INM370 – Advanced Databases

Tutorial 3 – Relational Database Management Issues

I. Consider a relational database, which maintains, among other details, information about students' login/password together with the respective registration fee amount. The database controls issuing of login/password to the students that have paid the respective registration by debit card.

   For each transaction control property (i.e. for each of the ACID properties), explain the property and give an example of a problem that might occur with the database above if the property is not supported.

II. Explain the concept of Transaction Isolation level. What are the 4 Isolation Levels defined by the SQL-92 standard, and which anomalies does each protect, or not, against? What trade-off does a programmer face when choosing an isolation level?

III. Demonstrate the Non-Repeatable read anomaly in Oracle DBMS when transaction isolation level is set to READ COMMITTED[1]

Table "Customer" needs to be created with columns cID (INTEGER), and Balance (NUMBER (5,2)) and it needs to contain at least one row with the values (1, 10)

```
CREATE TABLE Customer
(
     cID INTEGER,
     Balance NUMBER (5,2)
);

INSERT INTO Customer VALUES (1, 10)
```

Then execute the following commands, in two terminals, following the indicated sequence: 1) to 9).

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Terminal 1

1) connect to Oracle DBMSs on `nsq754ap.enterprise.internal.city.ac.uk` (via SQLcl, and SQLDeveloper);

```
2) SET TRANSACTION ISOLATION LEVEL READ COMMITTED;
5) SELECT * FROM Customer WHERE cID = 1;
8) SELECT * FROM Customer WHERE cID = 1;
9) COMMIT;
```

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Terminal 2

3) connect to Oracle DBMSs on `nsq754ap.enterprise.internal.city.ac.uk` (via SQLcl, or SQLDeveloper);

```
4) SET TRANSACTION ISOLATION LEVEL READ COMMITTED;
```

[1] This is the default Isolation Level in Oracle.

```
6) UPDATE Customer SET Balance = Balance + 15 WHERE cID = 1;
7) COMMIT;
```

How is the “Non-repeatable read” anomaly demonstrated here?
Which transaction isolation level(s) would guard against such anomaly?
Does it make a difference if we execute each session using two different database client programs (e.g. one using SQLcl, the other using SQLDeveloper)? Justify your answer.

IV. Review, and understand, Lost Update, Uncommitted Dependency, and Inconsistent Analysis problems, and their *examples* - see Sect. 22.2.1 in the Connolly & Begg book, where the problems are specified, as well as possible *solutions* – see Sect. 22.2.3 in the Connolly & Begg book where these are provided. Review the relevant lecture slides, too (especially 25-27).