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MATH. - NATURWISS. FAKULTÄT
FACHBEREICH INFORMATIK
KOGNITIVE SYSTEME · PROF. A. ZELL

Artificial Intelligence

Assignment 09

Assignment due by: 28.01.2022

Question 1 Cryptarithmetic Puzzle (4 points)

Solve the cryptarithmetic problems below by hand. Write down the constraints and detail your reasoning.

(a)

$$\begin{array}{cccccc} & & \mathrm{F} & \mathrm{O} & \mathrm{U} & \mathrm{R} \\ + & & \mathrm{F} & \mathrm{I} & \mathrm{V} & \mathrm{E} \\ \hline & \mathrm{N} & \mathrm{I} & \mathrm{N} & \mathrm{E} & \end{array}$$

(b)

$$\begin{array}{cccccc} & & & \mathrm{C} & \mathrm{A} & \mathrm{K} & \mathrm{E} \\ + & \mathrm{C} & \mathrm{O} & \mathrm{O} & \mathrm{K} & \mathrm{I} & \mathrm{E} \\ \hline & \mathrm{A} & \mathrm{L} & \mathrm{I} & \mathrm{E} & \mathrm{N} & \mathrm{S} \end{array}$$

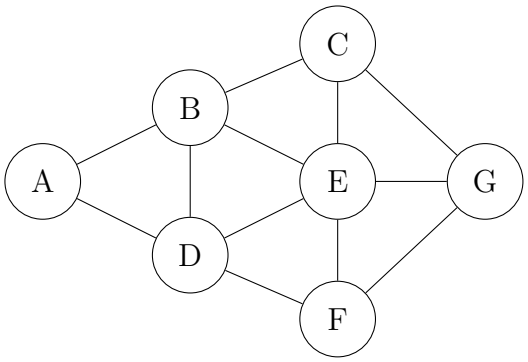
Question 2 CSP: AC–3 [4 points]

Use the AC–3-algorithm on the 4 by 4 Sudoku (only digits 1–4) board below until the algorithm terminates.

1			
			3
	2	4	

Consider each tile a variable and denote these with a double subscript (i.e. $X_{i,j}, D_{i,j}, \ldots$), like you would in matrix notation. For example, for this particular board we have $D_{1,1} = \{1\}$ and $D_{1,2} = \{1, 2, 3, 4\}$. Show your work in detail until you have at least found three more certain digits, then you may continue by just stating the numbers until the end. Here, in detail means: write down, which value x is deleted from which domain $D_{i,j}$, because of what constraint. See the pseudocode in the slides of chapter 6, page 15 & 16.

Question 3 CSP: Cartographic coloring (6+6=12 points)



(a) The goal is to assign one of the colors *red (r)*, *green (g)*, or *blue (b)* to each node of the above graph so that two adjacent nodes do not have the same color. For this question please use the format shown in the table below. Solve the problem using simple **Forward Checking** (not MAC). Assign variables strictly using an alphabetic order. Assign colors in the order *r, g, b* if possible. Note: When the domain of any node becomes empty, backtrack to the last node in which you had a choice of at least two colors in its domain.

	D_A	D_B	D_C	D_D	D_E	D_F	D_G
	r, g, b	r, g, b	r, g, b	r, g, b	r, g, b	r, g, b	r, g, b
A ← r	r	g, b	r, g, b	g, b	r, g, b	r, g, b	r, g, b
B ← g	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C ← r	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

(b) Now solve the same problem now using **MAC**.