ISE 3230 Problem Formulation

Decision Variables:
$income_{ij}$ represents the amount of income for movie i at timeslot j
i=1,2,..,8 and j=1,2,...,41

$tickets_{ij}$ represents the amount of tickets sold for movie i at timeslot j
i=1,2,..,8 and j=1,2,...,41

$showings_{ij} \in \{0, 1\}$ represents whether or not movie i is shown at timeslot j
i=1,2,..,8 and j=1,2,...,41

$theaters[k]_{ij} \in \{0, 1\}$ represents whether or not theater k shows movie i at timeslot j
k=1,2,...,8 and i=1,2,...,8 and j=1,2,...,41

Objective Function:
z represents the amount of income in dollars ($)

$$max(z) = \sum_{i=1}^{8} \sum_{j=1}^{41} income_{ij}$$

Constants:
$price_j$ is the price of a ticket at timeslot j

$mPopularity_i$ is the popularity index of movie i as determined by IMDB charts at its time of release

$tPopularity_j$ is the popularity index of timeslot j as determined by Google analytics and reviews for Gateway Theaters

$theaterCapacity_k$ is the capacity of theater k

$movieLength_i$ is the length of movie i measured in the number of 15 minute timeslots it would take to finish the movie

Constraints:

$$\sum_{i=1}^{8} showings_{ij} \leq 2 \quad \text{for j=1,2,...,41}$$

$$\sum_{j=1}^{41} showings_{ij} \leq 5 \quad \text{for i=1,2,...,8}$$

$$\sum_{j=1}^{41} showings_{ij} \geq 1 \quad \text{for i=1,2,...,8}$$

$$showings = theaters1 + theaters2 + ... + theaters8$$

$$tickets_{ij} = theaterCapacity_k * theaters[k]_{ij}$$
$$\text{for k=1,2,...,8 and i=1,2,...,8 and j=1,2,...,41}$$

$$income_{ij} = tickets_{ij} * price_j * mPopularity_i * tPopularity_j$$
$$\text{for i=1,2,...,8 and j=1,2,...,41}$$

$$\sum_{a=j}^{j+movieLength_i} theaters[k]_{ij} \leq 1$$
$$\text{for k=1,2,...,8 and i=1,2,...,8 and j=1,2,...,41}$$

$$income_{ij} \geq 0 \quad \text{for i=1,2,...,8 and j=1,2,...,41}$$
$$tickets_{ij} \geq 0 \quad \text{for i=1,2,...,8 and j=1,2,...,41}$$
$$showings_{ij} \geq 0 \quad \text{for i=1,2,...,8 and j=1,2,...,41}$$

$$theaters[k]_{ij} \geq 0 \quad \text{for k=1,2,...,8 and i=1,2,...,8 and j=1,2,...,41}$$