PDP Lab 1 Documentation

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936/1

2. Bank Accounts

At a bank, we have to keep track of the balance of some accounts. Also, each account has an associated log (the list of records of operations performed on that account). Each operation record shall have a unique serial number, that is incremented for each operation performed in the bank.

We have concurrently run transfer operations, to be executed on multiple threads. Each operation transfers a given amount of money from one account to some other account, and also appends the information about the transfer to the logs of both accounts.

From time to time, as well as at the end of the program, a consistency check shall be executed. It shall verify that the amount of money in each account corresponds with the operations records associated to that account, and also that all operations on each account appear also in the logs of the source or destination of the transfer.

The solution involves using a mutex for each account (particularly a Java ReentrantLock()), and when a transfer is being made between two accounts, their respective mutexes are locked before their balances are changed and unlocked afterwards. This ensures that both resources are protected from outside interference while the transfer is being made, which could also potentially lead to a deadlock.

The consistency check can occur with a 0.1 probability, which one could say it is low, but considering the number of operations divided by the number of threads, it is actually reasonable.

The number of accounts was always 100 when running the tests, however the operations count and number of threads were changed consistently. After each test, the time elapsed is documented.

1.5 threads, 10000 transactions

```
Time elapsed: 0.128 seconds
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2.5 threads, 100000 transactions

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Time elapsed: 0.448 seconds
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3. 10 threads, 50000 transactions

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Time elapsed: 0.64 seconds
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Used hardware:

Item	Value
OS Name	Microsoft Windows 10 Education
Version	10.0.17134 Build 17134
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	ALEX-PC
System Manufacturer	To Be Filled By O.E.M.
System Model	To Be Filled By O.E.M.
System Type	x64-based PC
System SKU	To Be Filled By O.E.M.
Processor	Intel(R) Core(TM) i7-4790 CPU @ 3.60GHz, 3601 Mhz, 4 Core(s), 8 Logical Pro...
BIOS Version/Date	American Megatrends Inc. P1.90, 22-Dec-15
SMBIOS Version	2.7
Embedded Controller Version	255.255
BIOS Mode	Legacy
BaseBoard Manufacturer	ASRock
BaseBoard Model	Not Available
BaseBoard Name	Base Board
Platform Role	Desktop
Secure Boot State	Unsupported
PCR7 Configuration	Binding Not Possible
Windows Directory	C:\WINDOWS
System Directory	C:\WINDOWS\system32
Boot Device	\Device\HarddiskVolume1
Locale	United States
Hardware Abstraction Layer	Version = "10.0.17134.1098"
User Name	ALEX-PC\Alex
Time Zone	GTB Daylight Time
Installed Physical Memory (RAM)	16.0 GB
Total Physical Memory	15.9 GB
Available Physical Memory	4.63 GB
Total Virtual Memory	20.7 GB
Available Virtual Memory	2.85 GB
Page File Space	4.80 GB
Page File	C:\pagefile.sys
Kernel DMA Protection	Off
Virtualization-based security	Not enabled
Device Encryption Support	Reasons for failed automatic device encryption: TPM is not usable, PCR7 bindi...
Hyper-V - VM Monitor Mode E...	Yes
Hyper-V - Second Level Addres...	Yes
Hyper-V - Virtualization Enable...	Yes
Hyper-V - Data Execution Prote...	Yes