UNIVERSITY COMPUTER SCIENCE • EXERCISE SHEET

# 8.5 Transactions and concurrency

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

**KEY WORDS** transaction • serializability

## Objective

Classify schedules as serializable or lost-update, and match isolation levels to anomalies.

## 1 Key knowledge and worked examples

### ■ The reference

T1 withdraws 10, T2 deposits 20 from a balance of 100 ✓. `R1 R2 W2 W1` ends 90 (the deposit lost); `R1 W1 R2 W2` ends 110 – equal to serial T1 then T2 ✓.

### ■ Worked example: the levels

Read-uncommitted allows the dirty read (T2 sees T1's uncommitted value that may roll back); read-committed removes it; repeatable-read stabilises re-reads; serializable removes phantoms ✓.

## 2 Practice

**2.1** ACID: name the C and what it means. [3]

**2.2** From 100, `R2 R1 W1 W2` (withdraw 10, deposit 20): final value? [3]

**2.3** Name 2PL's price and its cure. [3]

## 3 Exam-style questions

**3.1** From balance 200: T1 withdraws 30, T2 deposits 50.

Compute the ending of `R1 R2 W2 W1` and say which update vanished. Compute the ending of `R1 W1 R2 W2`. State the serializability verdict of each, with the reason. State what 2PL changes about the first schedule's outcome. [8]

**3.2** T1 updates rows matching a filter; T2 inserts a new matching row between T1's two reads.

Name the anomaly. State which isolation level prevents it and which lowest level already shows consistent re-reads. Give the mechanism serializable uses (range locks or equivalent) and why read-committed cannot stop the insert. [7]

## Solutions

**2.1**

- Consistency: constraints hold before and after every transaction ✓.

**2.2**

- Both read 100; T2's write lands last: $100 + 20 = 120$ – the withdrawal lost ✓.

**2.3**

- Deadlock; the detector kills a victim, which retries ✓.

**3.1**

- `R1 R2 W2 W1`: both read 200; final $= 200 - 30 = 170$ – T2's deposit vanished ✓.
- `R1 W1 R2 W2`: $170 + 50 = 220$ ✓.
- Verdicts: the first is not serializable (no serial order yields 170); the second equals serial T1-then-T2 ✓.
- 2PL: T2's read of the locked balance waits, so the schedule becomes the serial-equivalent one ending 220 ✓.

**3.2**

- The phantom read: T1's second read sees a row its first did not ✓.
- Serializable prevents it; repeatable-read already gives consistent re-reads of existing rows ✓.
- Serializable uses range locks over the predicate's key range (or an equivalent) – the insert's key falls inside a held range ✓.
- Read-committed locks only current row reads – no range is held, so the matching insert proceeds ✓.

exercises.lol exercises.com.cn