 requests of teller 0 to make a withdrawal of $500
Customer 1 joined by main
Customer 2 requests of Loan Officer to apply for a loan of $100
Customer 3 gets receipt from teller 1
Customer 3 departs the bank
Loan Officer approves loan for Customer 2
Teller 0 processes withdrawal for Customer 4
Customer 2 gets loan from Loan Officer
Customer 4 gets cash and receipt from teller 0
Customer 4 departs the bank
Teller 1 Begins serving Customer 2
Customer 2 requests of teller 1 to make a deposit of $200
Teller 1 processes deposit for Customer 2
Customer 2 gets receipt from teller 1
Customer 2 departs the bank
Customer 2 joined by main
Customer 3 joined by main
```

```
Customer 4 joined by main

          Bank Simulation Summary

              Ending Balance      Loan Amount

Customer 0    1400          0
Customer 1    400           0
Customer 2    1200          300
Customer 3    1700          100
Customer 4    500           900

Totals        5200          1300
```

Submitted by –

PULKIT KHEMKA