Technische Universität Dresden

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Formal Concept Analysis
Exercise Sheet 1, Winter Semester 2014/15

1 Set Theory

Exercise 1 (a piece of recapitulation)

Given the following hints and the universe $M := \{1, 2, 3, 4, 5, 6, 7, 8\}$, compute the sets A, B, C:

(a) $A \cup B = \{2, 3, 4, 5, 6, 7, 8\}$

(b) $B \cup C = \{1, 2, 4, 6, 8\}$

(c) $A \cup C = \{1, 2, 3, 4, 5, 7, 8\}$

(d) $A \cap B = \{2\}$

(e) $B \cap C = \{2, 4, 8\}$

(f) $A \cap C = \{2\}$

2 Logic

Exercise 2 (repetition first-order logic)

Formalize the following statements for natural numbers a, b, c:

(i) a divides b.

(ii) a is odd.

(iii) a is common divisor of b and c

(iv) a is the gcd of b and c.

(v) a is a square number.

(vi) a is a prime number.

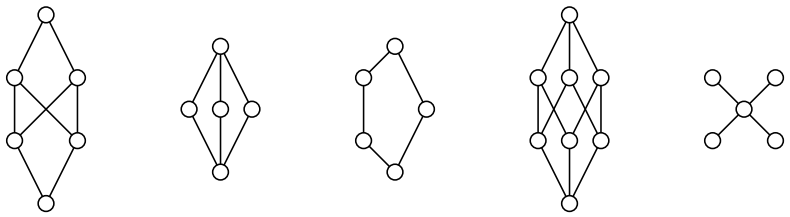
3 Lattice Theory

Exercise 3 (line diagram)

a) Define: What is a lattice?

b) Find a preferably small lattice and draw its line diagram.

c) Which of the following line diagrams is not a lattice? Why?



(i) (ii) (iii) (iv) (v)

Exercise 4 (complete lattice)

a) Define: What is a complete lattice?

b) Can you find a *complete* lattice among the lattices of Exercise 1c?

c) Let $P := (M, \leq)$ be an ordered set such that for every subset X of M the infimum $\bigwedge X$ exists. Show that P is a complete lattice.

4 Formal Concept Analysis

Exercise 5 (Formal Context)

Regard the following formal context $\mathbb{K}$, given as a cross table:

	needs water to live	lives in water	lives on land	needs chlorophyll to produce food	two seed leaves	one seed leaf	can move around	has limbs	suckles its offspring
Leech	x	x					x		
Bream	x	x					x	x	
Frog	x	x	x				x	x	x
Spike-Weed	x	x		x		x			
Reed	x	x	x	x		x			
Bean	x		x	x	x				
Maize	x		x	x		x			

a) Specify the following sets:

(i) $\{\text{Bean}\}'$

(ii) $\{\text{lives on land}\}'$

(iii) $\{\text{two seed leaves}\}''$

(iv) $\{\text{Frog, Maize}\}'$

(v) $\{\text{needs chlorophyll to produce food, can move around}\}'$

(vi) $\{\text{lives in water, lives on land}\}'$

(vii) $\{\text{needs chlorophyll to produce food, can move around}\}''$

b) Extend $\mathbb{K}$ with both an object and an attribute.