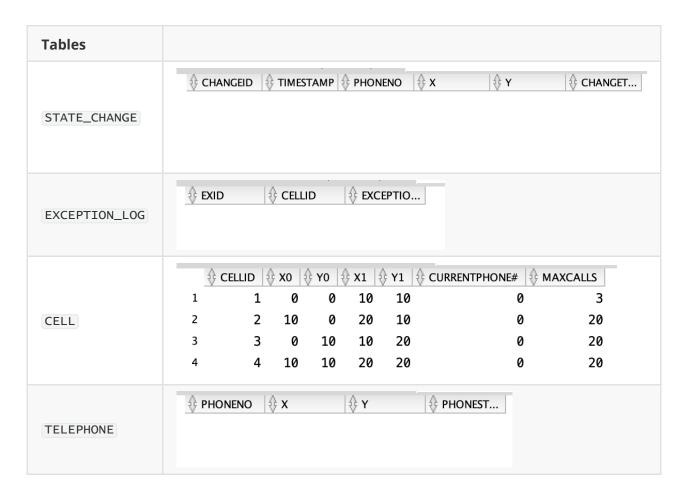
Homework 3 - Enrico Castelli s280124

Triggers

1) Switching on/off the phone

```
CREATE OR REPLACE TRIGGER UpdateTelephone
    AFTER INSERT ON STATE CHANGE
    FOR EACH ROW
    WHEN (NEW.ChangeType = '0' OR NEW.ChangeType = 'F')
 5
    DECLARE
 6
         PhoneCellId NUMBER(38,0);
 7
    BEGIN
 8
         -- save CellId where the phone belongs
 9
        SELECT Cellid INTO PhoneCellid
10
         FROM CELL
         WHERE x0 \le \text{NEW.} x \text{ AND } : \text{NEW.} x < x1 \text{ AND } y0 \le \text{NEW.} y \text{ AND } : \text{NEW.} y < y1;
11
12
13
         IF :NEW.ChangeType = '0' THEN
14
             -- add phone to TELEPHONE table
             INSERT INTO TELEPHONE (PhoneNo, X, Y, PhoneState)
15
16
             VALUES (:NEW.PhoneNo, :NEW.x, :NEW.y, 'On');
17
             -- increase CurrentPhone# in corresponding cell
             UPDATE CELL
18
19
             SET CurrentPhone# = CurrentPhone# + 1
20
             WHERE CellId=PhoneCellId;
21
         ELSE
22
             -- remove phone from TELEPHONE table
23
             DELETE FROM TELEPHONE WHERE PhoneNo=: NEW. PhoneNo;
24
             -- decrease CurrentPhone# in corresponding cell
25
             UPDATE CELL
26
             SET CurrentPhone# = CurrentPhone# - 1
27
             WHERE CellId=PhoneCellId;
28
         END IF;
29
    END;
    /
```

After running create_db_telefoni_en.sql and the script that contains the triggers:



```
1 INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (1, sysdate, '333000010', 3, 3, 'o');
```

Tables								
STATE_CHANGE	∯ C⊦ 1		Y	1ESTAM EC-20	I Y	PHONENO {	x ∯ y ∯ CHANG	ЕТҮРЕ
EXCEPTION_LOG	∯ EXID	\$	CELL	ID	⊕ EXC	EPTIO		
CELL	1 2 3 4	1 2 3 4	xo { 0 10 0 10	YO (0 0 10 10	10 20 10 20 20	Y1 10 CUR 10 10 20 20	RENTPHONE# MA 1 0 0 0	3 20 20 20 20
TELEPHONE	- Y	HONENO 000010	1.4	- Y	(† PHC On	DNESTATE		

INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (2, sysdate, '333000009', 15, 15, '0');

