Учреждение образования

«БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ ИНФОРМАТИКИ И РАДИОЭЛЕКТРОНИКИ»

Отчет по лабораторной работе №5

по дисциплине «Модели данных и системы управления базами данных»

Студент: гр. 953501
Кореневский С. А.

Проверил: Чащин С.В.

Минск 2022

Задание 1

Создать три таблицы произвольной структуры, необходимые условия: в каждой таблице необходим первичный ключ. В таблицах как минимум 3 столбца. Предусмотреть наличие внешних ключей и наличия столбцов символьного типа, цифрового типа и типа дата-время.

```sql
create table aircraft_carrier (
    id number generated by default on null as identity primary key,
    name varchar(50),
    displacement number,
    max_aircraft_number int,
    commissioned date
);

create table fighter_jet (
    id number generated by default on null as identity primary key,
    type varchar2(50),
    speed number,
    aircraft_carrier_id number,
    constraint ac_fj_fk foreign key (aircraft_carrier_id)
        references aircraft_carrier(id) on delete cascade
);

create table bomber (
    id number generated by default on null as identity primary key,
    type varchar2(50),
    bombs_capacity int,
    aircraft_carrier_id number,
    constraint ac_b_fk foreign key (aircraft_carrier_id)
        references aircraft_carrier(id) on delete cascade
);
```

Результат:

```
STANKORE> create table aircraft_carrier (
              id number generated by default on null as identity primary key,
              name varchar(50),
              displacement number,
              max_aircraft_number int,
              commissioned date
          )
[2022-05-20 16:21:17] completed in 98 ms




STANKORE> create table fighter_jet (
              id number generated by default on null as identity primary key,
              type varchar2(50),
              speed number,
              aircraft_carrier_id number,
              constraint ac_fj_fk foreign key (aircraft_carrier_id)
                  references aircraft_carrier(id) on delete cascade
          )
[2022-05-20 16:21:24] completed in 63 ms




STANKORE> create table bomber (
              id number generated by default on null as identity primary key,
              type varchar2(50),
              bombs_capacity int,
              aircraft_carrier_id number,
              constraint ac_b_fk foreign key (aircraft_carrier_id)
                  references aircraft_carrier(id) on delete cascade
          )
[2022-05-20 16:21:26] completed in 56 ms
```

