Equivalences (Rewrite Rules) in Relational Algebra

Equivalences

No.	Equivalence	Conditions
1.	$R \times S \equiv S \times R$	Order of attributes in the resulting relation does not count.
2.	$R \times (S \times T) \equiv (R \times S) \times T$	
3.	$R \bowtie S \equiv S \bowtie R$	Order of attributes in the resulting relation does not count.
4.	$R \bowtie (S \bowtie T) \equiv (R \bowtie S) \bowtie T$	
5.	$R \bowtie_C S \equiv S \bowtie_C R$	Order of attributes in the resulting relation does not count.
6.	$R \cup S \equiv S \cup R$	
7.	$R \cup (S \cup T) \equiv (R \cup S) \cup T$	
8.	$R \cap S \equiv S \cap R$	
9.	$R \cap (S \cap T) \equiv (R \cap S) \cap T$	
10.	$\sigma_{(C_1 \wedge C_2)}(R) \equiv \sigma_{C_1}(\sigma_{C_2}(R))$	
11.	$\sigma_{(C_1 \vee C_2)}(R) \equiv \sigma_{C_1}(R) \cup \sigma_{C_2}(R)$	
12.	$\sigma_{C_1}(\sigma_{C_2}(R)) \equiv \sigma_{C_2}(\sigma_{C_1}(R))$	
13.	$\sigma_C(R \cup S) \equiv \sigma_C(R) \cup \sigma_C(S)$	
14.	$\sigma_C(R - S) \equiv \sigma_C(R) - S$	
15.	$\sigma_C(R - S) \equiv \sigma_C(R) - \sigma_C(S)$	
16.	$\sigma_C(R \times S) \equiv \sigma_C(R) \times S$	C is the condition **only** on attributes of R
17.	$\sigma_C(R \bowtie S) \equiv \sigma_C(R) \bowtie S$	C is the condition **only** on attributes of R
18.	$\sigma_C(R \bowtie_D S) \equiv \sigma_C(R) \bowtie_D S$	C is the condition **only** on attributes of R
19.	$\sigma_C(R \cap S) \equiv \sigma_C(R) \cap S$	
20.	$\sigma_C(R \cap S) \equiv \sigma_C(R) \cap \sigma_C(S)$	

No.	Equivalence	Conditions
21.	$\sigma_C(R \times S) \equiv \sigma_C(R) \times \sigma_C(S)$	Both R and S contian **all** attributes from C
22.	$\sigma_C(R \bowtie S) \equiv \sigma_C(R) \bowtie \sigma_C(S)$	Both R and S contian **all** attributes from C
23.	$\sigma_C(R \bowtie_D S) \equiv \sigma_C(R) \bowtie_D \sigma_C(S)$	Both R and S contian **all** attributes from C
24.	$\pi_L(R \bowtie S) \equiv \pi_L(R) \bowtie \pi_L(S)$	L is the list of join attributes for R and S.
25.	$\pi_L(R \bowtie_D S) \equiv \pi_M(R) \bowtie_D \pi_N(S)$	M is the list of attributes of R that are in L; N is the list of attributes of S that are in L; D includes only attributes from L.
25.	$\pi_L(R \bowtie_D S) \equiv \pi_L(\pi_M(R) \bowtie_D \pi_N(S))$	M is the list of attributes of R that are in L; N is the list of attributes of S that are in L.
26.	$\pi_L(\sigma_C(R)) \equiv \pi_L(\sigma_C(\pi_M(R)))$	M is the list of all attributes that are in L or in C.
27.	$\pi_L(\sigma_C(R)) \equiv \sigma_C(\pi_L(R))$	C mentions only attributes in L.
28.	$R \bowtie_C S \equiv \sigma_C(R \times S)$	
29.	$R \bowtie S \equiv \pi_L(\sigma_C(R \times S))$	L is the list of attributes both in R and S; C is the conjunction of $R.A = S.A$ conditions for all $A \in L$.
30.	$\pi_L(R \cup S) \equiv \pi_L(R) \cup \pi_L(S)$	
31.	$\delta(R \times S) \equiv \delta(R) \times \delta(S)$	
32.	$\delta(R \bowtie S) \equiv \delta(R) \bowtie \delta(S)$	
33.	$\delta(R \bowtie_D S) \equiv \delta(R) \bowtie_D \delta(S)$	
34.	$\delta(\sigma_C(R)) \equiv \sigma_C(\delta(R))$	
35.	$\delta(R) \equiv R$	R has no duplicates (e.g.,has a primary key)
36.	$\delta(R \cap_{bag} S) \equiv \delta(R) \cap_{bag} \delta(S)$	
37.	$\delta(R \cup S) \equiv R \cup S$	
38.	$\delta(R - S) \equiv R - S$	
39.	$\delta(R \cap S) \equiv R \cap S$	
40.	$\delta(\gamma_L(R)) \equiv \gamma_L(R)$	
41.	$\gamma_L(R) \equiv \gamma_L(\pi_M(R))$	M is all attributes of R not in L
42.	$\delta(\gamma_L(R)) \equiv \gamma_L(\delta(R))$	only `MAX` and `MIN` aggregates are used