3. Exercise

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Exercise 3.1

1. a)

$\pi_{A,B}(R) \bowtie \pi_{B,C}(\pi_{A,C}(\sigma_{B=1}(R)) \bowtie \pi_{A,B}(R))$

$S_1 := \{[a,b] \mid \exists c\, R(a,b,c)\}$
$S_2 := \{[a,c] \mid \exists a,c\, R(a,1,c)\}$
$\pi_{B=1}(S_2 \bowtie S_1) := \{[b,c] \mid \exists a,c_1,c_2\, R(a,b,c_1) \wedge R(a,1,c_2)\}$
Insgesamt $:= \{[a,b,c] \mid \exists a_1,c_1,c_2(\, R(a,b,c_1) \wedge R(a_1,1,c) \wedge R(a_1,b,c_2)\}$

1.b)

T_1			
a	b	c_1	R
a_1	1	c	R
a_1	b	c_2	R

2)

$h_1 : T_2 \to T_1 : a \to a, b \to b, a_5 \to a_1, b_5 \to b_1, c_4 \to c_1$
$\Rightarrow T_2 \subseteq T_1 \qquad (1)$

$h_2 : T_1 \to T_2 : a \to a, b \to b, b_1 \to b, c_1 \to c_4, a_1 \to a, b_2 \to b_5, c_2 \to c_4, b_3 \to b_5, c_3 \to c_4$
$\Rightarrow T_1 \subseteq T_2 \qquad (2)$

$(1)\&(2) \Rightarrow T_1 \equiv T_2$

Exercise 3.2