Задание 2

Реализовать механизм сохранения изменений данных в этих таблицах (интересуют только DML изменения).

```sql
create table aircraft_carrier_audit (
    operation_id number generated by default on null as identity primary key,
    operation_type varchar2(10),
    operation_ts timestamp,
    operation_reverted number,
    old_ac_id number,
    new_ac_id number,
    old_name varchar(50),
    new_name varchar(50),
    old_displacement number,
    new_displacement number,
    old_max_aircraft_number int,
    new_max_aircraft_number int,
    old_commissioned date,
    new_commissioned date
);

create table fighter_jet_audit (
    operation_id number generated by default on null as identity primary key,
    operation_type varchar2(10),
    operation_ts timestamp,
    operation_reverted number,
    old_fj_id number,
    new_fj_id number,
    old_type varchar2(50),
    new_type varchar2(50),
    old_speed number,
    new_speed number,
    old_aircraft_carrier_id number,
    new_aircraft_carrier_id number
);

create table bomber_audit (
    operation_id number generated by default on null as identity primary key,
    operation_type varchar2(10),
    operation_ts timestamp,
    operation_reverted number,
    old_b_id number,
    new_b_id number,
    old_type varchar2(50),
    new_type varchar2(50),
    old_bombs_capacity int,
    new_bombs_capacity int,
```

```sql
        old_aircraft_carrier_id number,
        new_aircraft_carrier_id number
);
create or replace trigger aircraft_carrier_audit_trigger before
        update or insert or delete on aircraft_carrier
        for each row
begin
        case
                when updating then
                        insert into aircraft_carrier_audit (
                                operation_type,
                                operation_ts,
                                operation_reverted,
                                old_ac_id,
                                new_ac_id,
                                old_name,
                                new_name,
                                old_displacement,
                                new_displacement,
                                old_max_aircraft_number,
                                new_max_aircraft_number,
                                old_commissioned,
                                new_commissioned
                        ) values (
                                'UPDATE',
                                current_timestamp,
                                0,
                                :old.id,
                                :new.id,
                                :old.name,
                                :new.name,
                                :old.displacement,
                                :new.displacement,
                                :old.max_aircraft_number,
                                :new.max_aircraft_number,
                                :old.commissioned,
                                :new.commissioned
                        );
                when inserting then
                        insert into aircraft_carrier_audit (
                                operation_type,
                                operation_ts,
                                operation_reverted,
                                new_ac_id,
                                new_name,
                                new_displacement,
                                new_max_aircraft_number,
                                new_commissioned
                        ) values (
                                'INSERT',
                                current_timestamp,
                                0,
                                :new.id,
                                :new.name,
                                :new.displacement,
```

```sql
                :new.max_aircraft_number,
                :new.commissioned
            );
        when deleting then
            insert into aircraft_carrier_audit (
                operation_type,
                operation_ts,
                operation_reverted,
                old_ac_id,
                old_name,
                old_displacement,
                old_max_aircraft_number,
                old_commissioned
            ) values (
                'DELETE',
                current_timestamp,
                0,
                :old.id,
                :old.name,
                :old.displacement,
                :old.max_aircraft_number,
                :old.commissioned
            );
    end case;
end;

create or replace trigger fighter_jet_audit_trigger before
    update or insert or delete on fighter_jet
    for each row
begin
    case
        when updating then
            insert into fighter_jet_audit (
                operation_type,
                operation_ts,
                operation_reverted,
                old_fj_id,
                new_fj_id,
                old_type,
                new_type,
                old_speed,
                new_speed,
                old_aircraft_carrier_id,
                new_aircraft_carrier_id
            ) values (
                'UPDATE',
                current_timestamp,
                0,
                :old.id,
                :new.id,
                :old.type,
                :new.type,
                :old.speed,
                :new.speed,
                :old.aircraft_carrier_id,
```

```sql
                    :new.aircraft_carrier_id
                );
            when inserting then
                insert into fighter_jet_audit (
                    operation_type,
                    operation_ts,
                    operation_reverted,
                    new_fj_id,
                    new_type,
                    new_speed,
                    new_aircraft_carrier_id
                ) values (
                    'INSERT',
                    current_timestamp,
                    0,
                    :new.id,
                    :new.type,
                    :new.speed,
                    :new.aircraft_carrier_id
                );
            when deleting then
                insert into fighter_jet_audit (
                    operation_type,
                    operation_ts,
                    operation_reverted,
                    old_fj_id,
                    old_type,
                    old_speed,
                    old_aircraft_carrier_id
                ) values (
                    'DELETE',
                    current_timestamp,
                    0,
                    :old.id,
                    :old.type,
                    :old.speed,
                    :old.aircraft_carrier_id
                );
        end case;
end;

create or replace trigger bomber_audit_trigger before
    update or insert or delete on bomber
    for each row
begin
    case
        when updating then
            insert into bomber_audit (
                operation_type,
                operation_ts,
                operation_reverted,
                old_b_id,
                new_b_id,
                old_type,
                new_type,
```

```sql
                old_bombs_capacity,
                new_bombs_capacity,
                old_aircraft_carrier_id,
                new_aircraft_carrier_id
            ) values (
                'UPDATE',
                current_timestamp,
                0,
                :old.id,
                :new.id,
                :old.type,
                :new.type,
                :old.bombs_capacity,
                :new.bombs_capacity,
                :old.aircraft_carrier_id,
                :new.aircraft_carrier_id
            );
        when inserting then
            insert into bomber_audit (
                operation_type,
                operation_ts,
                operation_reverted,
                new_b_id,
                new_type,
                new_bombs_capacity,
                new_aircraft_carrier_id
            ) values (
                'INSERT',
                current_timestamp,
                0,
                :new.id,
                :new.type,
                :new.bombs_capacity,
                :new.aircraft_carrier_id
            );
        when deleting then
            insert into bomber_audit (
                operation_type,
                operation_ts,
                operation_reverted,
                old_b_id,
                old_type,
                old_bombs_capacity,
                old_aircraft_carrier_id
            ) values (
                'DELETE',
                current_timestamp,
                0,
                :old.id,
                :old.type,
                :old.bombs_capacity,
                :old.aircraft_carrier_id
            );
    end case;
end;
```

