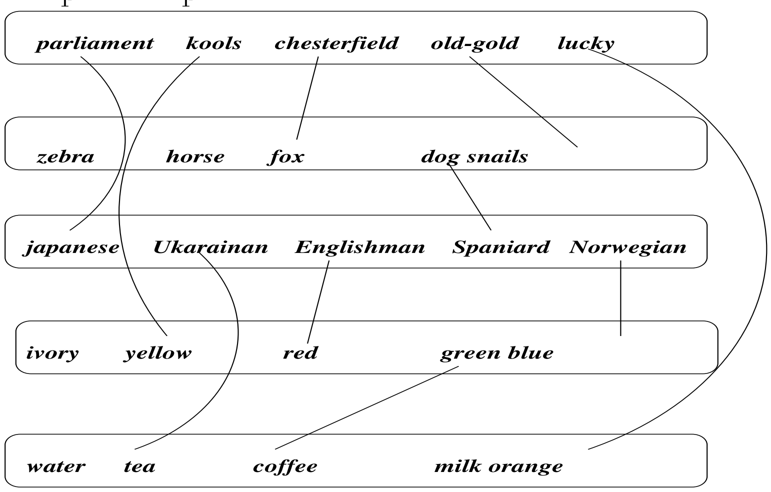
Rina Dechter, Fall-99

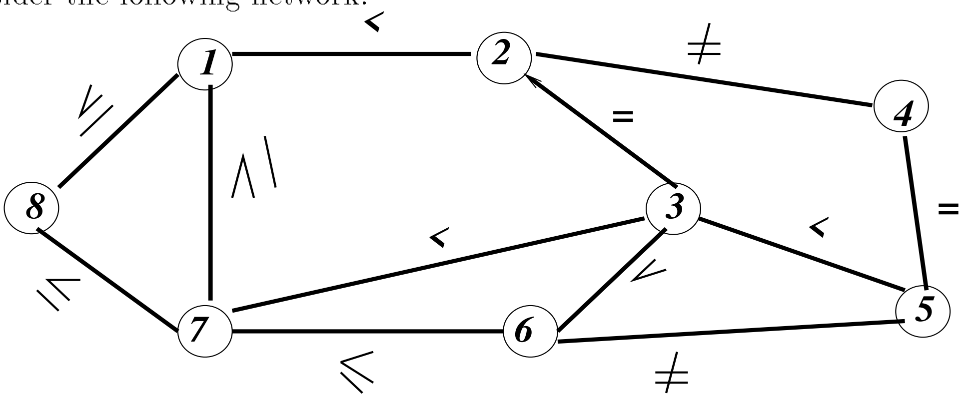
ICS 275a, Assignment 3

Whenever you are asked to generate arc,path consistent network you should not only show the end-result but show also how it is derived. You can either implement one of the known algorithms hand-in your code, or hand-simulate one of the known algorithm. Stop when your simulation takes more then one page.

1. Consider the CSP formulation of the Zebra problem Where you have 25 variables, divided into clusters and where the domains are the houses numbers (see attached figure). Is the problem arc-consistent? If not specify an equivalent arc-consistent problem. Is the problem path-consistent?



2. Consider the following network.



Assume that each variable has a domain of $\{1, 2, 3, 4\}$. Find an equivalent arc and path-consistent network. Is the path-consistent network minimal? Is it backtrack-free?

3. Consider 2-cnf formulas (conjunction of clauses of length 2).

(a) Describe an algorithm for enforcing arc-consistency of 2-cnf formulas using resolution.

(b) Describe an algorithm for enforcing path-consistency on 2-cnf formulas, using resolution.

4. Let R be an arbitrary 3-graph coloring problem.

   - Discuss what would be the effect of enforcing 2,3-consistency on R.
   - What would be the effect $2, 3, 4, ...k-1, k, k+1$-consistency on a k-coloring problem?

5. Prove that an arc-consistent binary network having no cycles is consistent.

6. Consider the following cnf theory

$$\varphi = \{(a, \neg b, d)(\neg d, f, c)(\neg c)\}$$

   Apply RC_1 to this theory. Apply RC_2 to this theory.

7. (extra credit) Translate algorithms RC_1 (Figure 3.17 in chapter 3) to be applied to general cnf theories (again: use resolution as the basic operation).

8. (extra credit) Translate algorithms RC_1 (Figure 3.17 in chapter 3) to be applied to numerical constraints that expressed by linear expressions.

9. Read chapter 3 carefully and provide comments. Is the chapter too detailed? not too detailed? Does it have too few or too many examples?, etc. Is it hard/easy to digest? Did you enjoy/suffer while studying? etc.