Tables	
STATE_CHANGE	
EXCEPTION_LOG	
CELL	♠ CELLID ♠ X0 ♠ Y0 ♠ X1 ♠ Y1 ♠ CURRENTPHONE# ♠ MAXCALLS 1 1 0 0 10 10 1 3 2 2 10 0 20 10 0 20 3 3 0 10 10 20 0 20 4 4 10 10 20 20 1 20
TELEPHONE	

After running

INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (3, sysdate, '333000009', 15, 15, 'F');

Tables							
STATE_CHANGE	CHANGEIE CHANGE	1 06-DEC-2 2 06-DEC-2 3 06-DEC-2	20 333	HONENO 8000010 8000009 8000009	3 3 15 15 15 15	0	ТҮРЕ
EXCEPTION_LOG	⊕ EXID	CELLID	⊕ EXC	CEPTIO			
CELL	1 1 2 2 3 3 4 4	0 0 10 10 10 10	10 20 10	Y1 0 CU 10 10 20 20	RRENTPHON	E# ① MA: 1 0 0 0	3 20 20 20 20
TELEPHONE	∯ PHONENCE 1 333000010	- Y - Y	′ ∯ PHO 3 0n	NESTATE			

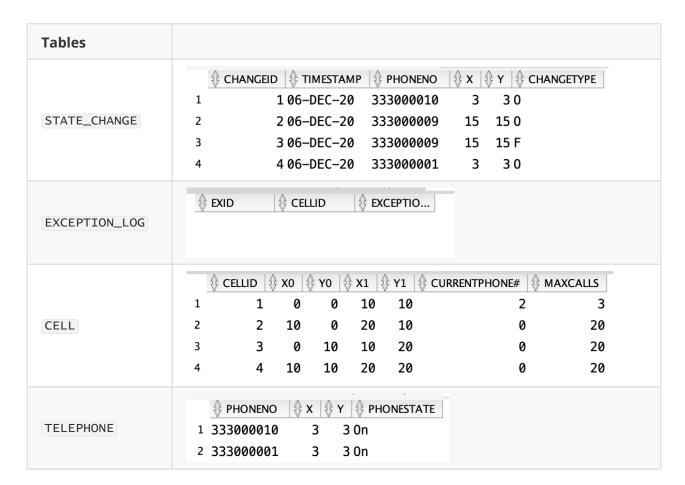
We notice how the phone that was turned off has been removed from the TELEPHONE table.