Результат:

```
STANKORE> create table aircraft_carrier_audit (
                ...
            )
[2022-05-12 17:29:02] completed in 67 ms



STANKORE> create table fighter_jet_audit (
                ...
            )
[2022-05-12 17:29:06] completed in 54 ms



STANKORE> create table bomber_audit (
                ...
            )
[2022-05-12 17:29:09] completed in 64 ms



STANKORE> create or replace trigger
aircraft_carrier_audit_trigger before
                update or insert or delete on aircraft_carrier
                for each row
            begin
                ...
            end;
[2022-05-12 17:29:13] completed in 67 ms



STANKORE> create or replace trigger fighter_jet_audit_trigger before
                update or insert or delete on fighter_jet
                for each row
            begin
                ...
            end;
[2022-05-12 17:29:18] completed in 25 ms



STANKORE> create or replace trigger bomber_audit_trigger before
                update or insert or delete on bomber
                for each row
            begin
                ...
            end;
[2022-05-12 17:29:21] completed in 20 ms
```
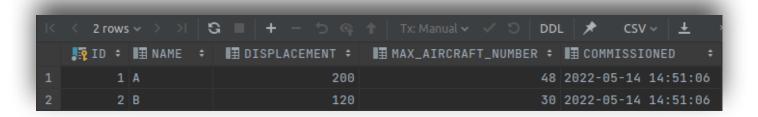
```sql
begin
    insert into aircraft_carrier(
        name, displacement, max_aircraft_number, commissioned
    ) values (
        'A', 200, 45, sysdate
    );
    insert into aircraft_carrier(
        name, displacement, max_aircraft_number, commissioned
    ) values (
        'B', 120, 30, sysdate
    );
    insert into aircraft_carrier(
        name, displacement, max_aircraft_number, commissioned
    ) values (
        'C', 80, 15, sysdate
    );
end;

begin
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F1', 300, 1
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F1', 290, 2
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F1', 295, 1
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F2 type 2', 255, 1
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F2 type 2', 250, 2
    );
```

```sql
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F2 type 2', 245, 1
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F2 type 3', 220, 2
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F2 type 4', 215, 1
    );
    insert into fighter_jet(
        "TYPE", speed, aircraft_carrier_id
    ) values (
        'F2 type 5', 215, 3
    );
end;

begin
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B1', 60, 1
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B1', 60, 2
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B1', 58, 1
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B2 type 2', 48, 1
    );
    insert into bomber(
```
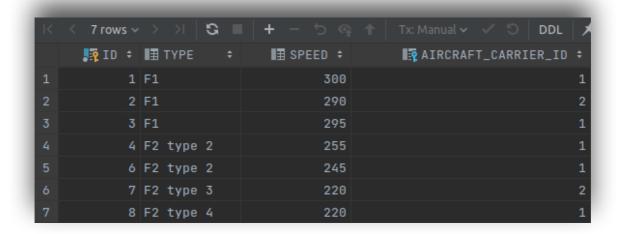
```sql
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B2 type 2', 48, 2
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B2 type 2', 48, 1
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B2 type 3', 40, 2
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B2 type 4', 38, 1
    );
    insert into bomber(
        "TYPE", bombs_capacity, aircraft_carrier_id
    ) values (
        'B2 type 5', 37, 3
    );
end;

begin
    update aircraft_carrier
    set max_aircraft_number=48 where max_aircraft_number = 45;

    update fighter_jet
    set speed=220 where speed = 215;

    update bomber
    set bombs_capacity=49 where bombs_capacity = 48;
end;

begin
    delete from fighter_jet where speed = 250;
    delete from bomber where bombs_capacity = 38;
    delete from aircraft_carrier where max_aircraft_number = 15;
end;

select * from aircraft_carrier;
```
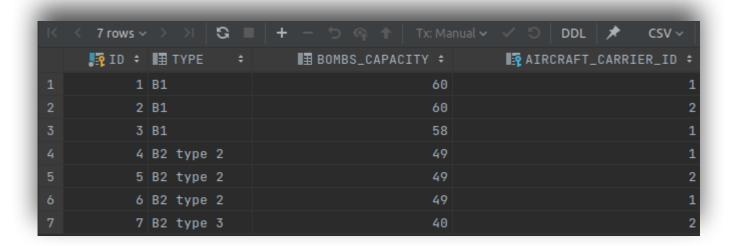
```sql
select * from fighter_jet;
select * from bomber;

select * from aircraft_carrier_audit;
select * from fighter_jet_audit;
select * from bomber_audit;
```

2 rows

ID	NAME	DISPLACEMENT	MAX_AIRCRAFT_NUMBER	COMMISSIONED
1	A	200	48	2022-05-14 14:51:06
2	B	120	30	2022-05-14 14:51:06

7 rows

	ID	TYPE	SPEED	AIRCRAFT_CARRIER_ID
1	1	F1	300	1
2	2	F1	290	2
3	3	F1	295	1
4	4	F2 type 2	255	1
5	6	F2 type 2	245	1
6	7	F2 type 3	220	2
7	8	F2 type 4	220	1

7 rows

	ID	TYPE	BOMBS_CAPACITY	AIRCRAFT_CARRIER_ID
1	1	B1	60	1
2	2	B1	60	2
3	3	B1	58	1
4	4	B2 type 2	49	1
5	5	B2 type 2	49	2
6	6	B2 type 2	49	1
7	7	B2 type 3	40	2

Table 1 (5 rows)

OPERATION_ID	OPERATION_TYPE	OPERATION_TS
1	INSERT	2022-05-14 14:51:06.273701
2	INSERT	2022-05-14 14:51:06.276138
3	INSERT	2022-05-14 14:51:06.277563
4	UPDATE	2022-05-14 14:51:24.918724
5	DELETE	2022-05-14 14:51:29.217374

Table 2 (13 rows)

OPERATION_ID	OPERATION_TYPE	OPERATION_TS
1	INSERT	2022-05-14 14:51:11.061962
2	INSERT	2022-05-14 14:51:11.066505
3	INSERT	2022-05-14 14:51:11.067859
4	INSERT	2022-05-14 14:51:11.069160
5	INSERT	2022-05-14 14:51:11.070299
6	INSERT	2022-05-14 14:51:11.071428
7	INSERT	2022-05-14 14:51:11.072651
8	INSERT	2022-05-14 14:51:11.073687
9	INSERT	2022-05-14 14:51:11.074860
10	UPDATE	2022-05-14 14:51:24.923257
11	UPDATE	2022-05-14 14:51:24.923505
12	DELETE	2022-05-14 14:51:29.211559
13	DELETE	2022-05-14 14:51:29.221673

Table 3 (14 rows)

