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4.1 Isolation Levels and SQL

a)

How can you determine the currently set isolation level?

```
SHOW TRANSACTION ISOLATION LEVEL;
```

What is the default isolation level of PostgreSQL?
Read Committed is the default isolation level in PostgreSQL.

How can the isolation level be changed during a session in PostgreSQL?

For current transaction:

```
SET TRANSACTION ISOLATION LEVEL
{ SERIALIZABLE | REPEATABLE READ | READ COMMITTED | READ UNCOMMITTED }
```

For default transaction characteristics:

```
SET SESSION CHARACTERISTICS AS TRANSACTION ISOLATION LEVEL
{ SERIALIZABLE | REPEATABLE READ | READ COMMITTED | READ UNCOMMITTED }
```

b)

```
CREATE TABLE public."OPK"
(
    "ID" integer,
    "NAME" text
);

ALTER TABLE public."OPK"
    OWNER to postgres;
```

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c)

```
INSERT INTO public."OPK"(
    "ID", "NAME")
    VALUES (1, 'shaggy');

INSERT INTO public."OPK"(
    "ID", "NAME")
    VALUES (2, 'fred');

INSERT INTO public."OPK"(
    "ID", "NAME")
    VALUES (3, 'velma');

INSERT INTO public."OPK"(
    "ID", "NAME")
    VALUES (4, 'scooby');

INSERT INTO public."OPK"(
    "ID", "NAME")
    VALUES (5, 'daphne');
```

d)

Scenario: A transaction T1 updates / writes in the same row in the same table, at the same time. T1 holds an exclusive lock for the addressed row. The transaction T2 from the exercise sheet tries to get a shared lock for the select query. But T2 must wait until T1 releases its lock. When T1 ends and releases its exclusive lock, T2 gets shared lock, queries OPK table and ends.

Read Committed:

Under read committed isolation, the user is only allowed to read committed data. If a transaction needs to read a row that has been modified by an incomplete transaction in another session, the transaction waits until the first transaction completes (either commits or rolls back.) Read Committed isolation prevents Dirty Read.

read committed releases the shared lock as soon as possible

Diese Isolationsebene setzt fÃijr die gesamte Transaktion Schreibsperren auf Objekten, die verÃďndert werden sollen, setzt Lesesperren aber nur kurzzeitig beim tatsÃďchlichen Lesen der Daten ein. Daher kÃűnnen Non-Repeatable Read und Phantom Read auftreten, wenn wÃďhrend wiederholten Leseoperationen auf dieselben Daten, zwischen der ersten und der zweiten Leseoperation, eine Schreiboperation einer anderen Transaktion die Daten verÃďndert und committed.

In DB2: Read Committed = Cursor Stability CS is the default isolation level. - Locks and unlocks each row, 1 at a time (never has 2 locks at once) - Guaranteed to only return data which was committed at the time of the read

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Cursor Stability - 2 Locks needed IS Table lock, 1 NS row lock

Shared Locks are acquired for the concerned records. The Shared Locks are released when the current instruction ends. This isolation level prevents "Dirty Reads"but, since the record can be updated by other concurrent transactions, "Non-Repeatable Reads"(transaction A retrieves a row, transaction B subsequently updates the row, and transaction A later retrieves the same row again. Transaction A retrieves the same row twice but sees different data) or "Phantom Reads"(in the course of a transaction, two identical queries are executed, and the collection of rows returned by the second query is different from the first) can occur.

e)

The transaction can repeat the same query, and no rows that have been read by the transaction will have been updated or deleted.

Under Repeatable Reads isolation level, Shared Locks are acquired for the transaction duration. "Dirty Readsänd "Non-Repeatable Readsäre prevented but "Phantom Reads"can still occur.

REPEATABLE READ guarantees that no item you've selected the first time can be modified or deleted until you commit.

SQL Scripts

Create Database

```
CREATE DATABASE dis
    WITH
    OWNER = postgres
    ENCODING = 'UTF8'
    CONNECTION LIMIT = -1;
```

