Ch. 6

5.

a) For each rect R_i w/ width, w, and height, h:

Variables = $\{x, y, w, h\}$

Constraints:

$$\left.\begin{aligned} &R_i x \geq 0 \\ &R_i x + R_i w \leq W \\ &R_i y \geq 0 \\ &R_i y + R_i h \leq H \end{aligned}\right\} \text{ Confines small rects to the large rect.}$$

There are also constraints between rects R_i & R_j:

$R_i x + R_i w \leq R_j x$ or $R_i x \geq R_j x + R_j w$

$R_i y + R_i h \leq R_j y$ or $R_i y \geq R_j y + R_j h$

b) Variables = {Teachers, Subjects, Classrooms, Time slots}

Constraints:

Given: T_{ij} = teacher in classroom i at time j.

S_{ij} = set of subjects

$\rightarrow T_{ij} \neq T_{kj}, \quad k \neq i$

let $D(t)$ = subjects that teacher, t, can teach

then $C(t) = t$ is assigned to $T_{ij} \rightarrow S_{ij}$ is assigned value from $D(t)$

6. Variables = $\{T, W, O, F, U, R\}$

Constraints:

$$O + O = R + 10(x_1)$$

$$x_1 + W + W = U + 10(x_2)$$

$$x_2 + T + T = O + 10(x_3)$$

$$x_3 = F$$

Alldiff (F, O, U, R, T, W)

Domains:

- $D_F, D_{x_3} = \{1\}$
- $D_{x_2}, D_{x_1} = \{0, 1\}$
- $D_T = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
- $D_W, D_O, D_U, D_R = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

~~D_F~~, ~~D_{X_3}~~ = ~~{1}~~

~~D_{X_2}~~, ~~D_{X_1}~~ = {0, 1}

D_T = ~~{1, 2, 3, 4~~, 5, 6, 7, 8, 9}

$D_W = D_R$ = {0, ~~1~~, 2, 3, 4, 5, 6, 7, 8, 9}

F = 1

X_3 = 1

X_2 = 0

X_1 = 0

O = 2

W = 3

X_1 = 1

O = 6

W = 3

(1, 6, 7, 2, 8, 3, 0, 0, 1)

D_U = {3, 5, 7, 9}

D_H = {0, 3, 4}

```
  836
+ 836
------
 1672
```

7. With constraint variable, C, with domain as a set of all possible 3-tuples satisfying A + B = C, we can define a new set of constraints:

$C[A] \in A$

$C[B] \in B$

$C[C] \in C$

which enforces a binary constraint which is satisfied only if tuple, t, in the domain is C is compatible with value, x, in domain A/B/C such that $t[A/B/C] = x$.