The Great Hamster Hire

A) Incorrect solution

Below is my edited version (BLUE statement is changes from what ChatGPT provided.)

Assumption:

If boosted intelligence is greater than maximum capability, you can't boost it.

Decision Variables:

$x_{i,j}$: A binary variable that equals 1 if junior engineer i is assigned to senior engineer j

$y_{i,k}$: A binary variable that equals 1 if junior engineer i is assigned to do contract k

z_j : A binary variable that equals 1 if senior engineer j is hired.

Define the parameters:

N : number of junior engineers.

M : number of senior engineers.

K : number of contracts.

C : Large Constant number

H : maximum number of junior engineers that a senior engineer can manage.

d_k : difficulty of contract k.

r_k : payment for contract k.

ϵ_i : intelligence value of junior engineer i.

p_i : annual salary of junior engineer i

i_j : intelligence value of senior engineer j.

P_j : annual salary of senior engineer j.

T : The boost in intelligence that a senior engineer can provide.

Objective Function

$$\sum_{k=1}^{K}(r_k \sum_{i=1}^{N} y_{i,k}) - \sum_{i=1}^{N}(p_i \sum_{k=1}^{K} y_{i,k}) - \sum_{j=1}^{M}(P_j \cdot z_j)$$

Constraints

1. Each junior engineer can be assigned to at most one senior engineer:

$$\sum_{j=1}^{M} x_{i,j} \leq 1 \text{ for } i = 1,2,...,N$$

2. Each contract must be assigned to at most one junior engineer and vice versa.

$$\sum_{i=1}^{N} y_{i,k} \leq 1 \text{ for } k = 1,2,...,K \text{ and } \sum_{k=1}^{K} y_{i,k} \leq 1 \text{ for } i = 1,2,...,N$$

3. The intelligence boost should not exceed the senior engineer's intelligence:

$$\epsilon_i + T \cdot \sum_{j=1}^{M} x_{i,j} \leq C(1 - \sum_{j=1}^{M} x_{i,j}) + \sum_{j=1}^{M} i_j x_{i,j} \text{ for } i = 1,2,...,N$$

4. Each senior engineer can manage at most H junior engineers:

$$\sum_{i=1}^{N} x_{i,j} \leq H \cdot z_j \text{ for } j = 1,2,...,M$$

5. The assigned engineering's intelligence must be greater than the contract difficulty:

$$\epsilon_i + T \sum_{j=1}^{M} x_{i,j} \geq \sum_{k=1}^{K} y_{i,k} d_k \text{ for } i = 1,2,...,N$$

6. Binary constraints for decision variables:

$$x_{i,j} \in \{0,1\} \text{ for } i = 1,2,...,N \text{ and } j = 1,2,...M$$

$$y_{i,k} \in \{0,1\} \text{ for } i = 1,2,...,N \text{ and } k = 1,2,...,K$$

$$z_j \in \{0,1\} \text{ for } j = 1,2,...,M$$

B) Just think as ChadGPT as a senior engineer with 240 USD annual salary, can boost T_{AI} intelligence, upper boundary of boosted intelligence is Q, and can manage N junior engineer.

Assumption

ChadGPT cost is per person.

They are 3 choices of improvement:

Use only ChadGPT	Use only senior engineer	Use ChadGPT then senior engineer.

Additional Decision Variables

AI_i : A binary variable that equals 1 if junior engineer is using ChadGPT.

Objective

$$\sum_{k=1}^{K}(r_k\sum_{i=1}^{N}y_{i,k})-\sum_{i=1}^{N}(p_i\sum_{j=1}^{K}y_{i,k})-\sum_{j=1}^{M}(P_j\cdot z_j)-240\sum_{i=1}^{N}AI_i$$

Additional Constraints

Modify no.3

The intelligence boost should not exceed maximum capability:

$$\epsilon_i+T_{AI}\cdot AI_i\le C(1-AI_i)+Q \text{ for } i=1,2,...,N$$

$$\epsilon_i+T_{AI}\cdot AI_i+T\cdot\sum_{j=1}^{M}x_{i,j}\le C(1-\sum_{j=1}^{M}x_{i,j})+\sum_{j=1}^{M}i_jx_{i,j} \text{ for } i=1,2,...,N$$

Modify no.5

1. The assigned engineering's intelligence must be greater than the contact difficulty:

$$\epsilon_i+T_{AI}\cdot AI_i+T\sum_{j=1}^{M}x_{i,j}\ge\sum_{k=1}^{K}y_{i,k}d_k \text{ for } i=1,2,...,N$$

Hiring Strategy: Since ChadGPT can boost N juniors, ChadGPT might be better options than senior that cost more than ChadGPT and able to boost less than ChadGPT.