Exercise Session 5

Correctness and Recoverability in Transaction Processing

Note: In this exercise we will be using the terms **history** and **schedule** interchangeably.

5.1 The need for Concurrency Control and Recovery in Database Systems

a) Explain the role of transactions in database systems.

b) Describe the ACID properties of transactions.

c) Which of the four ACID properties are enforced respectively by concurrency control and recovery techniques?

5.2 Correctness Criteria in Transaction Processing

a) Why is a correctness criterion needed? Give examples of incorrect concurrent executions.

b) What requirements does a correctness criterion need to satisfy? What is understood by prefix-commit closeness? Why is this property important for recoverability?

c) What is understood by serializability? Why are serializable histories considered as correct?

5.3 View Serializability (VSR) vs. Conflict Serializability (CSR)

a) What is the difference between view and conflict equivalence and view and conflict serializability respectively?

b) Given is the following history: H = r1(a) r3(b) r2(a) w1(a) w1(c) c1 w2(c) w2(d) c2 w3(c) c3

- Is the history conflict serializable? Why?

- Is the history view serializable? Why?

5.4 Order Preservation of Transactions

Order preservation of transactions:
Def: Ti is in H entirely before Tj, if for all $o \in op(T_j)$ we have $c_i <_H o$.
Give an example of a CSR history H with the following properties:

- Transaction T1 is entirely before T2 in H.
- In every serial history H', conflict-equivalent to H, T2 is entirely before T1.

5.5 Recoverability

a) To what extent are the classes (resp. their characteristics) RC (recoverable), ACA (Avoids Cascading Aborts) and ST (Strict) of practical significance? Explain the problematic by use of examples.

b) Show that CSR and ST are incomparable sets.

5.6 Serializability and Recoverability

Give examples of histories with the following properties:

a) $H1 =? : H1 \in (CSR \cap RC) \setminus ACA$

b) $H2 =? : H2 \in (VSR \cap ACA) \setminus (CSR \cup ST)$

c) $H3 =? : H3 \in ST \setminus VSR$