2) Starting a phone call

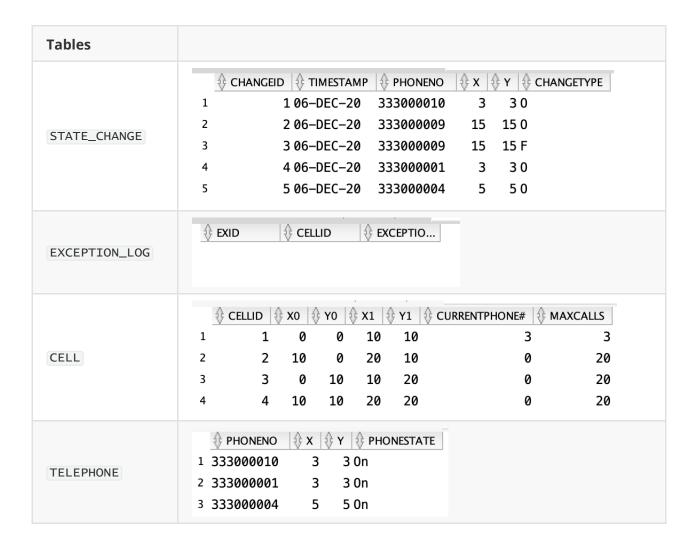
```
CREATE OR REPLACE TRIGGER StartPhoneCall
    AFTER INSERT ON STATE_CHANGE
 3
    FOR EACH ROW
    WHEN (NEW.ChangeType = 'C')
 5
    DECLARE
 6
       PhoneCellId NUMBER(38,0);
 7
        CellMaxCalls NUMBER(38,0);
8
        Cellx0 NUMBER(7,2);
9
        CellyO NUMBER(7,2);
10
       Cellx1 NUMBER(7,2);
11
        Celly1 NUMBER(7,2);
12
        CurrentCellCalls NUMBER(38,0);
13
        LastExId NUMBER(38,0);
14
    BEGIN
15
        -- save cell info to variables
        SELECT Cellid, MaxCalls, x0, y0, x1, y1 INTO PhoneCellid,
16
    CellMaxCalls, CellX0, CellY0, CellX1, CellY1
17
        FROM CELL
18
        WHERE x0 \le \text{NEW.x} AND \text{NEW.x} < x1 AND y0 \le \text{NEW.y} AND \text{NEW.y} < y1;
19
20
         -- save number of active phones in cell to variable
```

```
SELECT COUNT(*) INTO CurrentCellCalls
21
22
        FROM TELEPHONE
23
        WHERE PhoneState='Active' AND CellX0<=x AND x<CellX1 AND CellY0<=y AND
    y<CellY1;
24
        IF CurrentCellCalls < CellMaxCalls THEN</pre>
25
            -- phone state becomes active
26
27
            UPDATE TELEPHONE
            SET PhoneState = 'Active'
28
29
            WHERE PhoneNo=:NEW.PhoneNo;
30
        ELSE
31
            -- save biggest ExId to variable (or use 1 if no ExIds in table)
32
            SELECT MAX(Exid) + 1 INTO LastExid
33
            FROM EXCEPTION_LOG;
34
            IF LastExid IS NULL THEN
                LastExid := 1;
35
36
            END IF;
37
            -- insert exception in EXCEPTION_LOG
            INSERT INTO EXCEPTION_LOG (Exid, Cellid, ExceptionType)
38
            VALUES (LastExId, PhoneCellId, 'C');
39
40
        END IF;
41
   END;
42
```

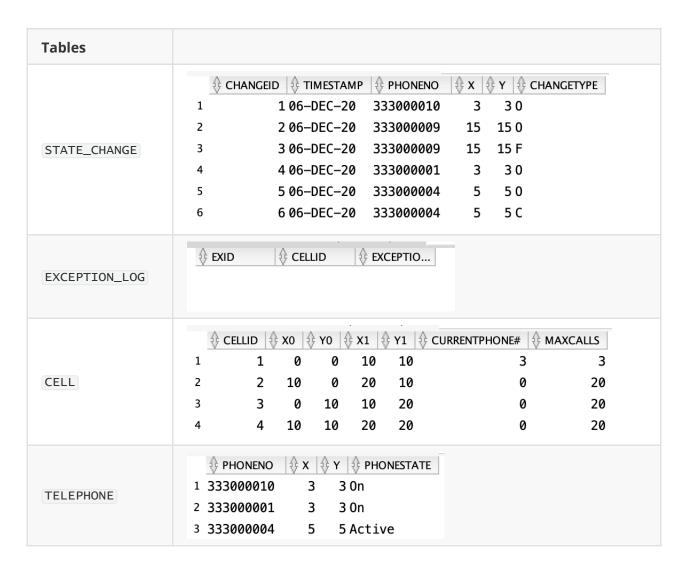
```
1 INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (4, sysdate, '333000001', 3, 3, '0');
```



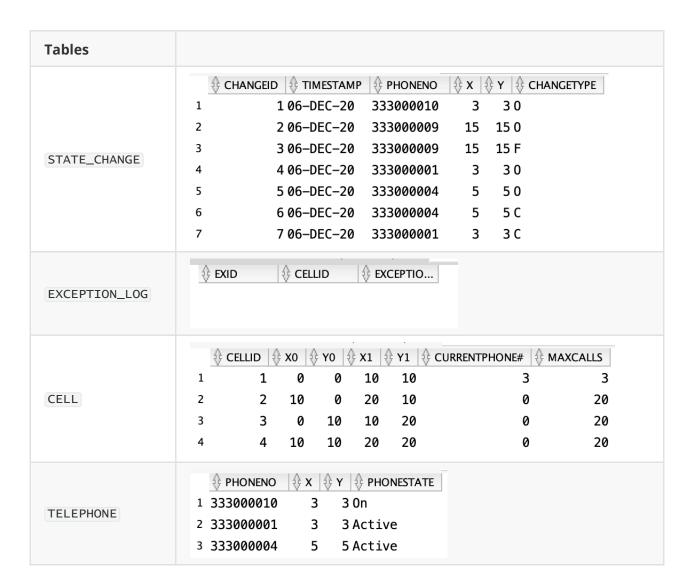
```
INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (5, sysdate, '333000004', 5, 5, '0');
```