:ID	OPER...	OPERATION_TS	OPERATION_REV...	OLD_B_ID	NEW_B_ID	OLD_TYPE	NEW_TYPE	OLD_BOMBS...	NEW_BOM...	OLD_AIRCRAFT_CARRIER_ID	NEW_AIRCRAFT_CARRIER_ID
1	1 INSERT	2022-05-14 14:51:17.091426	0	<null>	1	<null>	B1	<null>	60	<null>	1
2	2 INSERT	2022-05-14 14:51:17.096902	0	<null>	2	<null>	B1	<null>	60	<null>	2
3	3 INSERT	2022-05-14 14:51:17.098951	0	<null>	3	<null>	B1	<null>	58	<null>	1
4	4 INSERT	2022-05-14 14:51:17.101424	0	<null>	4	<null>	B2 type 2	<null>	48	<null>	1
5	5 INSERT	2022-05-14 14:51:17.103751	0	<null>	5	<null>	B2 type 2	<null>	48	<null>	2
6	6 INSERT	2022-05-14 14:51:17.104407	0	<null>	6	<null>	B2 type 2	<null>	48	<null>	1
7	7 INSERT	2022-05-14 14:51:17.106552	0	<null>	7	<null>	B2 type 3	<null>	48	<null>	2
8	8 INSERT	2022-05-14 14:51:17.108600	0	<null>	8	<null>	B2 type 4	<null>	38	<null>	1
9	9 INSERT	2022-05-14 14:51:17.111060	0	<null>	9	<null>	B2 type 5	<null>	37	<null>	3
10	10 UPDATE	2022-05-14 14:51:24.927683	0	4	4	B2 type 2	B2 type 2	48	49	1	1
11	11 UPDATE	2022-05-14 14:51:24.927904	0	5	5	B2 type 2	B2 type 2	48	49	2	2
12	12 UPDATE	2022-05-14 14:51:24.928005	0	6	6	B2 type 2	B2 type 2	48	49	1	1
13	13 DELETE	2022-05-14 14:51:29.213999	0	8	<null>	B2 type 4	<null>	38	<null>	1	<null>
14	14 DELETE	2022-05-14 14:51:29.223399	0	9	<null>	B2 type 5	<null>	37	<null>	3	<null>

