Grundlagen der Wissensverarbeitung

Blatt 6

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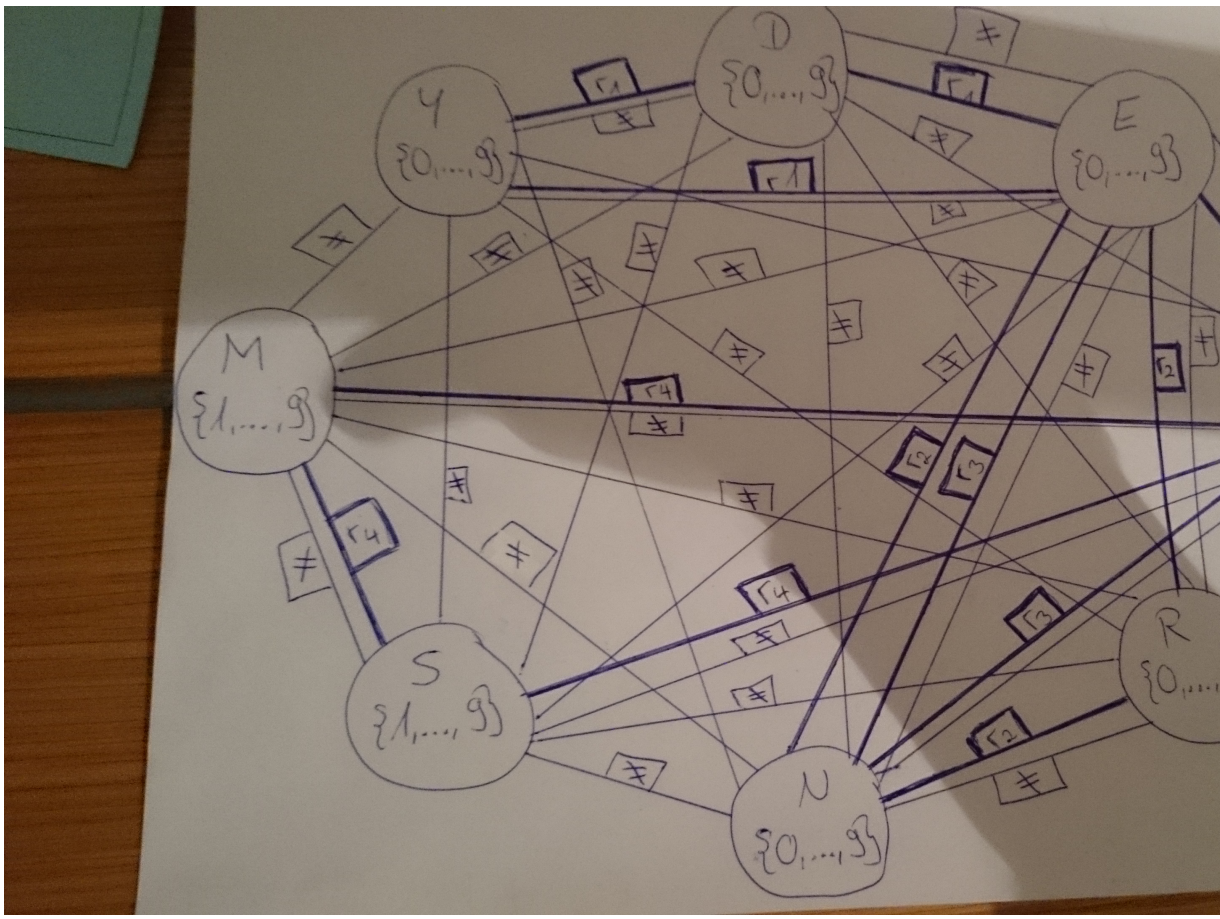
Exercise 1.1: (Constraints)

Formalize this riddle in the form of a constraint network.
Ideas:
We have the following relations:
r1: Y = (D + E) mod 10
r2: E = (N + R + ((D + E) mod 10)) mod 10
r3: N = (E + O + (N + R + ((D + E) mod 10)) mod 10) mod 10
r4: O = (S + M + (E + O + (N + R + ((D + E) mod 10)) mod 10) mod 10) mod 10

Since we have relations between 3 variables (e.g. Y, D, E, because Y = (D + E) mod 10), 3 arcs in the network are the result.
The mod 10 indicates a possible carry after each sum.
Every variable can be a digit between 0 and 9. S and M can't be zero, because they are the leading digit of "SEND" ans "MONEY"/"MORE".
Every variable represents another digit, so no variable can be the same as another.



Manual constraint solving. First, try to solve the problem without any formal methods or tools.

Human solution: Trial and Error with some logic.

Step 1:

Which words can be filled in 1Across (A1xD1, A1xD2, A1xD3) or 1Down (A1xD1, A2xD1, A3xD1)?

add? No, because then we need 2 words, which start with d. But we don't have any word starting with d.
(...)
are? Yes, because we have other words starting with a or e and one word starting with r.
(...)
bag? No because we don't have a word starting with g.
(...)
lee? No, because we would need a second word starting with l and we don't have one.
oaf? No, because we would need a second word starting with o and we don't have one.
(...)

The following words remain, if we exclude words from the list by the logic above:
are, art, bat, bee, boa, ear, eel, eft, far, fat, tar.

Step 2:
Enter the remaining words from step 1, which start with the same letter 1Across and 1Down. Test if possible:
are and art. Impossible, because then we would need two words starting with r, but we have only one from the orogin list (rat).
far and fat. Impossible, because if we use far, we also have to enter rat in 3Down. Then we have a word starting and ending with t in 3Across. But we don't have a word of this form in the origin list.
tar. Impossible, because no other word starting with t in the list from step 1.
ear and eel, ear and eft or eel and eft. Impossible, (...).
bat and bee or bat and boar. Impossible. Case bat and bee: If we choose bee as 1Across and bat as 1Down, then we can put the words ear, eel, eft 2Down and 3 Down. But that gives us an r, l or t in A3xD2, which is not possible, because only words from origin list start with t, but none of them has r, l or t as second letter. (...)

Only one solution: **bee and boa** in 1Across and 1Down. Rest see table:

x	D1	D2	D3
A1	b	e	e
A2	o	a	f
A3	a	r	t

Solve the problem by hand using domain consistency as a first step and as a second step the arc consistency.

TO DO !