

# Assignment 1

## combinatorial optimization

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### Exercise 1:

*intensifier*

$i \backslash j$	1	2	3	4
1	0	0	1	1
2	X	X	X	0
3	X	X	0	1
4	0	0	1	1

Room 1 = 50 seat Room 2 = 50 seat  
 Room 3 = 100 seat Room 4 = 150 seat

لاس نوع ۱ که ساعت به اتاق تقسیم داده شده باشد  
 $x_{ij}^k$  در غیر این صورت

$$\min Z = \sum_{k=1}^K 100 \times K \times \left( \sum_{j=1}^4 x_{1j}^k \times intensifier_{1j} \right) +$$

$$\sum_{k=1}^K 100 \times K \times \left( \sum_{j=1}^4 x_{2j}^k \times intensifier_{2j} \right) +$$

$$100 \times \omega \times \left( \sum_{j=1}^4 x_{3j}^k \times intensifier_{3j} \right) +$$

$$\sum_{k=1}^K 100 \times K \times \left( \sum_{j=1}^4 x_{4j}^k \times intensifier_{4j} \right)$$

$$s.t \quad \sum_{j=1}^4 x_{1j}^k = 1 \quad \forall K = 1, 2, 3, 4$$

$$\sum_{j=1}^4 x_{2j}^k = 1 \quad \forall K = 1, 2, 3$$

$$\sum_{j=1}^4 x_{3j}^k = 1 \quad \forall K = \omega$$

$$\sum_{j=1}^4 x_{4j}^k = 1 \quad \forall K = 1, 2$$

$$x_{2,1}^k = x_{2,2}^k = x_{2,3}^k = 0 \quad \forall K = 1, 2, 3$$

$$x_{2,1}^k = x_{2,2}^k = 0 \quad \forall K = \omega$$

$$\omega - \sum_{k=1}^K K \times x_{1j}^k - \sum_{k=1}^K K \times x_{2j}^k - x_{3j}^k \times \omega - \sum_{k=1}^K x_{4j}^k \times K$$

$$(1 - x_{1j}^k) \times K + x_{1j}^k \times K$$

به ازای ۱، ۲، ۳ و ۴ برای تمامی مقادیر ممکن  $K$

## Exercise 2:

$\delta_i$  {  
 1. الرصيد المتولد  
 0. الرصيد المتولد

(12)

$x_i$  من الرصيد المتولد

$$\min Z = 22x_1 + 30x_2 + 29x_3 + 25x_4 + 19x_5 + 18x_6 + 17x_7 + 2000 \sum_{i=1}^7 \delta_i$$

s.t

$$x_1 \geq 400$$

$$x_2 + x_1 \geq 400 + 700$$

$$x_3 + x_2 + x_1 \geq 700 + 500$$

$$x_4 + x_3 + x_2 + x_1 \geq 1900 + 700$$

$$x_5 + x_4 + x_3 + x_2 + x_1 \geq 1900 + 200$$

$$x_6 + x_5 + x_4 + x_3 + x_2 + x_1 \geq 2100 + 400$$

$$x_7 + x_6 + x_5 + x_4 + x_3 + x_2 + x_1 \geq 2400 + 200$$

$$x_i \leq M \delta_i \quad \forall i = 1, \dots, 7$$

$$2700 = \sum_{i=1}^7 \text{demand}_i$$

GAMS implementation is attached

## Execution

```
----- 62 VARIABLE x1.L           =      700.000
          VARIABLE x2.L           =         0.000
          VARIABLE x3.L           =      500.000
          VARIABLE x4.L           =      700.000
          VARIABLE x5.L           =      800.000
          VARIABLE x6.L           =         0.000
          VARIABLE x7.L           =         0.000
          VARIABLE d1.L           =         1.000
          VARIABLE d2.L           =         0.000
          VARIABLE d3.L           =         1.000
          VARIABLE d4.L           =         1.000
          VARIABLE d5.L           =         1.000
          VARIABLE d6.L           =         0.000
          VARIABLE d7.L           =         0.000
          VARIABLE z.L            =     72100.000
```

```
EXECUTION TIME      =          0.000 SECONDS      3 MB  25.1.2 r67455 WEX-WEI
```

```
USER: GAMS Development Corporation, USA      G871201/0000CA-ANY
      Free Demo, +1 202-342-0180, support@gams.com, www.gams.com DC0000
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