Задание 3

Реализовать перегруженную пакетную процедуру на вход которой подается либо дата-время либо интервал в миллисекундах в первом случае должен происходить откат всех изменений на заданную дату-время, во втором на указанное количество миллисекунд назад.

```
create or replace procedure restore_data(restore_ts timestamp)
  is
  procedure restore_ac(restore_ts timestamp)
    is
  begin
    for entry in (select * from aircraft_carrier_audit
              where operation_ts >= restore_ts
              and operation_reverted = 0
              order by operation_ts desc)
    loop
      if entry.operation_type = 'INSERT' then
        delete from aircraft_carrier where id = entry.new_ac_id;
      elsif entry.operation_type = 'UPDATE' then
        update aircraft_carrier
        set id=entry.old_ac_id,
          name=entry.old_name,
          displacement=entry.old_displacement,
          max_aircraft_number=entry.old_displacement,
          commissioned=entry.old_commissioned
        where id = entry.new_ac_id;
      else
        insert into aircraft_carrier(
          id,
          name,
          displacement,
          max_aircraft_number,
          commissioned
        ) values (
          entry.old_ac_id,
          entry.old_name,
          entry.old_displacement,
          entry.old_max_aircraft_number,
          entry.old_commissioned
        );
      end if;
      update aircraft_carrier_audit
      set operation_reverted=1 where operation_id = entry.operation_id;
    end loop;
  end restore_ac;
  procedure restore_ff(restore_ts timestamp)
    is
```

```sql
begin
    for entry in (select * from fighter_jet_audit
                where operation_ts >= restore_ts
                and operation_reverted = 0
                order by operation_ts desc)
    loop
        if entry.operation_type = 'INSERT' then
            delete from fighter_jet where id = entry.new_fj_id;
            elsif entry.operation_type = 'UPDATE' then
                update fighter_jet
                set id=entry.old_fj_id,
                    "TYPE"=entry.old_type,
                    speed=entry.old_speed,
                    aircraft_carrier_id=entry.old_aircraft_carrier_id
                where id = entry.new_fj_id;
            else
                insert into fighter_jet(
                    id,
                    "TYPE",
                    speed,
                    aircraft_carrier_id
                ) values (
                    entry.old_fj_id,
                    entry.old_type,
                    entry.old_speed,
                    entry.old_aircraft_carrier_id
                );
        end if;
        update fighter_jet_audit
        set operation_reverted=1 where operation_id = entry.operation_id;
    end loop;
end restore_fj;
procedure restore_b(restore_ts timestamp)
    is
begin
    for entry in (select * from bomber_audit
                where operation_ts >= restore_ts
                and operation_reverted = 0
                order by operation_ts desc)
    loop
        if entry.operation_type = 'INSERT' then
            delete from bomber where id=entry.new_b_id;
        elsif entry.operation_type = 'UPDATE' then
            update bomber
            set id=entry.old_b_id,
                "TYPE"=entry.old_type,
                bombs_capacity=entry.old_bombs_capacity,
                aircraft_carrier_id=entry.old_aircraft_carrier_id
```

```
                    where id = entry.new_b_id;
            else
                insert into bomber(
                    id,
                    "TYPE",
                    bombs_capacity,
                    aircraft_carrier_id
                ) values (
                    entry.old_b_id,
                    entry.old_type,
                    entry.old_bombs_capacity,
                    entry.old_aircraft_carrier_id
                );
            end if;
            update bomber_audit
            set operation_reverted=1 where operation_id = entry.operation_id;
        end loop;
    end restore_b;
begin
    restore_ac(restore_ts);
    restore_fj(restore_ts);
    restore_b(restore_ts);
end restore_data;
```
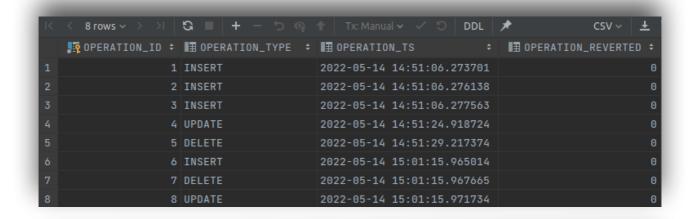
Результат:
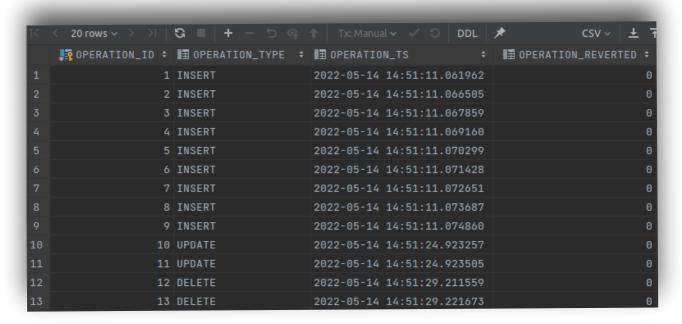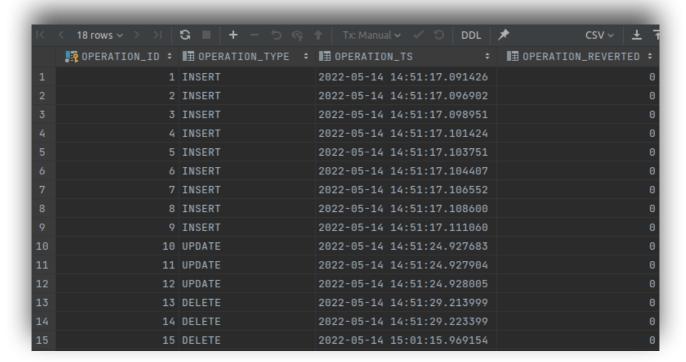
```
begin
    insert into aircraft_carrier (id, name, displacement, max_aircraft_number, commissioned) values (
        42, 'D', 100, 25, sysdate
    );
    delete from aircraft_carrier where id = 1;
    update aircraft_carrier set max_aircraft_number=28 where id = 42;
    insert into fighter_jet("TYPE", speed, aircraft_carrier_id) values (
        'F3', 275, 42
    );
    insert into fighter_jet("TYPE", speed, aircraft_carrier_id) values (
        'F3', 275, 42
    );
end;


select * from aircraft_carrier;
select * from fighter_jet;
select * from bomber;


select * from aircraft_carrier_audit;
select * from fighter_jet_audit;
select * from bomber_audit;
```

2 rows

	ID	NAME	DISPLACEMENT	MAX_AIRCRAFT_NUMBER	COMMISSIONED
1	2	B	120	30	2022-05-14 14:51:06
2	42	D	100	28	2022-05-14 15:01:15

4 rows

	ID	TYPE	SPEED	AIRCRAFT_CARRIER_ID
1	2	F1	290	2
2	10	F3	275	42
3	7	F2 type 3	220	2
4	11	F3	275	42

3 rows

	ID	TYPE	BOMBS_CAPACITY	AIRCRAFT_CARRIER_ID
1	2	B1	60	2
2	5	B2 type 2	49	2
3	7	B2 type 3	40	2

OPERATION_ID	OPERATION_TYPE	OPERATION_TS	OPERATION_REVERTED
1	INSERT	2022-05-14 14:51:06.273701	0
2	INSERT	2022-05-14 14:51:06.276138	0
3	INSERT	2022-05-14 14:51:06.277563	0
4	UPDATE	2022-05-14 14:51:24.918724	0
5	DELETE	2022-05-14 14:51:29.217374	0
6	INSERT	2022-05-14 15:01:15.965014	0
7	DELETE	2022-05-14 15:01:15.967665	0
8	UPDATE	2022-05-14 15:01:15.971734	0

OPERATION_ID	OPERATION_TYPE	OPERATION_TS	OPERATION_REVERTED
1	INSERT	2022-05-14 14:51:11.061962	0
2	INSERT	2022-05-14 14:51:11.066505	0
3	INSERT	2022-05-14 14:51:11.067859	0
4	INSERT	2022-05-14 14:51:11.069160	0
5	INSERT	2022-05-14 14:51:11.070299	0
6	INSERT	2022-05-14 14:51:11.071428	0
7	INSERT	2022-05-14 14:51:11.072651	0
8	INSERT	2022-05-14 14:51:11.073687	0
9	INSERT	2022-05-14 14:51:11.074860	0
10	UPDATE	2022-05-14 14:51:24.923257	0
11	UPDATE	2022-05-14 14:51:24.923505	0
12	DELETE	2022-05-14 14:51:29.211559	0
13	DELETE	2022-05-14 14:51:29.221673	0

