

## 4. Exercise

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### Exercise 4.1

1.

$T_1$  and  $T_2$

$T_1 \subseteq T_2?$

Find mapping  $h : T_2 \rightarrow T_1, x \mapsto \begin{cases} b_3 & x = b_1 \\ 5 & x = b_2 \\ b_4 & x = b_3 \\ b_3 & x = b_4 \\ a_1 & x = a_1 \\ a_2 & x = a_2 \end{cases} \Rightarrow T_1 \subseteq T_2$

$T_2 \subseteq T_1?$

Impossible since we would have to map the constant 5 to an other constant and  $T_2$  does not contain a constant. So  $T_2 \not\subseteq T_1$

**Overall**

$\Rightarrow T_1 \subset T_2$ , but  $T_2 \not\subseteq T_1$  and therefore  $T_1 \neq T_2$

$T_2$  and  $T_3$

$T_2 \subseteq T_3?$

$T_3 \subseteq T_3?$

**Overall**

$T_1$  and  $T_3$

$T_1 \subseteq T_3?$

$T_3 \subseteq T_3?$

Analogously to  $T_2 \subseteq T_1$  we would have to map the constant 5 to an other constant and  $T_3$  does not contain a constant. So  $T_3 \not\subseteq T_1$

**Overall**

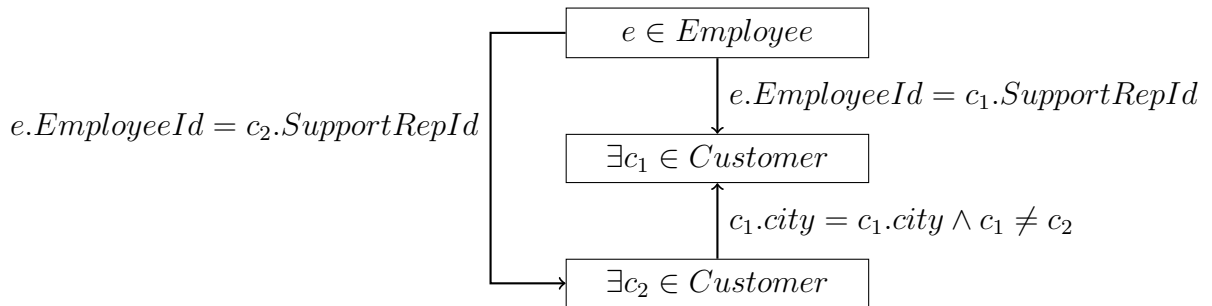
$\Rightarrow T_1 \not\subseteq T_3, T_3 \not\subseteq T_1$  and therefore especially  $T_1 \neq T_3$

**2.**

## Exercise 4.2

**1.a)**

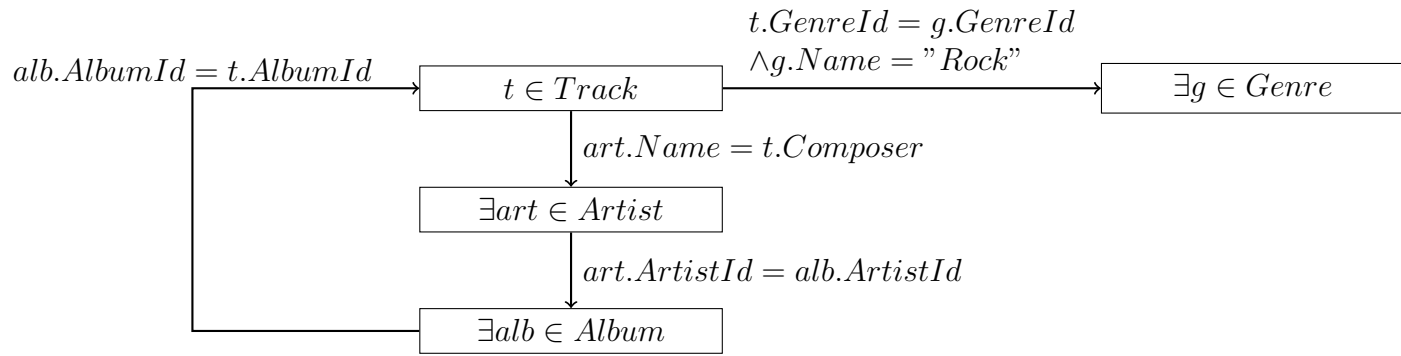
$\{ \langle e.EmployeeId, e.LastName \rangle \mid e \in Employee \wedge \exists c_1 \in Customer \wedge c_1.SupportedRepId = e.EmployeeId \wedge \exists c_2 \in Customer \wedge c_2.SupportRepId = e.EmployeeId \wedge c_1.City = c_2.City \wedge c_1 \neq c_2 \}$



This graph is cycle free, which means the query is optimizable using semi-joins.

**1.b)**

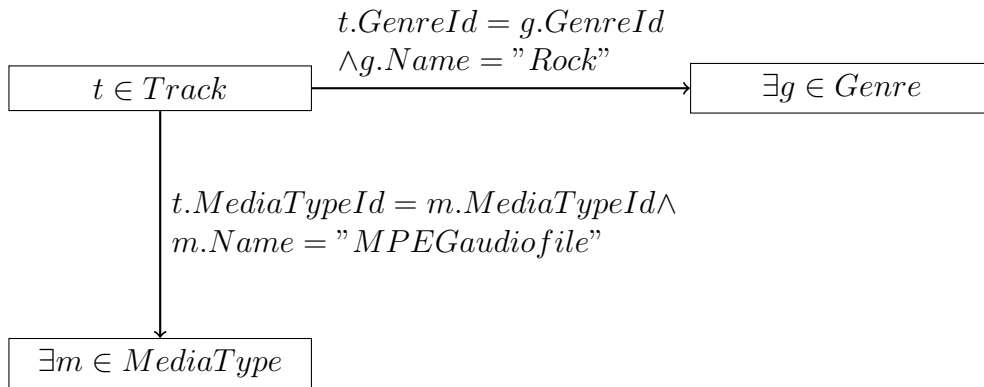
$\{ \langle t.name, t.composer \rangle \mid t \in Track \wedge \exists g \in Genre \wedge g.GenreId = t.GenreId \wedge g.Name = "Rock" \wedge \exists art \in Artist \wedge \exists alb \in Album \wedge alb.ArtistId = art.ArtistId \wedge t.AlbumId = alb.AlbumId \wedge t.Composer = art.Name \}$



This Graph has a cycle. This means the query is not optimizable using semi-joins.

2.

$\{ \langle t.Name \rangle \mid t \in Track \wedge t.Milliseconds \leq 90000 \wedge \exists g \in Genre \wedge t.GenreId = g.GenreId \wedge g.Name = "Rock" \wedge \exists m \in MediaType \wedge t.MediaTypeId = m.MediaTypeId \wedge m.Name = "MP3Audiofile" \}$



TODO: es fehlt das mit den  $\leq 90000ms$

The graph is cycle free, which means it can be optimized using semi-joins.