Moralizing stories

Requirements on transactions
THE PROBLEM OF THE LOST UPDATE

A conspiracy between your instructor and his spouse
Begins with a balance of $500
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100.
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100.

ATM gets current balance from bank computer
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100.
ATM gets current balance from bank computer
At the same time the spouse does the same
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100.
ATM gets current balance from bank computer
At the same time the spouse does the same
First ATM calculates new balance
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100.

ATM gets current balance from bank computer

At the same time the spouse does the same

First ATM calculates new balance

And updates the central computer
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100.
ATM gets current balance from bank computer
At the same time the spouse does the same
First ATM calculates new balance
And updates the central computer
And of course the other ATM does the same
Begins with a balance of $500

The instructor tells the ATM he will withdraw $100. ATM gets current balance from bank computer. At the same time the spouse does the same thing. First ATM calculates new balance and updates the central computer. And of course the other ATM does the same.
How was the Update Lost?

- Each ATM read same balance
- Husband’s ATM update was ignored
- Moral: Wife’s ATM should not have been able to get the balance until husband’s transaction was done.
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THE PROBLEM OF THE DIRTY READ

Another conspiracy between your instructor and his spouse

It all begins with a bank balance of $500
The Dirty Read
The instructor tells the ATM he will deposit $100.
The instructor tells the ATM he will deposit $100.

ATM gets current balance from bank computer,
The instructor tells the ATM he will deposit $100.

ATM gets current balance from bank computer,
calculates new balance,
The instructor tells the ATM he will deposit $100.
ATM gets current balance from bank computer,
calculates new balance,
updates main computer
The instructor tells the ATM he will deposit $100.
ATM gets current balance from bank computer,
calculates new balance,
updates main computer
Now spouse will withdraw $100, so ...
The instructor tells the ATM he will deposit $100.
ATM gets current balance from bank computer,
calculates new balance,
updates main computer
Now spouse will withdraw $100, so ...
ATM gets balance
The instructor tells the ATM he will deposit $100.
ATM gets current balance from bank computer,
calculates new balance,
updates main computer
Now spouse will withdraw $100, so ...
ATM gets balance
Instructor CANCELS, ATM revises figures
The instructor tells the ATM he will deposit $100.
ATM gets current balance from bank computer, calculates new balance, updates main computer
Now spouse will withdraw $100, so ...
   ATM gets balance
Instructor CANCELS, ATM revises figures
Meanwhile, other ATM pays out and updates
The instructor tells the ATM he will deposit $100.
ATM gets current balance from bank computer, calculates new balance, updates main computer.
Now spouse will withdraw $100, so ...
ATM gets balance.
Instructor CANCELS, ATM revises figures.
Meanwhile, other ATM pays out and updates.
What was Dirty?

• The spouse’s ATM dirty-read $600.
• But this was later cancelled.
• Problem: the ATM acted on invalid information.
• So cancellation was not effective
• Moral: transactions should not complete when based on bad data
What was Dirty?

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THE PROBLEM OF THE INCORRECT SUMMARY

Illustrates that the state of the database may not be consistent during a transaction
Transferring $100 from Savings to Checking

- During transfer, the bank is totaling up funds of each customer.

<table>
<thead>
<tr>
<th>Savings</th>
<th>Total Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>0</td>
</tr>
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<th>Checking</th>
</tr>
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<tr>
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Deduct $100 from savings
Transferring $100 from Savings to Checking

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Deduct $100 from savings
Add $100 to checking
Why is Bank $100 off?

• Money transfer transaction has two steps
• During the transfer, the account total is inconsistent
• Cannot allow other transactions access to inconsistent values
THE LOST TRANSACTION

Highlighting an important duty of the database
Again Transferring $100

Savings
500

Checking
300
Again Transferring $100

• The transfer proceeds normally to completion
Again Transferring $100

- The transfer proceeds normally to completion
- $100 goes from savings to checking.
Again Transferring $100

- The transfer proceeds normally to completion
- $100 goes from savings to checking.
Again Transferring $100

- The transfer proceeds normally to completion
- $100 goes from savings to checking.
But the Server Dies

- So your instructor bounced a check
- charged $25 by the store
- and $25 by the bank
Moral of this story

- The bank’s computer should remember the transaction
- Head crash is not an excuse
The Incomplete Transaction

Savings
500

Checking
300
The Incomplete Transaction

Savings
$100
Checking
$300

500
400
The Incomplete Transaction

$100

Savings
500
400

Checking
300
The Incomplete Transaction

- In the midst of the transaction the server dies
- Only the deduction is recorded
- Leaving your instructor $100 short.
Moral of this Story

• Transaction should be wholly completed
• Or not performed at all
• No partial completion.