OPERATION_ID	OPERATION_TYPE	OPERATION_TS	OPERATION_REVERTED
1	INSERT	2022-05-14 14:51:17.091426	0
2	INSERT	2022-05-14 14:51:17.096902	0
3	INSERT	2022-05-14 14:51:17.098951	0
4	INSERT	2022-05-14 14:51:17.101424	0
5	INSERT	2022-05-14 14:51:17.103751	0
6	INSERT	2022-05-14 14:51:17.104407	0
7	INSERT	2022-05-14 14:51:17.106552	0
8	INSERT	2022-05-14 14:51:17.108600	0
9	INSERT	2022-05-14 14:51:17.111060	0
10	UPDATE	2022-05-14 14:51:24.927683	0
11	UPDATE	2022-05-14 14:51:24.927904	0
12	UPDATE	2022-05-14 14:51:24.928005	0
13	DELETE	2022-05-14 14:51:29.213999	0
14	DELETE	2022-05-14 14:51:29.223399	0
15	DELETE	2022-05-14 15:01:15.969154	0

```
begin
    restore_data(to_timestamp('2022/05/14 15:00:00', 'YYYY/MM/DD HH24:MI:SS'));
end;
```

	ID	NAME	DISPLACEMENT	MAX_AIRCRAFT_NUMBER	COMMISSIONED
1	1	A	200	48	2022-05-14 14:51:06
2	2	B	120	30	2022-05-14 14:51:06

7 rows

	ID	TYPE	SPEED	AIRCRAFT_CARRIER_ID
1	1	F1	300	1
2	2	F1	290	2
3	3	F1	295	1
4	4	F2 type 2	255	1
5	6	F2 type 2	245	1
6	7	F2 type 3	220	2
7	8	F2 type 4	220	1

7 rows

	ID	TYPE	BOMBS_CAPACITY	AIRCRAFT_CARRIER_ID
1	1	B1	60	1
2	2	B1	60	2
3	3	B1	58	1
4	4	B2 type 2	49	1
5	5	B2 type 2	49	2
6	6	B2 type 2	49	1
7	7	B2 type 3	40	2

```
begin
    restore_data(to_timestamp('2022/05/14 15:00:00', 'YYYY/MM/DD HH24:MI:SS'));
end;
```

