Constraint 1:

$$\sum_{t=1}^{30} X_{i,t,l} = 0 \qquad \forall i, \ \forall l \in INFLOC;$$

This shows the list of the locations where doctor i cannot be at a shift

Constraint 2:

(3) → we have 3 locations: ICU1, ICU2, SR

$$\sum_{l=1}^{3} X_{i,t,l} \leq 1 \qquad \forall i, \forall t,$$

Constraint 3:

$$\sum_{i=1}^{16} X_{i,t,l=ICU1} = 1 \qquad \forall t$$

$$\sum_{i=1}^{16} X_{i,t,l=ICU2} = 1 \qquad \forall t$$

Constraint 4 & 5

$$0 \leq \sum_{i=1}^{16} X_{i,t,l=SR} \leq 1 \qquad \forall t$$

Constraint 6

$$\sum_{t=1}^{30} \sum_{l=1}^{3} X_{i,t,l} = \underline{TotalShift(i)} \qquad \forall i$$

This is a __list__ which shows the number of shifts that each resident (doctor) must take/perform

Constraint 7:

$$\sum_{t=1}^{30} \sum_{l=1}^{3} X_{i,t,l} = \underline{WEShift(i)} \qquad \forall i$$

The list showing the number of weekend shifts

Constraint 8:

$$\sum_{t=1}^{30} \sum_{i=1}^{3} X_{i,t,l} - df_i^+ + df_i^- = FridayShifts(i)$$

$\underbrace{\qquad}$ Deviation constraints

$\underbrace{\qquad}$ the list showing friday shifts

Constraint 9

$$\sum_{l=1}^{2} X_{i,t,l} + X_{i,t+1,l} \leq 1.$$

Constraint 10:

Not important.

Constraint 11. (Tandem shifts (Guhasırı nöbetler))

$$\sum_{\ell=1}^{3} \left(X_{i,t,\ell} + X_{i,t+1,\ell} + X_{i,t+2,\ell} \right) - dt^{+}_{i,t} \leq 1.$$

t is not in the set SWF

$$\forall i, \quad t \in \underset{\underset{1}{=}}{T2}, \quad t \notin SWF$$

normal T set is $\{1, \ldots 30\}$

this set is $\{1, \ldots 28\}$.

Constraint 12, 13

Not important.

Constraint 14:

a list showing whether the doctor asks for sunday with friday

$$\sum_{\ell=1}^{3} \left(X_{i,t-2,\ell} \cdot SwChoose[i] \right)$$

$$= X_{i,t,\ell} \cdot SwChoose[i]$$

$$- dswf_{i,t}^{+} \leq 0 \qquad \forall i, \forall t \in \mathcal{E}swF$$

the list of sundays that are eligible to write here.

Constraint 15, 16

Not important.

Constraint 17:

$$\sum_{\ell=1}^{3} X_{i,t,\ell} = 0 \qquad \forall i, \forall t \in VacDays[i]$$

The list showing the vacation days of the doctors.

Constraint 18

$$\sum_{i=1}^{3} X_{i,t,\ell} = 1 \qquad \forall i, \forall t \in MustDays(i)$$

The list showing the "must days" of the doctors.

Constraint 19.

$$\sum_{i=1}^{3} X_{i,t,\ell} \boxed{- doff^{+}_{i,t}} = 0$$

$$\forall i, \forall t \in OffDays(i)$$

deviation variable.

the list showing the off days.

Constraint 20.

Similar to 19 & 18.