IEOR 240 : Homework 5

Arnaud Minondo

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Dorian Auto

Let x_1, x_2, x_3 be the respective amount of Compact, MidSize, Large cars.
Let $\forall i \in \{1,2,3\}, b_i = \begin{cases} 1 & \text{if } x_i > 0 \\ 0 & \text{otherwise} \end{cases}$.
The optimization problem corresponding to Dorian Auto case is :

$$\boxed{\begin{aligned} &\max(2000x_1 + 3000x_2 + 4000x_3) \\ &\text{s.t. } 30x_1 + 25x_2 + 40x_3 \leq 60000 \\ &\quad 1.5x_1 + 3x_2 + 5x_3 \leq 6000 \\ &\quad 1000b_1 \leq x_1 \leq 4000b_1 \\ &\quad 1000b_2 \leq x_2 \leq 4000b_2 \\ &\quad 1000b_3 \leq x_3 \leq 4000b_3 \\ &\quad x_1, x_2, x_3 \geq 0 \end{aligned}} \tag{1}$$

Coach Night

Let $T = (t_1, t_2, t_3, t_4, t_5, t_6, t_7)$ be the lineup starting. $\forall i \in \{1, 2, 3, 4, 5, 6, 7\}, t_i$ is binary, 1 if the player i starts, 0 otherwise. The problem is :

$$
\begin{aligned}
&\max(3t_1 + 2t_2 + 2t_3 + 3t_4 + 3t_5 + 3t_6 + t_7) \\
&\text{s.t. } t_1 + t_3 + t_5 + t_7 \geq 4 \\
&\quad t_3 + t_4 + t_5 + t_6 + t_7 \geq 2 \\
&\quad t_2 + t_4 + t_6 \geq 1 \\
&\quad \frac{1}{5}(3t_1 + 2t_2 + 2t_3 + t_4 + 3t_5 + 3t_6 + 3t_7) \geq 2 \\
&\quad \frac{1}{5}(3t_1 + 1t_2 + 3t_3 + 3t_4 + 3t_5 + 1t_6 + 2t_7) \geq 2 \\
&\quad \frac{1}{5}(1t_1 + 3t_2 + 2t_3 + 3t_4 + 3t_5 + 2t_6 + 2t_7) \geq 2 \\
&\quad \frac{1}{5}(3t_1 + 2t_2 + 2t_3 + 3t_4 + 3t_5 + 3t_6 + t_7) \geq 2 \\
&\quad t_6 \leq 1 - t_3 \\
&\quad \frac{1}{2}(t_4 + t_5) \geq t_1 \\
&\quad t_2 + t_3 \geq 1 \\
&\quad t_1 + t_2 + t_3 + t_4 + t_5 + t_6 + t_7 = 5
\end{aligned}
\tag{2}
$$

I assumed that the condition : "Either player 2 or player 3 must start" is equivalent to at least one them has to start.

Investment Management Company

Let $p_1, p_2, p_3, p_4, p_5, p_6$ be the binary corresponding to $p_i = 1$ if project i is chosen 0 otherwise.

$$
\begin{aligned}
&\max(0.1222p_1 + 0.1536p_2 + 0.1128p_3 + 0.171p_4 + 0.114p_5 + 0.2304p_6) \\
&\text{s.t. } 1.3p_1 + 0.8p_2 + 0.6p_3 + 1.8p_4 + 1.2p_5 + 2.4p_6 \leq 4 \\
&\quad \frac{1}{p_1 + p_2 + p_3 + p_4 + p_5 + p_6}(6p_1 + 4p_2 + 6p_3 + 5p_4 + 5p_5 + 4p_6) \leq 5 \\
&\quad p_2 \geq p_1 \\
&\quad p_5 \geq p_3 + p_4 - 1
\end{aligned}
\tag{3}
$$

MBA Student, Li Hua

Let $= (c_O, c_A, c_{IT}, c_F, c_M, c_{OB}, c_P, c_C)$ be the binary variable representing the course chosen by the student. The problem is :

$$\boxed{\begin{array}{l}\max(0.10c_O + 0.04c_A + 0.06c_{IT} + 0.12c_F + 0.08c_M + 0.03c_{OB} + 0.04c_P + 0.05c_C) \\ \text{s.t. } 9c_O + 7c_A + 5C_{IT} + 8c_F + 5c_M + 3c_{OB} + 7c_P + 10c_C \leq 40\end{array}} \tag{4}$$

In the problem satement it is said that the student has to study 40 hours but if we can have better with less it might be better to reconsider the planning. That's why I put less or equal to rather than equal to 40(Anyway it does not change the optimal solution but it could have). My result for this problem solved using AMPL is : $C = (1, 0, 1, 1, 1, 1, 0, 1)$

You can find the code in the appendix.

A .mod file

```
param coef{1..8};
param time{1..8};

param time_limit;

var choice{1..8} >=0 binary ;

maximize chance : sum{i in 1..8}choice[i]*coef[i];

s.t. t : sum{i in 1..8}time[i]*choice[i]<=time_limit;
```

B .dat file

```
param coef:=
1 0.10
2 0.04
3 0.06
4 0.12
5 0.08
6 0.03
7 0.04
8 0.05;

param time :=
1 9
2 7
3 5
4 8
5 5
6 3
7 7
8 10;

param time_limit := 40;
```

C .run file

```
reset;

model mba.mod;
data mba.dat;

option solver cplex;
solve;

display _var;
display _con;
```