Задание 4

Предусмотреть процедуру создания отчета об изменениях произошедших либо с момента последнего отчета либо начиная с указанной даты-времени. В отчет должна попасть информация по каждой таблице о количестве проделанных INSERT, UPDATE, DELETE, изменения которые отменены в отчете не должны быть указаны. Отчет необходимо формировать в формате HTML.

```sql
create or replace function create_html_report(ts in timestamp)
return varchar2
as
    html_document varchar2(10000) := '<!DOCTYPE html>' || chr(10)
        || '<html>' || chr(10)
        || ' <head>' || chr(10)
        || '  <title>Report</title>' || chr(10)
        || ' </head>' || chr(10)
        || ' <body>' || chr(10);
    sys_ref_c sys_refcursor;
    ac_audit_row aircraft_carrier_audit%rowtype;
    fj_audit_row fighter_jet_audit%rowtype;
    b_audit_row bomber_audit%rowtype;
begin
    html_document := html_document
        || '  <h1>aircraft_carrier</h1>' || chr(10);
    open sys_ref_c
        for 'select * from aircraft_carrier_audit ' ||
        'where operation_reverted = 0 and operation_ts >= to_timestamp(''' ||
        to_char(ts, 'DD-MM-YYYY HH24:MI:SS') ||
        ''', ''DD-MM-YYYY HH24:MI:SS'')';
    loop
        fetch sys_ref_c into ac_audit_row;
        exit when sys_ref_c%notfound;
        case ac_audit_row.operation_type
            when 'INSERT' then
                html_document := html_document ||
                    '   <p>' ||
                    ac_audit_row.operation_type ||
                    ': (' ||
                    ac_audit_row.new_ac_id || ', ' ||
                    ac_audit_row.new_name || ', ' ||
                    ac_audit_row.new_displacement || ', ' ||
                    ac_audit_row.new_max_aircraft_number || ', ' ||
                    ac_audit_row.new_commissioned ||
                    ')</p>' || chr(10);
            when 'UPDATE' then
                html_document := html_document ||
                    '   <p>' ||
```

```
                    ac_audit_row.operation_type ||
                    ': (' ||
                    ac_audit_row.old_ac_id || ', ' ||
                    ac_audit_row.old_name || ', ' ||
                    ac_audit_row.old_displacement || ', ' ||
                    ac_audit_row.old_max_aircraft_number || ', ' ||
                    ac_audit_row.old_commissioned ||
                    ') -> (' ||
                    ac_audit_row.new_ac_id || ', ' ||
                    ac_audit_row.new_name || ', ' ||
                    ac_audit_row.new_displacement || ', ' ||
                    ac_audit_row.new_max_aircraft_number || ', ' ||
                    ac_audit_row.new_commissioned ||
                    ')<\p>' || chr(10);
            else
                html_document := html_document ||
                    '    <p>' ||
                    ac_audit_row.operation_type ||
                    ': (' ||
                    ac_audit_row.old_ac_id || ', ' ||
                    ac_audit_row.old_name || ', ' ||
                    ac_audit_row.old_displacement || ', ' ||
                    ac_audit_row.old_max_aircraft_number || ', ' ||
                    ac_audit_row.old_commissioned ||
                    ')<\p>' || chr(10);
        end case;
    end loop;
close sys_ref_c;

html_document := html_document
    || '    <h1>fighter_jet</h1>' || chr(10);

open sys_ref_c
    for 'select * from fighter_jet_audit ' ||
        'where operation_reverted = 0 and operation_ts >= to_timestamp(''' ||
        to_char(ts, 'DD-MM-YYYY HH24:MI:SS') ||
        ''', ''DD-MM-YYYY HH24:MI:SS'')';
    loop
        fetch sys_ref_c into fj_audit_row;
        exit when sys_ref_c%notfound;
        case fj_audit_row.operation_type
            when 'INSERT' then
                html_document := html_document ||
                    '    <p>' ||
                    fj_audit_row.operation_type ||
                    ': (' ||
                    fj_audit_row.new_fj_id || ', ' ||
                    fj_audit_row.new_type || ', ' ||
```

```
                    fj_audit_row.new_speed || ', ' ||
                    fj_audit_row.new_aircraft_carrier_id || ', ' ||
                    ')<\p>' || chr(10);
          when 'UPDATE' then
              html_document := html_document ||
                  '   <p>' ||
                  fj_audit_row.operation_type ||
                  ': (' ||
                  fj_audit_row.old_fj_id || ', ' ||
                  fj_audit_row.old_type || ', ' ||
                  fj_audit_row.old_speed || ', ' ||
                  fj_audit_row.old_aircraft_carrier_id || ', ' ||
                  ') -> (' ||
                  fj_audit_row.new_fj_id || ', ' ||
                  fj_audit_row.new_type || ', ' ||
                  fj_audit_row.new_speed || ', ' ||
                  fj_audit_row.new_aircraft_carrier_id || ', ' ||
                  ')<\p>' || chr(10);
          else
              html_document := html_document ||
                  '   <p>' ||
                  fj_audit_row.operation_type ||
                  ': (' ||
                  fj_audit_row.old_fj_id || ', ' ||
                  fj_audit_row.old_type || ', ' ||
                  fj_audit_row.old_speed || ', ' ||
                  fj_audit_row.old_aircraft_carrier_id || ', ' ||
                  ')<\p>' || chr(10);
      end case;
    end loop;
close sys_ref_c;

html_document := html_document
    || '   <h1>bomber</h1>' || chr(10);

open sys_ref_c
    for 'select * from bomber_audit ' ||
        'where operation_reverted = 0 and operation_ts >= to_timestamp(''' ||
        to_char(ts, 'DD-MM-YYYY HH24:MI:SS') ||
        ''', ''DD-MM-YYYY HH24:MI:SS'')';
    loop
        fetch sys_ref_c into b_audit_row;
        exit when sys_ref_c%notfound;
        case b_audit_row.operation_type
            when 'INSERT' then
                html_document := html_document ||
                    '   <p>' ||
                    b_audit_row.operation_type ||
```

```plsql
                        ': (' ||
                    b_audit_row.new_b_id || ', ' ||
                    b_audit_row.new_type || ', ' ||
                    b_audit_row.new_bombs_capacity || ', ' ||
                    b_audit_row.new_aircraft_carrier_id || ', ' ||
                    ')<\p>' || chr(10);
            when 'UPDATE' then
                html_document := html_document ||
                    '   <p>' ||
                    b_audit_row.operation_type ||
                    ': (' ||
                    b_audit_row.old_b_id || ', ' ||
                    b_audit_row.old_type || ', ' ||
                    b_audit_row.old_bombs_capacity || ', ' ||
                    b_audit_row.old_aircraft_carrier_id || ', ' ||
                    ') -> (' ||
                    b_audit_row.new_b_id || ', ' ||
                    b_audit_row.new_type || ', ' ||
                    b_audit_row.new_bombs_capacity || ', ' ||
                    b_audit_row.new_aircraft_carrier_id || ', ' ||
                    ')<\p>' || chr(10);
            else
                html_document := html_document ||
                    '   <p>' ||
                    b_audit_row.operation_type ||
                    ': (' ||
                    b_audit_row.old_b_id || ', ' ||
                    b_audit_row.old_type || ', ' ||
                    b_audit_row.old_bombs_capacity || ', ' ||
                    b_audit_row.old_aircraft_carrier_id || ', ' ||
                    ')<\p>' || chr(10);
        end case;
    end loop;
    close sys_ref_c;

    html_document := html_document || '  </body>' || '</html>';
    return html_document;
end;
```

