Code:

class BankAccount {

private int balance;

private int account;

public void transferTo(BankAccount b, int amount) {

int tmp1 = this.balance - amount; // (a)

this.balance = tmp1; // (b)

int tmp2 = b.balance + amount; // (c)

b.balance = tmp2; // (d)

}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Thread S | | | Shared | | Thread T | | |
| a.transferTo(b,10) | tmp1 | tmp2 | a.bal | b.bal | b.transferTo(a,20) | tmp1 | tmp2 |
| 1 |  |  |  | 100 | 100 |  |  |  |
| 2 | tmp1 = a.bal-10 | 90 |  | 100 | 100 |  |  |  |
| 3 |  | 90 |  | 100 | 100 | tmp1 = b.bal-20 | 80 |  |
| 4 |  | 90 |  | 100 | 80 | b.bal = tmp1 | 80 |  |
| 5 |  | 90 |  | 100 | 80 | tmp2 = a.bal+20 | 80 | 120 |
| 6 |  | 90 |  | 120 | 80 | a.bal = tmp2 | 80 | 120 |
| 7 | a.bal = tmp1 | 90 |  | 90 | 80 |  |  |  |
| 8 | tmp2 = b.bal+10 | 90 | 90 | 90 | 80 |  |  |  |
| 9 | b.bal = tmp2 | 90 | 90 | 90 | 90 |  |  |  |
| 10 |  |  |  | 90 | 90 |  |  |  |

Table1

This is incorrect implementation.

Table2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Thread S | | | Shared | | Thread T | | |
| a.transferTo(b,10) | tmp1 | tmp2 | a.bal | b.bal | b.transferTo(a,20) | tmp1 | tmp2 |
| 1 |  |  |  | 100 | 100 |  |  |  |
| 2 | tmp1 = a.bal-10 | 90 |  | 100 | 100 |  |  |  |
| 3 |  | 90 |  | 100 | 100 | tmp1 = b.bal-20 | 80 |  |
| 4 |  | 90 |  | 100 | 80 | b.bal = tmp1 | 80 |  |
| 5 | a.bal = tmp1 | 90 |  | 90 | 80 |  | 80 |  |
| 6 | tmp2 = b.bal+10 | 90 | 90 | 90 | 80 |  | 80 |  |
| 7 | b.bal = tmp2 | 90 | 90 | 90 | 90 |  | 80 |  |
| 8 |  |  |  | 90 | 90 | tmp2 = a.bal+20 | 80 | 110 |
| 9 |  |  |  | 110 | 90 | a.bal = tmp2 | 80 | 110 |
| 10 |  |  |  |  |  |  |  |  |

The final result is correct, since at no point are tmp1 in one thread and tmp2 in the other

Thread (i.e. the two tmp variables that access the same shared value) updating concurrently – when one thread is updating a.bal the other thread doesn’t read from/ write to a.bal and ditto with b.bal.