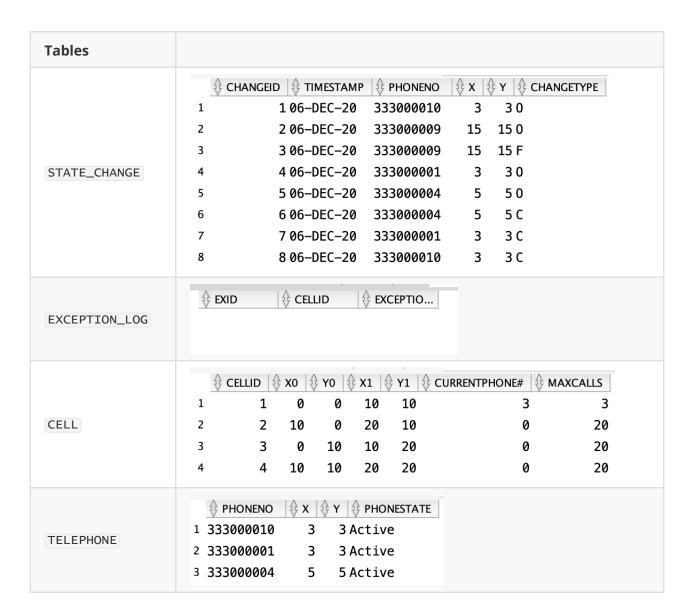
```
INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (6, sysdate, '333000004', 5, 5, 'C');
```



```
INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (7, sysdate, '333000001', 3, 3, 'C');
```



```
INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (8, sysdate, '333000010', 3, 3, 'C');
```



```
INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType) values (9, sysdate, '333000020', 4, 4, '0');
```

Tables	
	1 106-DEC-20 333000010 3 3 0
	2 2 06-DEC-20 333000009 15 15 0
	3 3 06-DEC-20 333000009 15 15 F
STATE_CHANGE	4 4 06-DEC-20 333000001 3 3 0
STATE_CHANGE	5 5 06-DEC-20 333000004 5 5 0
	6 6 06-DEC-20 333000004 5 5 C
	7 7 06-DEC-20 333000001 3 3 C
	8 8 06-DEC-20 333000010 3 3 C
	9 9 06-DEC-20 333000020 4 4 0
EXCEPTION_LOG	♠ EXID
	$\$ CELLID $ \$ X0 $ \$ Y0 $ \$ X1 $ \$ Y1 $ \$ CURRENTPHONE# $ \$ MAXCALLS
	1 1 0 0 10 10 4 3
CELL	2 2 10 0 20 10 0 20
	3 3 0 10 10 20 0 20
	4 4 10 10 20 20 0 20
TELEPHONE	<pre>↑ PHONENO</pre>

```
INSERT INTO STATE_CHANGE(ChangeId, TimeStamp, PhoneNo, x, y, ChangeType)
values (10, sysdate, '333000020', 4, 4, 'C');
```

