

## Session 5: Constraint Processing II & Waltz

### Constraint Processing II

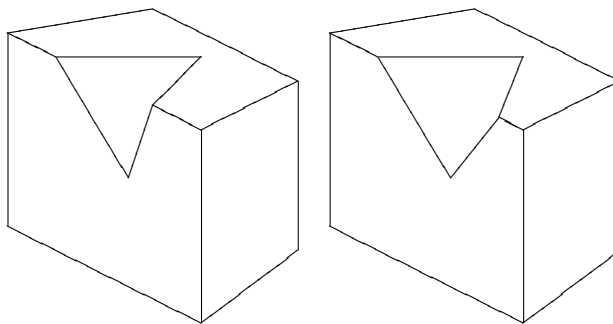
1. The 4-teachers problem. Four teachers,  $A$ ,  $B$ ,  $C$  and  $D$  have to give classes at the same time. To this end, 5 rooms are available, viz. rooms 1, 2, 3, 4 and 5. Teacher  $A$  doesn't want to teach in room 1. Teacher  $B$  doesn't want to teach in room 2. Teacher  $D$  wants to teach in a room with number greater or equal to 3, yet strictly less than the number of the room  $B$  is teaching in. Teacher  $C$  doesn't want to teach in a room adjacent to that of  $B$  (rooms with successive numbers are adjacent), nor in room 5. Obviously, we want to assign different rooms to different teachers.

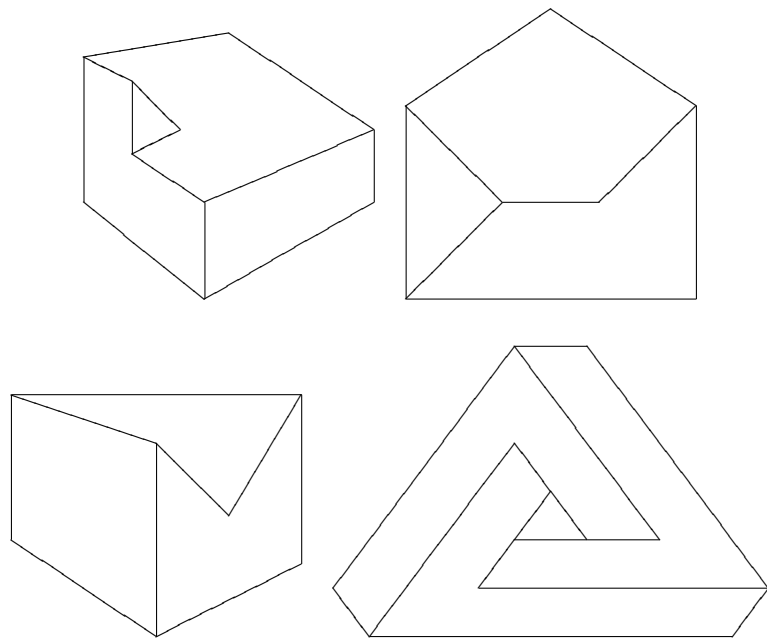
Formulate the above constraint problem in terms of constraints over the variables  $A$ ,  $B$ ,  $C$  and  $D$  and the finite domain  $\{1, 2, 3, 4, 5\}$ , as in the 4-houses problem. Use Forward Checking to generate a solution to the problem by drawing the search tree (depth-first with forward checking as arc-consistency method between successive assignments of the backtracking algorithm). Use a representation similar to the one used for the 4-houses problem in the course notes. Clearly indicate at each step which elements are removed from the domains.

Finally, do Forward Checking again, but this time with dynamic search rearrangement.

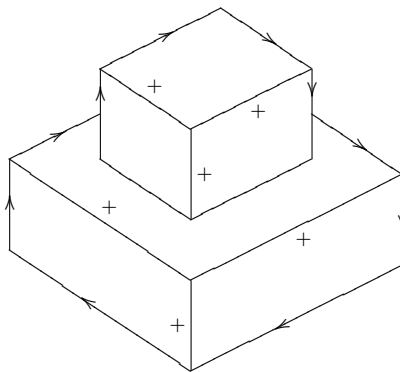
### Waltz

1. Waltz: Label the following figures.

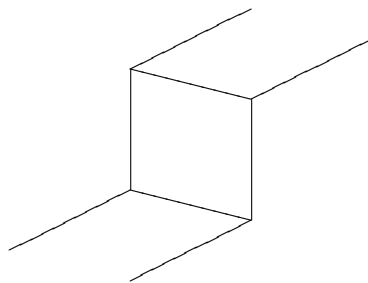




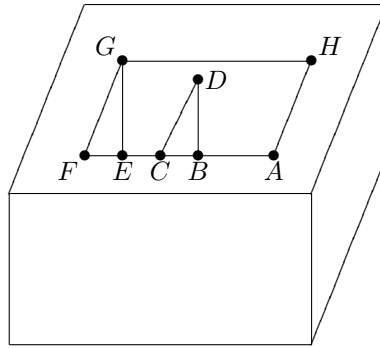
2. Finish the labeling of the following figure. Give all possible solutions.



3. Label the following figure fragment. Give all possible solutions.



4. Consider the following figure.(ex-exam)



You may assume that at most 3 edges meet at each vertex. There are no shadows or cracks. At each step write down the junction piles kept by the Waltz procedure for the junctions  $A$ ,  $B$ ,  $C$ ,  $D$ ,  $E$ ,  $F$ ,  $G$  and  $H$ . Consider the junctions in that order and return to previously visited junctions when pruning is possible. Your answer should look like this:

A: <pile of junctions that are allowed for A, oriented as in the figure>

B: <pile of junctions that are allowed for B, oriented as in the figure>

If A's pile can be pruned:

A: <pile of junctions that are allowed for A, oriented as in the figure>

Note: B and C are T junctions.