Create Tables

```
CREATE TABLE public.estate_agent
(
    agent_login text,
    agent_name text,
    agent_address text,
    agent_password text,
    PRIMARY KEY (agent_login)
);

ALTER TABLE public.estate_agent
    OWNER to postgres;
```

```
CREATE TABLE public.estate
(
    estate_id serial,
    city text,
    postal_code integer,
    street text,
    street_number text,
    square_area integer,
    manager text,
    PRIMARY KEY (estate_id),
    CONSTRAINT manager FOREIGN KEY (manager)
        REFERENCES public.estate_agent (agent_login) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID
);

ALTER TABLE public.estate
    OWNER to postgres;


CREATE TABLE public.apartment
(
    floor integer,
    rent text,
    rooms text,
    balcony boolean,
    kitchen boolean,
    CONSTRAINT apartment_pkey PRIMARY KEY (estate_id),
    CONSTRAINT manager FOREIGN KEY (manager)
        REFERENCES public.estate_agent (agent_login) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID
)
    INHERITS (public.estate);

ALTER TABLE public.apartment
    OWNER to postgres;


CREATE TABLE public.house
```

```
(
    floors integer,
    price text,
    garden boolean,
    CONSTRAINT house_pkey PRIMARY KEY (estate_id),
    CONSTRAINT manager FOREIGN KEY (manager)
        REFERENCES public.estate_agent (agent_login) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
)
    INHERITS (public.estate)
TABLESPACE pg_default;

ALTER TABLE public.house
    OWNER to postgres;


CREATE TABLE public.person
(
    id serial,
    first_name text,
    last_name text,
    address text,
    PRIMARY KEY (id)
);

ALTER TABLE public.person
    OWNER to postgres;


CREATE TABLE public.contract
(
    contract_number serial,
    contract_date date,
    place text,
    PRIMARY KEY (contract_number)
);

ALTER TABLE public.contract
    OWNER to postgres;


CREATE TABLE public.tenancy_contract
(
    start_date date,
    duration text,
    additional_costs text,
    person_id integer,
    apartment_id integer,
    CONSTRAINT tenancy_contract_pkey PRIMARY KEY (contract_number),
    CONSTRAINT person_id FOREIGN KEY (person_id)
        REFERENCES public.person (id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID,
    CONSTRAINT apartment_id FOREIGN KEY (apartment_id)
        REFERENCES public.apartment (estate_id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID
)
    INHERITS (public.contract);

ALTER TABLE public.tenancy_contract
    OWNER to postgres;


CREATE TABLE public.purchase_contract
(
    installment_amount text,
    intrest_rate text,
    person_id integer,
    house_id integer,
    CONSTRAINT purchase_contract_pkey PRIMARY KEY (contract_number),
    CONSTRAINT person_id FOREIGN KEY (person_id)
        REFERENCES public.person (id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID,
    CONSTRAINT house_id FOREIGN KEY (house_id)
        REFERENCES public.house (estate_id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID
)
    INHERITS (public.contract);

ALTER TABLE public.purchase_contract
```

```
    OWNER to postgres;
```

Insert Estate Agent

```
INSERT INTO public.estate_agent(
    agent_login, agent_name, agent_address, agent_password)
    VALUES ('testagent', 'testname', 'testaddress', 'testpassword');
```

4.2 Lock Conflicts

a)

b)

c)

d)

e)

Create an apartment, an estate agent and a tenancy contract with your java application. Validate that they are in the database (e.g. by using a screenshot of application and database).

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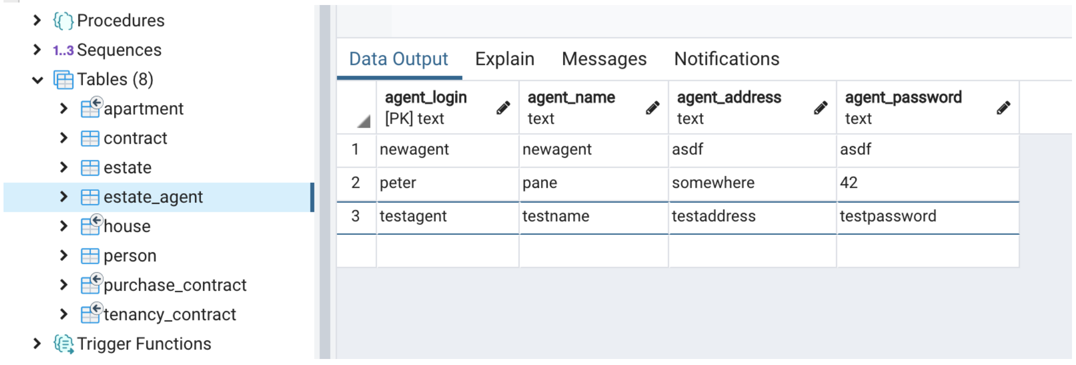
Create Estate Agent

```
Estate Agent Management:
[1] Create Agent
[2] Update Agent
[3] Delete Agent
[4] Back to Main Menu
Input: 1
Login: peter
Name: pane
Address: somewhere
Password: 42

Agent [peter, pane, somewhere, 42] created.
```

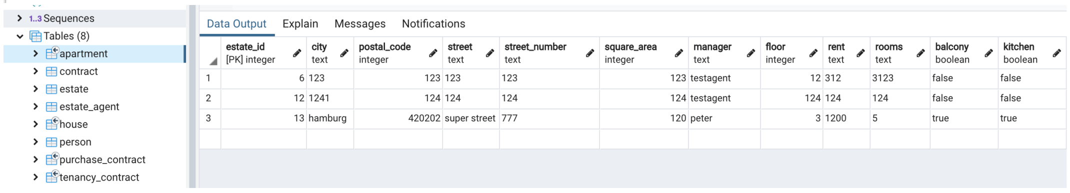


	agent_login [PK] text	agent_name text	agent_address text	agent_password text
1	newagent	newagent	asdf	asdf
2	peter	pane	somewhere	42
3	testagent	testname	testaddress	testpassword

