Constraint Satisfaction Problems

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Exercise Sheet 1

Due: 02.05.2012

Exercise 1.1 (2+2 Points)

(a) Solve the following Sudoku (http://sudoku.zeit.de/):

5		6				8		
		1		9	8			
			1		3	4	6	2
8				2		1		7
	7							
	9	4				6	3	
3			2	4			9	
9		7				2	8	5
		2	7		9			

(b) Briefly explain the methods you used to solved the Sudoku.

Exercise 1.2 (0.5+0.5+0.5+0.5 Points)
Let $R_{x,y} = \{(a,b),(a,c)\}$ and $S_{y,z} = \{(b,a),(a,b),(b,c)\}$. Calculate:

(a) $R_{x,y} \bowtie S_{y,z}$

(b) $\sigma_{z=c}(R_{x,y} \bowtie S_{y,z})$

(c) $\pi_x(R_{x,y})$

(d) $R_{x,y} \circ S_{y,z}$

Exercise 1.3 (1+1+1+1 Points)
Let X be a non-empty set, $\mathcal{R}(X)$ the set of all binary relations on X, and let $R, S, T \in \mathcal{R}(X)$. Proof the following statements:

(a) $R \circ (S \cup T) = (R \circ S) \cup (R \circ T)$

(b) $(-R)^{-1} = -(R^{-1})$

(c) $(R \circ S)^{-1} = S^{-1} \circ R^{-1}$

(d) $(R \circ S) \cap T^{-1} = \emptyset$ if and only if $(S \circ T) \cap R^{-1} = \emptyset$