Weekly exercises IN3020&4020 (2024)
Week 8: Transaction Management Concepts

1 Transaction Management Introduction: Review

1. What do we mean by transactions (informally) and their concurrent execution of database transactions?
2. Is transaction management relevant for a single-user DBMS? If so, why?
3. Why does a transaction need to read a block of data from the disk to local memory when executing `write`(X)?
4. Why do we need concurrency control?
5. What are the 4 concurrency control problems (phenomena) described in the lecture, describe and discuss each one of them.
6. Why do we need recovery management?
7. What can cause a transaction abort?
8. Discuss the ACID properties of a database transaction, including the subsystems responsible for ensuring them.

2 Transactions, schedules, conflicts

1. Describe the structure of committed, aborted, and partial translations.
2. Explain what is a schedule and when it is complete.
3. Explain what is a conflict in the context of transaction management. What should we do to avoid such conflicts? (Note: this question is provocative)

T_1
read(X);
$X := X - 1$;
write(X);
read(Y);
$Y := Y + 1$;
write(Y);

T_2
read(X);
$X := X + 1$;
write(X);

Figure 1: Transactions T_1 and T_2

T_1	T_2
read(X);	
$X := X - 1$;	
	read(X);
	$X := X + 1$;
write(X);	
read(Y);	
	write(X);
$Y := Y + 1$;	
write(Y);	

T_1	T_2
read(X);	
$X := X - 1$;	
write(X);	
	read(X);
	$X := X + 1$;
	write(X);
read(Y);	

Figure 2: Schedules A and B

3 Concurrent transactions

Consider the following two transactions in Figure 1 and schedules in Figure 2.

1. Write these transactions in our abbreviated syntax. Which of these transactions are committed, aborted, and partial?
2. Write these schedules in our abbreviated syntax. Which of these schedules are schedules of the two transactions?
3. Let the value of data item X (in the database) before a schedule starts be 10. Write the value of data item X (in the database) after each operation of Schedule A and of Schedule B.
4. Let us assume that Schedule A and of Schedule B both commit after their last operation in the figure. Which of them, you think, ensures Isolation principle?
5. List all the conflicts in Schedule A with their types.
6. (*) Give examples of concurrency control phenomena discussed in the lectures and Question 1.5 written as schedules in our syntax.