Constraints:

(1) Ensure required tutors for a workshop

$$\sum_{i \in I} x_{ijt} = r_{jt} \qquad \forall j \in J, t \in T$$

(2) Tutor weekly hour limits

$$L_i \leq \sum_{j \in J} w_j m_j 12 x_{ij} \leq U_i \qquad \forall i \in I$$

(3) Stop tutors from switching within workshop

$$W_{jt} = \begin{cases} 1 & \text{if timeslot } t \text{ is part of same workshop } j \text{ as } t-1 \\ 0 & \text{o/w} \end{cases}$$

$$x_{ijt} - x_{ij(t-1)} \leq 1 - W_{jt} \qquad \forall i \in I, j \in J, t \in T$$

- If $W_{jt} = 1 \Rightarrow x_{ijt}$ must be $= x_{ij(t-1)}$
- If $W_{jt} = 0 \Rightarrow$ a new workshop

(4) Tutor availibility & workshop active constraint

$$M x_{ij} \leq e_{jt} \cdot a_{it} \qquad \forall i \in I, j \in J, t \in T$$

(5) Weekly hours / Tutor / Course

$$12 w_j = \frac{1}{2} \sum_{t \in T} x_{ijt} \qquad \forall i \in I, j \in J$$

(6) Tutor Course Limits

$$l_i \leq \sum_{j \in J} x_{ij} \leq u_i \qquad \forall i \in I$$

(7) Maximum Consecutive Hours Constraint

(maybe, not sure how/if to add)

$$\sum_{t'=t}^{t+H} x_{ijt'} \leq H \qquad \forall i \in I, j \in J, t \in T$$

(8) Avoiding Overlapping Assignments

$$\sum_{j \in J} x_{ijt} \leq 1 \qquad \forall i \in I, t \in T$$

Objective Function:

$$\max \underbrace{\sum_{i \in I} p_{ij} x_{ij}}_{\text{1 weight on preference.}} - \underbrace{2\left(\max \sum_{i \in J} x_{ij} - \min \sum_{j \in J} x_{ij}\right)}_{\text{heavier weight on fairness than preference}}$$

Make graphs on • fairness from output
• preferences from output

Sets:

- I tutors
- J courses
- T timeslots

Variables

- p_{ij} = preference
- w_j = weekly tutor hrs / course
- m_j = TMM
- r_{jt} = # hours course j at timeslot t
- L_i, U_i = min max hrs / tutor / week
- l_i, u_i = min max courses / tutor

$a_{i,t}$ = Tutor availibirity

$e_{j,t}$ = if workshop exists at time t course j

$W_{j,t}$ = 1 if timeslot t belongs to same workshop for j as $t-1$

0 o/w.