Tables								
	∜ c	HANGEID	TIMESTA	мр ∣⊕	PHONENO	⊕ x	∯ Y ∯ CHAI	NGETYPE
	1	10	5-DEC-2	0 33	3000010	3	3 0	
	2	2 06-DEC-20			3000009	15	15 0	
	3	3 0	5-DEC-2	0 33	3000009	15 15 F		
	4	4 0	5-DEC-2	0 33	3000001	3	3 0	
STATE_CHANGE	5	5 0	5-DEC-2	0 33	3000004	5	5 0	
	6	6 0	5-DEC-2	0 33	3000004	5	5 C	
	7	7 0	5-DEC-2	0 33	3000001	3	3 C	
	8	8 0	5-DEC-2	0 33	3000010	3	3 C	
	9	9 0	5-DEC-2	0 33	3000020	4	4 0	
	10	10 0	5-DEC-2	0 33	3000020	4	4 C	
EXCEPTION_LOG	∳ E	XID ∯ CELL 1	D ∯ EXC 1 C	CEPTIO	NTYPE			
	⊕ CELLID ⊕ X0 ⊕ Y0 ⊕ X1 ⊕ Y1 ⊕ CURRENTPHONE# ⊕ MAXCALLS							
	1	1 (0	10	10		4	3
CELL	2	2 10	0	20	10		0	20
	3	3	10	10	20		0	20
	4	4 10	10	20	20		0	20
	∯ PH	IONENO {}	x ∯ Y	⊕ РНС	NESTATE			
	1 3330	000010						
TELEPHONE	2 3336	2 333000001 3 3 Acr						
	3 3336	000004	5 5	Activ	re			
		000020	4 4	0n				

We notice how initiating the fourth call triggers an exception to be recorded and does not allow the fourth phone to become active.

3) Changing the maximum number of active calls

```
1 | CREATE OR REPLACE TRIGGER ChangeMaxCalls
   BEFORE UPDATE OF MaxCalls ON CELL
   FOR EACH ROW
4 WHEN (NEW.MaxCalls < OLD.MaxCalls)
 5
   DECLARE
6
       CurrentCellCalls NUMBER(38,0);
7
   BEGIN
8
       -- save number of active phones in cell to variable
       SELECT COUNT(*) INTO CurrentCellCalls
9
10
        FROM TELEPHONE
11
       WHERE PhoneState='Active' AND :NEW.x0<=x AND x<:NEW.x1 AND :NEW.y0<=y
    AND y<:NEW.y1;
```

```
1 UPDATE CELL SET MaxCalls = MaxCalls-2;
```

Tables	
	⊕ CHANGEID ⊕ TIMESTAMP ⊕ PHONENO ⊕ X ⊕ Y ⊕ CHANGETYPE
	1 106-DEC-20 333000010 3 3 0
	2 2 06-DEC-20 333000009 15 15 0
	3 3 06-DEC-20 333000009 15 15 F
	4 4 06-DEC-20 333000001 3 3 0
STATE_CHANGE	5 5 06-DEC-20 333000004 5 5 0
	6 6 06-DEC-20 333000004 5 5 C
	7 7 06-DEC-20 333000001 3 3 C
	8 8 06-DEC-20 333000010 3 3 C
	9 9 06-DEC-20 333000020 4 4 0
	10 10 06-DEC-20 333000020 4 4 C
EXCEPTION_LOG	1 1 1 C
	1 1 0 0 10 10 4 3
CELL	2 2 10 0 20 10 0 18
	3 3 0 10 10 20 0 18
	4 4 10 10 20 20 0 18
TELEPHONE	<pre>↑ PHONENO</pre>

We notice how only the values of cells 2, 3 and 4 are updated.

