Lægrangian Relaxation

in Integer Programming

Originel Problem (OP) Lagrangian Relaxation Prablem (LR)

 $2 = min c^T x$ $A \times \leq b$ $D \times \leq e$ $\times \geq 0$ $\times integer$

 $2 \operatorname{lr}(\lambda) = \min_{C \in X} C \times + \lambda(\Delta x - b)$ $Dx \leq e$ $\times > 0$ x integral

Zep: objective function value af Overen relaxation af OP

2LD = Max 2LR(1)

Lagrangian dual problem NB: In LR Integrality constraint is not relaxed.

Facts:

= ZLP < Z becomse relaxation

· ZLR { Z become relaxation

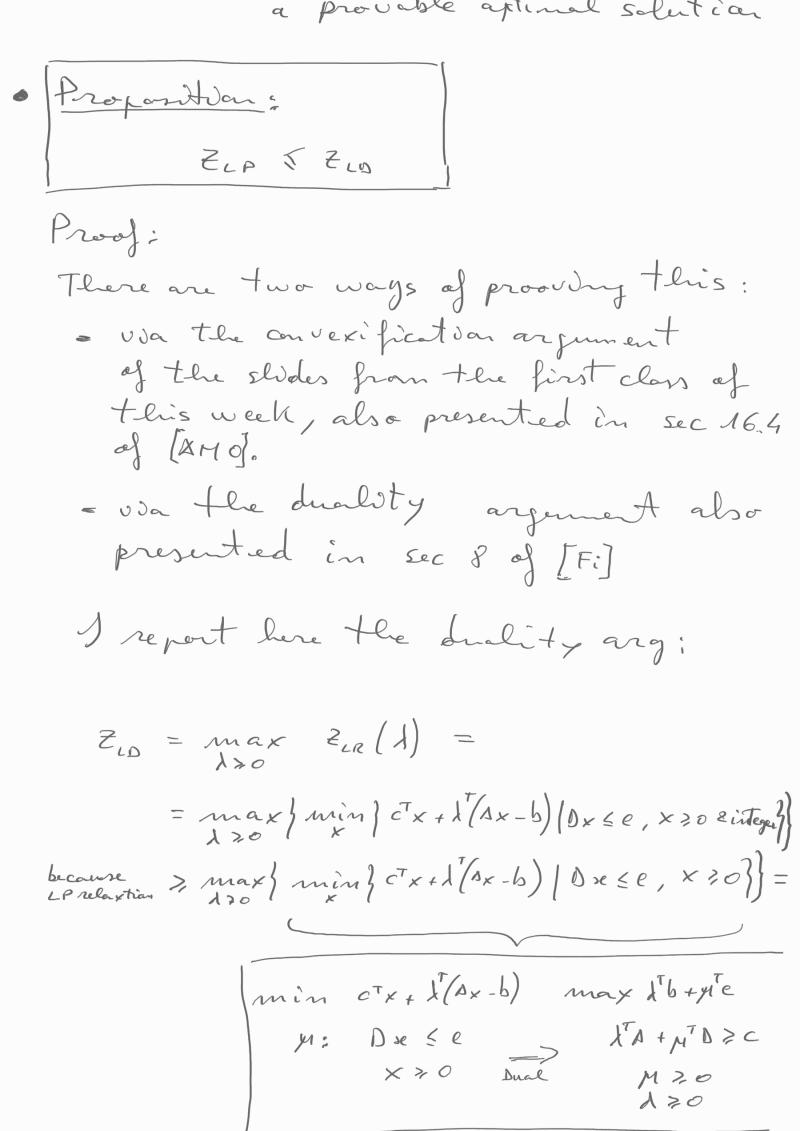
- ZIR & ZID becomere of definition

· ZLP (ZLD This is not thivial and important for motive ting the use of Iagrangian Relaxation in Integer Programming:

mativation A: if ZLP < ZLD then LR gives us a better bound to use In B&B

modivation B: if $\frac{2}{4}$ if $\frac{2}{4}$ if $\frac{2}{4}$ if $\frac{2}{4}$ if $\frac{2}{4}$ in the second still because $\frac{2}{4}$ in Combines be found more easily them with LP

mativation C: in any case LR gives us an alternative way to solve the problem. It is an heuristic way with the rare drance of getting also a dual bound and evertual,



max {max {\(\lambda \tau \) \(\lambda \) \

max ltb+pte

X: lta+ptb > C

prod

A > 0

Drad min cTx AxEb Dx { e X > O

= max } c x | 1 x & b, D x & e, x ≥ 0 } =

= 7,0



Proof:

The only inequality Introduced in the derivations of the proof above becomes equality as well.