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Formal Foundations of Information Systems
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4. Exercise Set: Evaluation of Join Expressions

Exercise 14 (GYO-Algorithmus und Verbundbäume, 1+2+1=4 Punkte)
Let $\mathcal{R} := \{S_1(ABC), S_2(BCDE), S_3(BCDG), S_4(CDEF)\}$ be a relational schema.

a) Draw the hypergraph for $\mathcal{R}$.

b) Apply the *GYO* algorithm. In each step specify the eliminated ear and a witness for this ear. Propose at least three different orders in which ears can be eliminated. Is $\mathcal{R}$ acyclic?

c) Draw a join tree for R and explain the connection between the *GYO*-algorithm and join trees using this example.

Exercise 15 (Voller Reduzierer, 2+2+2=6 Punkte)
Consider the relational schema $\mathcal{R} := \{R_1(ABC), R_2(BF), R_3(BCD), R_4(CDE), R_5(DEG)\}$ and the corresponding join expression $R_1 \bowtie R_2 \bowtie R_3 \bowtie R_4 \bowtie R_5$.

a) Show that the schema is acyclic.

b) Derive a full reducer ("Voller Reduzierer").

c) Apply your reducer to the sample instance below and show that the resulting instance is globally consistent.

A	B	C
a_1	b_1	c_1
a_2	b_1	c_1
a_1	b_2	c_1

B	F
b_1	f_1
b_1	f_2

B	C	D
b_1	c_1	d_1
b_1	c_1	d_2
b_2	c_1	d_1
b_2	c_2	d_2

D	E	G
d_1	e_1	g_1
d_1	e_1	g_2
d_2	e_1	g_1
d_2	e_2	g_2

C	D	E
c_1	d_1	e_1
c_1	d_2	e_1
c_2	d_2	e_2

Exercise 16 (Verbundausdrücke,2+2+2+2+2=10 Punkte)
Consider the join expression $BCD \bowtie CDE \bowtie DEG$.

a) Compute the associated hyper graph and apply the *GYO*-algorithm. Provide all intermediate results of the algorithm and finally show that it yields the empty hyper graph.

b) Draw all possible join trees.

c) Show that the following instances are pairwise consistent.

B	C	D
b_1	c_1	d_1
b_1	c_2	d_1

C	D	E
c_1	d_1	e_1
c_2	d_1	e_2

D	E	G
d_1	e_1	g_1
d_1	e_2	g_1

d) Derive the full reducers from the join trees (hint: exploit the fact that the relevant information of the *GYO*-algorithm is implicitly encoded in the join trees) and apply them to the instance above.

e) List the expressions that can be derived from the join trees. Evaluate these expressions on top of the sample instance above and compare the result with $(BCD \bowtie DEG) \bowtie CDE$.

Due by: 26.05.2009