Transaction processing in ANSI SQL

Dirty read phenomenon

Transaction 1	Transaction 2
	SELECT budget FROM Department WHERE name = 'SALES'
	2000
UPDATE DEPARTMENT SET BUDGET = BUDGET + 1000 WHERE NAME = 'Sales';	
	SELECT budget FROM Department WHERE name = 'SALES'
	3000
ROLLBACK;	
	???

Reading only committed data

Transaction 1	Transaction 2
	SELECT budget FROM Department WHERE name = 'SALES'
	2000
UPDATE DEPARTMENT SET BUDGET = BUDGET + 1000 WHERE NAME = 'Sales';	
	SELECT budget FROM Department WHERE name = 'SALES'
	2000
ROLLBACK;	

Non-repeatable read phenomenon

Transaction 1	Transaction 2
	SELECT budget FROM Department WHERE name = 'SALES'
	2000
UPDATE DEPARTMENT SET BUDGET = BUDGET + 1000 WHERE NAME = 'Sales';	
COMMIT;	
	SELECT budget FROM Department WHERE name = 'SALES'
	3000
	???

Phantom phenomenon

Transaction 1	Transaction 2
	SELECT count(*) FROM Department;
	20
DELETE DEPARTMENT WHERE NAME = 'Sales';	
COMMIT;	
	SELECT count(*) FROM Department;
	19

No phantoms

Transaction 1	Transaction 2
	SELECT count(*) FROM Department;
	20
DELETE DEPARTMENT WHERE NAME = 'Sales';	
COMMIT;	
	SELECT count(*) FROM Department;
	20

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Isolation levels

SQL provides four <u>levels of isolation</u> for database transactions

Isolation levels are equivalent to correctness levels

Isolation levels are defined in terms of several possible phenomena, or weird hard-to-explain occurrences of operations

Isolation levels

```
READ UNCOMMITTED
READ COMMITTED
REPEATABLE READ
SERIALIZABLE
```

Phenomena

Dirty read phenomenon
Read operations may access *dirty data*, i.e. data written by uncommitted transactions

Non-repeatable read phenomenon
Different reads by a single transaction to the same data will not be repeatable, i.e. they may return different values

Phantom phenomenon
A set of rows that transaction reads once might be a different set of rows if the transaction attempts to read them again

READ UNCOMMITTED level

At `READ UNCOMMITTED` isolation level a transaction may exhibit:
**   *dirty read phenomenon,***
**   *non-repeatable read phenomenon,***
**   *phantom phenomenon***

READ COMMITTED level

At `READ COMMITTED` isolation level a transaction may exhibit:
**   *non-repeatable read phenomenon,***
**   *phantom phenomenon***

REPEATABLE READ level

At `REPEATABLE READ` isolation level a transaction may exhibit:
**   *phantom phenomenon***

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SERIALIZABLE level

At **SERIALIZABLE** isolation level a transaction may exhibit:

none of the phenomena

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Isolation levels

Level	Dirty Read	Nonrepeatable Read	Phantom
READ UNCOMMITTED	Possible	Possible	Possible
READ COMMITTED	Not possible	Possible	Possible
REPEATABLE READ	Not possible	Not possible	Possible
SERIALIZABLE	Not possible	Not possible	Not possible

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Setting isolation levels in ANSI SQL

```
SET TRANSACTION ISOLATION LEVEL READ UNCOMMITTED
SET TRANSACTION ISOLATION LEVEL READ COMMITTED
SET TRANSACTION ISOLATION LEVEL REPEATABLE READ
SET TRANSACTION ISOLATION LEVEL SERIALIZABLE
```

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References

Elmasri R., Navathe S., Fundamentals of Database Systems, 6th edition, chapter 21.6 Transaction Support in SQL, pp. 774-776
`http://www.uow.edu.au/~jrg/235/HOMEWORK`
`10 How to control database transactions ?`