Create Apartment

```
Estate Management. Logged in as [peter]:
[1] Create Estate
[2] Update Estate
[3] Delete Estate
[4] Back to Main Menu
Input: 1
Create new Estate. Only [peter] can perform actions:
[1] Create Apartment
[2] Create House
[3] Back to Estate Menu
Input: 1
City: hamburg
Postalcode: 420202
Street: super street
Street Number: 777
Square Area: 120
Floor: 3
Rent: 1200
Rooms: 5
Balcony (1 = yes): 1
Kitchen (1 = yes): 1

Apartment [13, hamburg, 420202, super street, 777, 120, peter, 3, 1200, 5, true, true] created.
```



	estate_id [PK] integer	city text	postal_code integer	street text	street_number text	square_area integer	manager text	floor integer	rent text	rooms text	balcony boolean	kitchen boolean
1	6	123	123	123	123	123	testagent	12	312	3123	false	false
2	12	1241	124	124	124	124	testagent	124	124	124	false	false
3	13	hamburg	420202	super street	777	120	peter	3	1200	5	true	true

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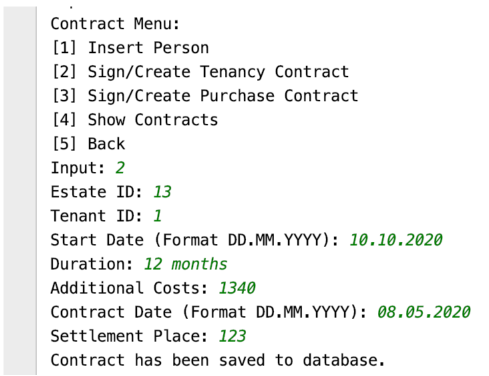
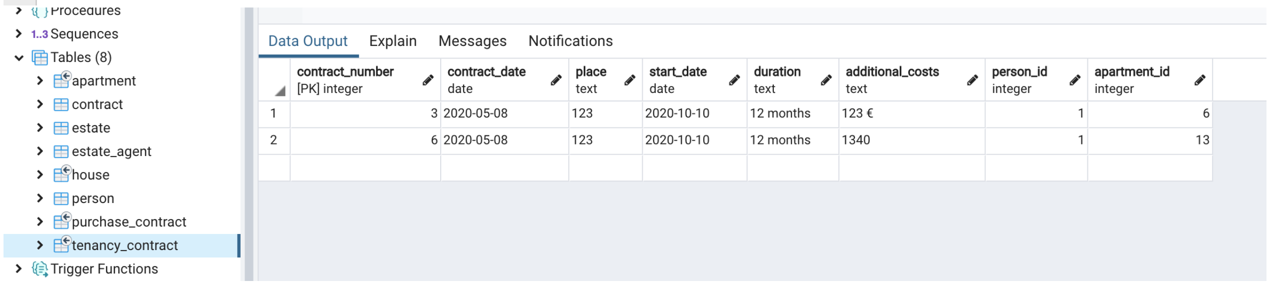
Create Tenancy Contract



```
Contract Menu:
[1] Insert Person
[2] Sign/Create Tenancy Contract
[3] Sign/Create Purchase Contract
[4] Show Contracts
[5] Back
Input: 2
Estate ID: 13
Tenant ID: 1
Start Date (Format DD.MM.YYYY): 10.10.2020
Duration: 12 months
Additional Costs: 1340
Contract Date (Format DD.MM.YYYY): 08.05.2020
Settlement Place: 123
Contract has been saved to database.
```



	contract_number [PK] integer	contract_date date	place text	start_date date	duration text	additional_costs text	person_id integer	apartment_id integer
1	3	2020-05-08	123	2020-10-10	12 months	123 €	1	6
2	6	2020-05-08	123	2020-10-10	12 months	1340	1	13

Create a contract with a non-existing estate. Does it work? Why/Why not?
No it does not work. The foreign key 'apartment-id' in the tenancy contract table needs to be valid. If the entered id is not existing in the corresponding estate table, an exception will be thrown:
ERROR: insert or update on table tenancy-contract violates foreign key constraint person-id
Detail: Key (person-id)=(123) is not present in table person.

Which inheritance model did you choose and why?
Horizontal: Postgresql offers the INHERITS keyword, which enables horizontal partitioning. Therefore we used this keyword because it is intuitive to use easy to implement.

Create an apartment, and let your application crash between inserting the estate information and inserting the apartment information. What is the effect on your database state?
Since it is only possible to create an apartment or house in one go, this use case will not happen. If the application crashes while the user inserts information for the estate he wants to create, the record will not be saved.