W/O position variable 'y'

All the previous notations are the same:

$i, j, k, z, x, N^{tsk}, N^{prc}, p_i, c_i, e^{o}_{iq}, u_i, f_{xz}, T_{ij}, B, \phi, E_{ijkxz}$.

obj. function ϕ : $\sum_{ijkxz} \left(X_{ijkxz} \times u_i \times \sum_{q=1}^{k} e^{o}_{iq} \right)$

New decision Variables:

→ X_{ijkxz} : whether job T_{ij} is assigned to the processor P_x with the frequency f_{xz} and executes upto k^{th} optional segment.
(similar to V_{ijkxyz}, but without y position)

- S_{ij} : start time of job T_{ij}
GRB. CONTINUOUS, lb = 0

- $B_{ij\,i'j'x}$: whether job T_{ij} starts after job $T_{i'j'}$ on processor P_x

- A_{ijx} : whether job T_{ij} is on processor P_x

$\therefore A_{ijx} = \sum_{kz} X_{ijkxz}$

New Constraints:

C1] : Job assigment unique : $\sum_{kxz} X_{ijkxz} = 1 \quad \forall i,j$

C2]

[2]. No overlap of jobs:

New variable $c_{ij} = s_{ij} + \sum_{k,n,z} \left(x_{ijknz} \times \frac{e_i + \sum_{q=1}^{k} e^{o}_{i,q}}{f_{n,z}} \right)$

completion time.

for two jobs T_{ij} & $T_{i'j'}$ and every P_x,

New variable A_{ijx}:

$$s_{ij} \geq c_{i'j'} - D(1 - B_{iji'j'x}) - D(2 - A_{ijx} - A_{i'j'x})$$

$$s_{i'j'} \geq c_{ij} - D(B_{iji'j'x}) - D(2 - A_{ijx} - A_{i'j'x})$$

: where D is a large constant.

[3] Timing constraints:

$$s_{ij} \geq (c_{j-1}) \times p_i \quad \forall i,j$$

$$c_{ij} \leq j \times p_i \quad \forall i,j$$

[4] Energy Budget (B)

$$\sum_{ijknz} \left(x_{ijknz} \times E_{ijknz} \right) \leq B.$$