CS 572(Assignment 4)

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Problem 6.4

(a) For rectilinear floor planning, assume the large rectangle has length L and breadth B. Each rectangle R_i is parameterized by four variables, x, y, l, b, which defines its co-ordinates position, length and breadth. All smaller rectangles have the set of constraints.

$$\begin{aligned} &R_{i,x} \geq 0, \\ &R_{i,x} + R_{i,l} \leq L \\ &R_{i,y} \geq 0, \\ &R_{i,y} + R_{i,b} \leq B \end{aligned}$$

which makes sure that the smaller rectangles lie within the larger rectangles. In addition to this, we can add constraints between two rectangles i and j, where $i \neq j$

$$\begin{aligned} &R_{i,x} + R_{i,l} \leq R_{j,x} \text{ or } R_{i,x} \geq R_{j,x} + R_{j,l} \\ &R_{i,y} + R_{i,b} \leq R_{j,y} \text{ or } R_{i,y} \geq R_{j,y} + R_{j,b} \end{aligned}$$

The domain of each variable is set of 4-tuples, provided above, that are the right size for the corresponding smaller rectangle so that it will fit inside the larger rectangle.

(b) Class Scheduling Problem:
Here the provided variables consists of Professors(P), Classrooms(C), Subjects (S) and Time Slots(S).
Let's use P_{ct} and S_{ct} to represent a Professor in classroom c on time t and a subject being taught in classroom c on time t respectively.
Now we apply constraints in such a way that now two Professors have classes in the same classroom at the same time, that means we need to have all three attributes unique for a particular time slot, i.e. Professor, Classroom and Subject.

The domain of each P_{ct} is the set of professors and domain of each S_{ct} is the set of subjects. Denote the set of subjects that professor P can teach by $D(t)$

$$P_{ct} \neq P_{dt}, \qquad \text{where } d \neq c$$

which implies that no professors are assigned to two different classes at the same time. Also, there is a constraint between every P_{ct} and S_{ct}, denoted by $C_{ij}(t, s)$ such that it ensures that

if a Professor P is being assigned to P_{ij}, then S_{ct} is assigned a value from $D(t)$.

Problem 6.7

(a) Let's introduce variables, i.e. Color, Nationality, Candy, Drink and Pet, to represent it as a CSP. It will result in having 25 variables. We will represent the house as numbers and keep it constant as rows. With this representation we will be able to represent all constraints in a simple way and each of the 25 variables will be able to take values from appropiate domains. Besides that we can also create another representation such that we have five variable for each house, with one having domain as color, one with nationality, one with candy, one with drink and one with pet. This representation will not be as simple as the previous one.