

CS331: Prog. Lang. Lab

Assignment II: Adv. Java Concurrent Programming

Deadline: 11.55 PM IST, 10th Feb 2025, Evaluation Date: 12th Feb 2025

Design and implement a Java multithreaded program to simulate a bank money transaction system for up to 10^6 users. The name of the bank is Guwahati National Bank (GNB) and the bank has 10 branches at different locations in India and each branch has 10 updaters. Initially, 10^4 users will be there for each branch with a random amount of money in their accounts. Every updater of the GNB can be modeled as a separate thread. All the write and modify operations need to be thread-safe (synchronized).

Type of requests to Updaters

- *The updater gets a request for a balance check of some account. This is a read only operation.*
- The updater gets a request for a Cash Deposit or cash withdrawal (the withdrawal amount should be less than the amount of money in the account).
- The updater gets a request to Transfer Money from one customer account to another customer account. The source account and destination account may be in different branches of GNB.
- The updater gets a request to add a customer with some initial money in that account, the added customer will be in the **updater's branch** of GNB.
- The updater gets a request to delete a customer from the system (or close the account of a user of the GNBs from **any branch**).
- The updater gets a request to transfer a customer account from **one branch to another branch** of GNB.

The probabilities of different type of requests like a balance check, a cash deposit, a cash withdrawal, a money transfer, adding a customer, deleting a customer, and or transferring a customer to the updater are 0.3, 0.23, 0.23, 0.23, 0.003, 0.003, and 0.004, respectively.

Suppose information about all the customer accounts of the GNB is maintained in **an array of linked lists**. Each linked list represents (or holds data of a) branch of GNB. There are 10 linked lists and the array of linked lists is maintained by a hash data structure. Every customer account number is represented by 10 digits and the first digit of the customer account number identifies the branches of GNB.

Your used linked list and hash data structure should be thread-safe, and throughput should be high. You are allowed to use any inbuilt data structure, locking protocol, synchronized functions for the same.

To improve the performance, you are allowed to used other data structure instead of array of linked list.

Simulate up to 10^6 transactions per updater to test the correctness of your implementation. Report the execution time of your simulation program.

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Submission Procedure:

- Upload your assignments code in the compressed folder (tgx/zip/gz) to MS team Grp_PLLab-CS331-2025 before the deadline.
- **Please embed comments, how to run and required inputs properly in the code, or a separate readme file.**
- Source code will be checked for plagiarism, which can detect variable/function name change, minor structure change (while loop to for loop, vice versa), code displacement/repositioning.
- **Plagiarism case leads to F grades for both source candidate and destination candidate.** Ensure your code is different from the internet code if available freely.