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 ✓.

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