ISYE 6669 Deterministic Optimization

Homework 14

April 25th, 2021

1.

$Decision\ Variables:$

$c:\ \#\ of\ compact\ cars\ to\ produce$

$m:\ \#\ of\ midsize\ cars\ to\ produce$

$l:\ \ \#\ of\ large\ cars\ to\ produce$

$y_1:\ Representing\ if\ compact\ cars\ are\ manufactured\ \{0,1\}$

$y_2:\ Representing\ if\ compact\ cars\ are\ not\ manufactured$

$y_3:\ Representing\ if\ medium\ cars\ are\ manufactured\ \{0,1\}$

$y_4:\ Representing\ if\ medium\ cars\ are\ not\ manufactured$

$y_5:\ Representing\ if\ large\ cars\ are\ manufactured\ \{0,1\}$

$y_6:\ Representing\ if\ large\ cars\ are\ not\ manufactured$

$max\ 2000c\ +\ 3000m\ +\ 4000l$

$s.t.$

$1.5c\ +\ 3m\ +\ 5l\ \leq\ 6000$

$30c\ +\ 25m\ +\ 40l\ \leq\ 60000$

$cy_1\ \geq\ 1000$

$cy_2\ \leq\ 0$

$cy_3\ \geq\ 800$

$cy_4\ \leq\ 0$

$(c+m)y_5\ \leq 1200$

$(c+m)y_6\ \geq\ 0$

$y_c + y_m + y_l \geq 1$

$c, m, l\ \in\ Z,\ y_i \in\ \{0,1\}\ \forall t = 1,2,3,4,5,6$

$Cy1$ >= 1000 ($So\ if\ y1\ =\ 1,\ meaning\ you're\ producing\ c,\ then\ you\ can\ produce\ at\ least$ 1000. $If\ y2\ =\ 1,\ then\ that\ means\ we're\ not\ producing\ c,\ then$

2.

$x:\ to\ denote\ the\ number\ (integer)\ of\ workers\ who\ start\ work\ on\ schedule\ permutation\ i\ \ on\ day\ i(i = 1\ is\ Monday,\ i = 7\ is\ Sunday)$

$w:\ to\ denote\ the\ total\ number\ of\ workers\ working\ on\ day\ i(i = 1\ is\ Monday,\ i = 7\ is\ Sunday)$

$permutation\ i\ \ on\ day\ i(i = 1\ is\ Monday,\ i = 7\ is\ Sunday)\ Used\ for\ measuring\ number\ of\ people\ scheduled\ on\ previous\ days,$

$y:\ binary\ variables\ representing\ if\ a\ schedule\ combination\ s_i\ is\ chosen$

$z:\ binary\ variables\ representing\ the\ constraint\ (i.e.\ If\ the\ number\ of$

$workers\ that\ start\ on\ a\ Monday\ exceed\ 10\ constraint)$
$s_1: \ binary\ variable\ representing\ if\ the\ number\ of\ workers\ that\ start\ on\ a\ Saturday$
$should\ be\ less\ than\ the\ number\ of\ workers\ that\ start\ on\ a\ Monday$
$s_2: \ binary\ variable\ representing\ if\ the\ number\ of\ workers\ that\ start\ on\ a\ Saturday$
$should\ be\ less\ than\ the\ number\ of\ workers\ that\ start\ on\ a\ Tuesday$

$min\ 1500x_1 + 1600(x_2 + x_7) + 1650(x_3 + x_4 + x_5 + x_6)$
$s.t.$

$w_1 = x_1 + x_7 + x_6 + x_5 + x_4$
$w_2 = x_2 + x_1 + x_7 + x_6 + x_5$
$w_3 = x_3 + x_2 + x_1 + x_7 + x_6$
$w_4 = x_4 + x_3 + x_2 + x_1 + x_7$
$w_5 = x_5 + x_4 + x_3 + x_2 + x_1$
$w_6 = x_6 + x_5 + x_4 + x_3 + x_2$
$w_7 = x_7 + x_6 + x_5 + x_4 + x_3$
$25 \leq w_i \leq 40\ \forall\ i = 1,2,4,5,6,7$
$25 \leq w_3 \leq 40(1-z) + 28z$
$w_i y_i \leq 35\ , y_i \in \{0,1\}\ \forall\ i = 1...7,\ \sum_{i=1}^{7} y_i \geq 3$
$z\ \geq\ \dfrac{x_1 - (10-\epsilon)}{(30+\ \epsilon)},\ x_3\ \leq 40(1-z) + 28z,\ z \in \{0,1\}$
$x_6\ \leq\ (x_1\ -1)s_1 + 40(1-s_1),\ x_6\ \leq\ (x_2\ -1)s_2 + 40(1-s_2),$
$s_1 + s_2 \geq 1,\ s_1, s_2 \in \{0,1\}$
$x \in Z^+ \cup \{0\}$

3.
$r_{it}: \ return\ of\ game\ i\ on\ time\ t$
$x_{it}: \ binary\ variable\ indicating\ if\ game\ i\ is\ scheduled\ on\ time\ t$
$max\ r_{it}x_{it}$
$s.t.$
$$\sum_{i=1}^{6}\sum_{t=1}^{3} x_{it} = 6$$
$x_{11} + x_{21} + x_{31} \leq 2$
$x_{12} + x_{22} + x_{32} \leq 2$
$x_{13} + x_{23} + x_{33} \leq 2$

$x_{11} + x_{41} \leq 2$

$$x_{12} + x_{42} \leq 2$$
$$x_{13} + x_{43} \leq 2$$

$$x_{21} + x_{51} + x_{61} \leq 2$$
$$x_{22} + x_{52} + x_{62} \leq 2$$
$$x_{23} + x_{53} + x_{63} \leq 2$$

$$x_{41} + x_{51} = 0$$
$$x_{42} + x_{52} \leq 2$$
$$x_{43} + x_{53} \leq 2$$

$$x_{31} + x_{61} \leq 2$$
$$x_{32} + x_{62} \leq 2$$
$$x_{33} + x_{63} \leq 2$$

$$x_{13} + x_{23} + x_{33} + x_{43} + x_{53} + x_{63} \geq 2$$
$$x_{11} + x_{52} \leq 1$$
$$x_{11} - x_{63} \leq 1$$
$$x_{it} \in \{0, 1\}$$