ISYE 3133 Project 2

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Non-Decision Variables

$k = \#$ of shifts needing to be staffed

$n = \#$ of job types.

$s = \#$ of consecutive shifts worked that constitute a workday.

$p_{1,j}$ = the amount an employee of type j is paid to work a regular workday comprising s shifts, $0 <= j < n$

$p_{2,j}$ = the amount an employee of type j is paid to work an overtime shift, $0 <= j < n$

$r_{i,j}$ = the number of employees of type j that must be working during shift i in order to meet staffing requirements, $0 <= i < k$, $0 <= j < n$

Decision Variables:

$x_{1,i,j}$ = the number of employees of type j hired to begin work in shift i and work a regular workday comprised of s shifts (no overtime), $0 <= i < k$, $0 <= j < n$

$x_{2,i,j}$ = the number of employees of type j hired to begin work in shift i and work a regular workday comprised of s shifts *and* an additional overtime shift, $0 <= i < k$, $0 <= j < n$

Objective Function:

$min\{\sum_{j=0}^{n-1}\sum_{i=0}^{k-1}(x_{1,i,j}) * (p_{1,j}) + (x_{2,i,j}) * (p_{1,j} + p_{2,j})\}$

Constraints:

$$\sum_{t=i-s+1}^{i} x_{1,(t)mod(k),j} + \sum_{t=i-s}^{i} x_{2,(t)mod(k),j} >= r_{i,j}, \forall i, j$$

Implementation Notes

Gurobi Implementation will make use of matrices A and B, containing all $x_{1,i,j}$ and $x_{2,i,j}$ to simplify the LP. A and B are defined as follows:

$A_{(kxn)}$ = A zero-indexed k x n matrix where the element $A_{i,j}$ represents the # of employees of type j beginning work in shift i and working 0 overtime shifts, $0 < i \leq k, 0 < j \leq n$

$B_{(kxn)}$ = A k x n matrix where the element A_{ij} represents the # of employees of type $j-1$ beginning work in shift $i-1$ and working exactly 1 overtime shifts, $0 < i \leq k, 0 < j \leq n$