# Exercise 6

Date of Issue: 12.04.2021
Date of Issue Solutions: 19.04.2021

# 1 Anomalies

Consider the following relation schema: **gameRelease**

$$\text{gameRelease(developer, \underline{game}, \underline{platform}, release\_year)}$$

The primary key is $(game, platform)$.

**gameRelease**

|       | developer | game | platform | release_year |
|-------|-----------|------|----------|--------------|
| $g_1$ | ZeniMax Online Studios | Elder Scrolls Online | PC/Mac | 2014 |
| $g_2$ | ZeniMax Online Studios | Elder Scrolls Online | Xbox | 2014 |
| $g_3$ | Arkane Studios | Dishonored 2 | PC/Mac | 2016 |
| $g_4$ | Lucas Arts | Monkey Island | DOS | 1990 |

For each of the following tasks, use the instance of **gameRelease** given above.

1. Insert anomaly

   (a) Give a DML statement that leads to an *insert* anomaly in this instance of **gameRelease**.
   (b) Explain shortly, but precisely why your statement leads to an *insert* anomaly. State all your assumptions.

2. Update anomaly

   (a) Give a DML statement that leads to an *update* anomaly in this instance of **gameRelease**.
   (b) Explain shortly, but precisely why your statement leads to an *update* anomaly. State all your assumptions.

3. Delete anomaly

   (a) Give a DML statement that leads to a *delete* anomaly in this instance of **gameRelease**.
   (b) Explain shortly, but precisely why your statement leads to a *delete* anomaly. State all your assumptions.

# 2    Functional Dependencies

1. Consider a relation schema $\mathcal{R}(A,B,C,D)$ for which the functional dependencies $\{B \to C, D \to A\}$ hold. List all the candidate keys and all the superkeys of $\mathcal{R}$.

2. Given the following set $\mathcal{F}_\mathcal{R}$ of functional dependencies for relation schema $\mathcal{R}(A,B,C,D,E,F)$:

$$
\begin{aligned}
\mathcal{F}_\mathcal{R} \;=\; \{ \\
A &\to DE, \\
B &\to F, \\
CE &\to D, \\
F &\to BD, \\
E &\to A \\
\}
\end{aligned}
$$

Determine for each functional dependency $F_1$ listed bellow if it can be derived from $\mathcal{F}_\mathcal{R}$ .

(i.e., $\mathcal{F}_\mathcal{R} \Rightarrow F_1$)

(a) $CEF \to ABCDEF$

(b) $AF \to ABCDEF$

(c) $E \to D$

(d) $ACF \to BCD$

(e) $ABC \to DEF$

(f) $D \to B$

3. Consider a relation schema $\mathcal{R}(A,B,C,D,E,F)$ for which the functional dependencies $\{ABC \to BC, B \to C, C \to DE, F \to B\}$ hold. Decide if AF $\to$ D holds.

4. Consider a relation schema $\mathcal{R}(A,B,C,D,E,F)$ for which the functional dependencies $\{AB \to C, BC \to AD, D \to E, CF \to B\}$ hold. Use the inference rules you learn in the lecture and show that AB $\to$ D holds.

# 3    Multivalued Dependency

1. Assume B $\twoheadrightarrow$ A is a multivalued dependency on the relation schema $\mathcal{R}(A,B,C)$. Based on the three tuples in relation $R$, add all other tuples that must belong to the relation.

$R$

|       | A | B | C |
|-------|---|---|---|
| $r_1$ | a | 1 | 7 |
| $r_2$ | c | 1 | 8 |
| $r_3$ | e | 1 | 9 |

2. Disprove the following statements. **Hint:** Find a counterexample to disprove the statements.

(a) X $\twoheadrightarrow$ Y $\Rightarrow$ X $\to$ Y

(b) X$\twoheadrightarrow$Y Z $\Rightarrow$ X$\twoheadrightarrow$Y, X$\twoheadrightarrow$Z