1. (EPigraph Problem)

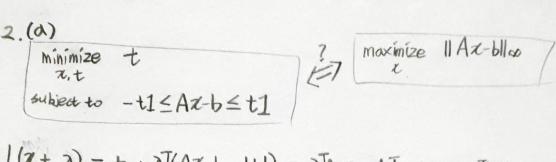
(Standard Problem)

(S

... P\* ≥ fo(2) of Elet.

이를 Standard form es 포함하면

minimize fo(え) 3 丑色な 今 型は、



$$L(x,t,\lambda) = t + \lambda T(Ax-b-|t|) = \lambda TAx - bT\lambda + t - \lambda T|t|$$

$$\nabla_t L(x,t,\lambda) = \{1-\lambda^* \dots t > 0\} = 0 \text{ (kkT condition (4))}$$

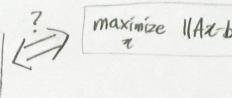
KKT condition (3) all slat,

$$9(\lambda) = \inf_{t} L(z, t, \lambda) = \begin{cases} Az - b \cdots (\lambda = \lambda^* = 1) \\ -\infty \cdots (\text{otherwise}) \end{cases}$$

maximize 11A2-bllow 3+ Stolet.

minimize 1Ty
x,y

subject to -y < Az-b < y



$$L(x,y,\lambda_{1},\lambda_{2}) = 1^{T}y - \lambda_{1}^{T}(Ax-b+y) + \lambda_{2}^{T}(Ax-b-y)$$

$$KKT \ \text{condition (4)} = ((\lambda_{2}-\lambda_{1})^{T}A) \times + (1-\lambda_{1}-\lambda_{2})^{T}y - b^{T}(\lambda_{1}+\lambda_{2})$$

$$\frac{\partial L}{\partial x} = -\lambda_{1}^{T}A + \lambda_{2}^{T}A = 0 \Rightarrow (\lambda_{2}-\lambda_{1})^{T}A = 0$$

$$\frac{\partial L}{\partial y} = 1 - \lambda_{1} - \lambda_{2} = 0 \Rightarrow \lambda_{1} + \lambda_{2} = 1$$

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$$\frac{\partial L}{\partial y} = 1 - \lambda_$$

$$L(z, \lambda, U) = f(z) = \sum_{i=1}^{k} \lambda_i^* z_i + V_{i-1}^{T} 1$$

$$\nabla_z L(z, \lambda, U) = \frac{\partial + \langle z \rangle}{\partial z_i} - \sum_{i=1}^{k} \lambda_i^* = 0 \qquad \frac{\partial + \langle z \rangle}{\partial z_i} = \sum_{i=1}^{k} \lambda_i^*$$

$$g(\lambda, U) = \sup_{z} L(z, \lambda, U) = \begin{cases} f(z) - U \cdots (z_i = 0) \\ 0 \cdots (z_i \neq 0) \end{cases}$$

4. Az=b: underdetermined equation AERPEN (PCN)

A=[A, AZ], AIERPXP

$$A = P A_1 A_2$$

Underdetermined linear equational offe

$$A^{T} \cdot (AA^{T})^{T} \cdot b = F \cdot \mathbb{Z} + 2$$
 $(n \times P) \cdot (P \times P) \cdot (P \times I) \cdot (n \times I) \cdot (n \times I)$ 

=> AAFTAATT. b = A.F. Z + A. 2 (Pan) (Pan) (nano) (n-Pan) (Pan) (nan)

$$\Rightarrow b = [A, A_2][F_2](B) + [A_1 A_2](A)$$

5. KKT matrix: [PAT] where PEST AERPXN rank A = P<n

show that each of the following statements is equivalent to non-singularity of the KKT matrix.

(1) N(P) 1 N(A) = 403.

(2) Az=0, Z≠0 => zTPz >0.

(3) FTPF> 0, where FER (N-CO-P) is a matrix for which R(F)=N(A).

(4) P+ATQA>0 for some Q≥0.

K=[Ao] 이라 하면, K[光]=[d]가 성립한다.

nonsingularity of the KKT matrixt K9 4990 Exhibite Holch

(2) ON H AZ=0, Z +0 0 X=FZ where Z +0 0 512,

スTPス= ZTFTPF2 7 5101 (2)와 (3)은 동刘가 된다.

(1) on A Z ENCA) (NCP), Z =0 0 12 AZ=0, Z =0 0 12 ATPZ=00 1214.

P는0 이므로 PZ=0이 되고, 况EN(P) 가된다.: (이는 (1)원 포함시카메된다.

(2) 7+ 설립할 때, (4)는 Q=I가 된다.

(477 some Q=0= \$24717 04801, 55 Q>07 52004.

·· (4)는 (2)를 성및(귀게 된다.

 $\begin{bmatrix} PAT \\ A \circ \end{bmatrix} \begin{bmatrix} z \\ o \end{bmatrix} = 0 \text{ old } K7+ \text{ singulat oles}$   $\begin{bmatrix} PAT \\ A \circ \end{bmatrix} \begin{bmatrix} z \\ z \end{bmatrix} = 0 \text{ old } K7+ \text{ singulat oles}$   $\begin{bmatrix} PAT \\ A \circ \end{bmatrix} \begin{bmatrix} z \\ z \end{bmatrix} = 0 \text{ old } K7+ \text{ singulat oles}$   $\begin{bmatrix} PAT \\ A \circ \end{bmatrix} \begin{bmatrix} z \\ z \end{bmatrix} = 0 \text{ old } K7+ \text{ singulat oles}$   $\begin{bmatrix} AZ = 0 \dots \emptyset \end{bmatrix}$ 

①의 외쪽에 ズでき 最かで ズーアストス「ATZ=0 ②(y ズーアス=0 : Px=0 olch.

이건은 X=0 이억야만 성립하고 270 이면 모습된다. .. 공 40 이고 ATZ=0은 rank A와 모습된다. 따라서 각 조건은 K의 역행렬이 조사함과 동치가 된다.