

Programming Applications with Databases

Exercise Set 4

1. Create three examples showing the anomalies of dirty read, non-repeatable read, and phantom read, respectively. Verify experimentally what are the isolation levels at which these anomalies appear. Present visually interactions between two parallel scripts pointing out where exactly an anomaly occurs and that a respective isolation level is preventing that.

[3p]

2. Consider the following table:

ID	Patient	Patient Address	Appointment time and location	Price	Physician	Appointment cause
1	Jan Kot	6 Dolna Street, 44-444 Bór	2029-02-01 12:30, room 12	300 zł	Oleg Wyrwiząb	Dental: Denture fitting in (...)
2	Maria Mysz	9 Górna Street, 55-555 Las	2030-01-04 11:45, room 7	150 zł	Ewa Ciarka	Dermatology: Birthmark inspection (...)

Design alternative schemas for the same data that conform with 1NF, 2NF, and 3NF. There is no need to create an SQL script, it is enough to present appropriate schemas.

[3p]

3. Consider the following query:

```
SELECT DISTINCT c.PESEL, c.Nazwisko
FROM Egzemplarz e
JOIN Ksiazka k ON e.Ksiazka_ID=k.Ksiazka_ID
JOIN Wypozyczenie w ON e.Egzemplarz_ID=w.Egzemplarz_ID
JOIN Czytelnik c ON c.Czytelnik_ID = w.Czytelnik_ID;
```

The following query that contains a subquery returns the same result:

```
SELECT c.PESEL, c.Nazwisko
FROM Czytelnik c WHERE c.Czytelnik_ID IN
(SELECT w.Czytelnik_ID FROM Wypozyczenie w
JOIN Egzemplarz e ON e.Egzemplarz_ID=w.Egzemplarz_ID
JOIN Ksiazka k ON e.Ksiazka_ID=k.Ksiazka_ID)
```

Compare and briefly analyze query plans. Generate more data and try to compare execution times. Create another variant of this query (i.e. guaranteed to return the same result) with a one more subquery. Analyze its query plan and compare the execution time with the others.

[2p]

4. Consider a query that joins the tables *Książka* (book) and *Egzemplarz* (book copy, specimen). Create clustered and non-clustered indexes, and at least one covering index to support the query. Analyze the query plans.

[2p]

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