

ISE 3230 Problem Formulation

Decision Variables:

$revenue_{ij}$ represents the amount of revenue for movie i at timeslot j
 $i=1,2,\dots,8$ and $j=1,2,\dots,41$

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

$showings_{ij}$ represents the number of showings of movie i at timeslot j
 $i=1,2,\dots,8$ and $j=1,2,\dots,41$

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

Objective Function:

z represents the amount of revenue in dollars (\$)

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

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:

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

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

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

$$showings = theaters1 + theaters2 + \dots + theaters8$$

$$tickets_{ij} = theaterCapacity_k * theaters[k]_{ij}$$

for $k=1,2,\dots,8$ and $i=1,2,\dots,8$ and $j=1,2,\dots,41$

$$revenue_{ij} = tickets_{ij} * price_j * mPopularity_i * tPopularity_j$$

for $i=1,2,\dots,8$ and $j=1,2,\dots,41$

$$\sum_{a=j}^{\min(41, j+movieLength_i)} theaters[k]_{ij} \leq 1$$

for $k=1,2,\dots,8$ and $i=1,2,\dots,8$ and $j=1,2,\dots,41$

$$revenue_{ij} \geq 0 \quad \text{for } i=1,2,\dots,8 \text{ and } j=1,2,\dots,41$$

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

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

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