4) Service guarantee

```
CREATE OR REPLACE TRIGGER ServiceGuarantee
 2
    AFTER UPDATE OF MaxCalls ON CELL
    DECLARE
        TotalMaxCalls NUMBER(38,0);
4
 5 BEGIN
6
        -- save the total number of MaxCalls for each cell to variable
 7
      SELECT SUM(MaxCalls) INTO TotalMaxCalls
8
      FROM CELL;
9
     -- apply constraint
10
11
      IF TotalMaxCalls <= 30 THEN</pre>
            RAISE_APPLICATION_ERROR(-20000, 'The updated MaxCalls value does
12
    not respect the constraint of service guarantee: >30 total MaxCalls');
13
        END IF;
14
   END;
    /
15
```

```
1 UPDATE CELL SET MaxCalls = MaxCalls-1;
```

Tables								
	⊕ CHAN	IGEID ∯ T	IMESTAM	Р 🕸 Р	HONENO	⊕ x	⊕ у ∣⊕ сна	NGETYPE
	1	1 06-	DEC-20	333	000010	3	3 0	
	2	2 06-	DEC-20	333	000009	15	15 0	
	3	3 06-DEC-2			000009	15	15 F	
	4	4 06-	DEC-20	333	000001	3	3 0	
STATE_CHANGE	5	5 06-	DEC-20	333	000004	5	5 0	
	6	6 06-	DEC-20	333	000004	5	5 C	
	7	7 06-	DEC-20	333	000001	3	3 C	
	8	8 06-DEC-20			000010	3	3 C	
	9	9 06-	DEC-20	333	000020	4	4 0	
	10	10 06-	DEC-20	333	000020	4	4 C	
EXCEPTION_LOG	∯ EXID 1 1	1.0	⊕ exce L C	PTIONT	YPE			
	$\$ CELLID $ \$ X0 $ \$ Y0 $ \$ X1 $ \$ Y1 $ \$ CURRENTPHONE# $ \$ MAXCALLS							
	1	1 0	0	10	10		4	3
CELL	2	2 10	0	20	10		0	17
	3	3 0	10	10	20		0	17
	4	4 10	10	20	20		0	17
	∯ PHON 1 333000	010		PHON ctive				
TELEPHONE		2 333000001 3						
	3 333000			ctive				
	4 333000	020	4 40	n				

We notice how no error is raised because the constraint is respected.

```
1 UPDATE CELL SET MaxCalls = MaxCalls-10;
```

Tables								
	∜ CHA	NGEID 🌵 T	IMESTAM	P ⊕ P	HONENO	⊕ x ÷	∯ Y ∯ СН.	ANGETYPE
	1	1 1 06-DEC-20				3	3 0	
	2	2 06-	DEC-20	333	000009	15	15 0	
	3	3 06-	DEC-20	333	000009	15	15 F	
	4	4 06-	DEC-20	333	000001	3	3 0	
STATE_CHANGE	5	5 06-	DEC-20	333	000004	5	5 0	
	6	6 06-	DEC-20	333	000004	5	5 C	
	7	7 06-	DEC-20	333	000001	3	3 C	
	8	8 06-	DEC-20	333	000010	3	3 C	
	9	9 06-	DEC-20	333	000020	4	4 0	
	10	10 06-	DEC-20	333	000020	4	4 C	
EXCEPTION_LOG	∯ EXID		⊕ EXCE 1 C	PTIONT	YPE			
	CELLID ⊕ X0 ⊕ Y0 ⊕ X1 ⊕ Y1 ⊕ CURRENTPHONE# ⊕ MAXCALLS							
	1	1 0	0	10	10		4	3
CELL	2	2 10	0	20	10		0	17
	3	3 0	10	10	20		0	17
	4	4 10	10	20	20		0	17
	♦ PHON	IENO 🛊 X	⊕	PHON	ESTATE			
	1 333000	1 333000010 3						
TELEPHONE	2 333000	0001	3 3 A	ctive				
	3 333000	0004	5 5 A	ctive				
	4 333000	020	4 40	n				

Error starting at line : 17 in command - UPDATE CELL SET MaxCalls = MaxCalls-10

Error report –

ORA-20000: The updated MaxCalls value does not respect the constraint of service guarantee: >30 total MaxCalls

ORA-06512: at "SYSTEM.SERVICEGUARANTEE", line 11

ORA-04088: error during execution of trigger 'SYSTEM.SERVICEGUARANTEE'

We notice how the CELL table does not change.