Результат

<!DOCTYPE html>
<html>
<head>
<title>Report</title>
</head>
<body>
<h1>aircraft_carrier</h1>
<p>INSERT: (1, A, 200, 45, 14-MAY-22)<\p>
<p>INSERT: (2, B, 120, 30, 14-MAY-22)<\p>
<p>INSERT: (3, C, 80, 15, 14-MAY-22)<\p>
<p>UPDATE: (1, A, 200, 45, 14-MAY-22) -> (1, A, 200, 48, 14-MAY-22)<\p>
<p>DELETE: (3, C, 80, 15, 14-MAY-22)<\p>
<p>INSERT: (42, D, 100, 25, 14-MAY-22)<\p>
<p>DELETE: (1, A, 200, 48, 14-MAY-22)<\p>
<p>UPDATE: (42, D, 100, 25, 14-MAY-22) -> (42, D, 100, 28, 14-MAY-22)<\p>
<h1>fighter_jet</h1>
<p>INSERT: (1, F1, 300, 1,)<\p>
<p>INSERT: (2, F1, 290, 2,)<\p>
<p>INSERT: (3, F1, 295, 1,)<\p>
<p>INSERT: (4, F2 type 2, 255, 1,)<\p>
<p>INSERT: (5, F2 type 2, 250, 2,)<\p>
<p>INSERT: (6, F2 type 2, 245, 1,)<\p>
<p>INSERT: (7, F2 type 3, 220, 2,)<\p>
<p>INSERT: (8, F2 type 4, 215, 1,)<\p>
<p>INSERT: (9, F2 type 5, 215, 3,)<\p>
<p>UPDATE: (8, F2 type 4, 215, 1,) -> (8, F2 type 4, 220, 1,)<\p>
<p>UPDATE: (9, F2 type 5, 215, 3,) -> (9, F2 type 5, 220, 3,)<\p>
<p>DELETE: (5, F2 type 2, 250, 2,)<\p>
<p>DELETE: (9, F2 type 5, 220, 3,)<\p>
<p>DELETE: (1, F1, 300, 1,)<\p>
<p>DELETE: (3, F1, 295, 1,)<\p>
<p>DELETE: (4, F2 type 2, 255, 1,)<\p>
<p>DELETE: (6, F2 type 2, 245, 1,)<\p>
<p>DELETE: (8, F2 type 4, 220, 1,)<\p>
<p>INSERT: (10, F3, 275, 42,)<\p>
<p>INSERT: (11, F3, 275, 42,)<\p>
<h1>bomber</h1>
<p>INSERT: (1, B1, 60, 1,)<\p>
<p>INSERT: (2, B1, 60, 2,)<\p>
<p>INSERT: (3, B1, 58, 1,)<\p>
<p>INSERT: (4, B2 type 2, 48, 1,)<\p>
<p>INSERT: (5, B2 type 2, 48, 2,)<\p>
<p>INSERT: (6, B2 type 2, 48, 1,)<\p>
<p>INSERT: (7, B2 type 3, 40, 2,)<\p>
<p>INSERT: (8, B2 type 4, 38, 1,)<\p>
<p>INSERT: (9, B2 type 5, 37, 3,)<\p>
<p>UPDATE: (4, B2 type 2, 48, 1,) -> (4, B2 type 2, 49, 1,)<\p>
<p>UPDATE: (5, B2 type 2, 48, 2,) -> (5, B2 type 2, 49, 2,)<\p>

<p>UPDATE: (6, B2 type 2, 48, 1,) -> (6, B2 type 2, 49, 1,)</p>
<p>DELETE: (8, B2 type 4, 38, 1,)</p>
<p>DELETE: (9, B2 type 5, 37, 3,)</p>
<p>DELETE: (1, B1, 60, 1,)</p>
<p>DELETE: (3, B1, 58, 1,)</p>
<p>DELETE: (4, B2 type 2, 49, 1,)</p>
<p>DELETE: (6, B2 type 2, 49, 1,)</p>
</body></html>

<!DOCTYPE html>
<html>
<head>
<title>Report</title>
</head>
<body>
<h1>aircraft_carrier</h1>
<p>INSERT: (42, D, 100, 25, 14-MAY-22)</p>
<p>DELETE: (1, A, 200, 48, 14-MAY-22)</p>
<p>UPDATE: (42, D, 100, 25, 14-MAY-22) -> (42, D, 100, 28, 14-MAY-22)</p>
<h1>fighter_jet</h1>
<p>DELETE: (1, F1, 300, 1,)</p>
<p>DELETE: (3, F1, 295, 1,)</p>
<p>DELETE: (4, F2 type 2, 255, 1,)</p>
<p>DELETE: (6, F2 type 2, 245, 1,)</p>
<p>DELETE: (8, F2 type 4, 220, 1,)</p>
<p>INSERT: (10, F3, 275, 42,)</p>
<p>INSERT: (11, F3, 275, 42,)</p>
<h1>bomber</h1>
<p>DELETE: (1, B1, 60, 1,)</p>
<p>DELETE: (3, B1, 58, 1,)</p>
<p>DELETE: (4, B2 type 2, 49, 1,)</p>
<p>DELETE: (6, B2 type 2, 49, 1,)</p>
</body></html>