

Lecture 5 - HW

(a), phase I.

$$\begin{array}{ccc|c} 0 & 0 & 0 & -1 \\ 1 & 1 & -1 & 0 \\ 0 & 1 & 0 & 1 \end{array} \begin{array}{l} 0 \\ x_5=16 \\ x_4=8 \end{array} \rightarrow \begin{array}{ccc|c} 1 & 1 & -1 & 0 \\ 1 & 1 & -1 & 0 \\ 0 & 1 & 0 & 1 \end{array} \begin{array}{l} 16 \\ x_5=16 \\ x_4=8 \end{array} \rightarrow \begin{array}{ccc|c} 0 & 0 & 0 & 0 \\ 1 & 1 & -1 & 0 \\ 0 & 1 & 0 & 1 \end{array} \begin{array}{l} 0 \\ x_5=16 \\ x_4=8 \end{array}$$

feasible solution

phase II.

$$\begin{array}{ccc|c} -1 & -2 & 0 & 0 \\ 1 & 1 & -1 & 0 \\ 0 & 1 & 0 & 1 \end{array} \begin{array}{l} 0 \\ x_1=16 \\ x_4=8 \end{array} \rightarrow \begin{array}{ccc|c} 0 & -1 & -1 & 0 \\ 1 & 1 & -1 & 0 \\ 0 & 1 & 0 & 1 \end{array} \begin{array}{l} 16 \\ x_1=16 \\ x_4=8 \end{array} \rightarrow \begin{array}{ccc|c} 0 & 0 & -1 & 1 \\ 1 & 0 & -1 & -1 \\ 0 & 1 & 0 & 1 \end{array} \begin{array}{l} \checkmark \\ x_1=16 \\ x_2=8 \end{array}$$

optimal solution

This direction is an unbounded improving direction.
 → This Lp is unbounded.


- (b) There is no optimal solution for primal.
 so we cannot solve the dual solution with this function. $\bar{y}^T = C^T A^{-1} B$.
- (c) Since we can't solve dual solution, the dual Lp is infeasible. So if we have an unbounded primal, the dual must be infeasible.
 It is not a coincidence.

5.

- (a) x_1^* and x_4^* is primal optimal solution.
 If a primal constraint is nonbinding, the corresponding dual variable is 0.
 the first and the fourth dual slack variables must be zero.

(b) $\min 600y_1 + 400y_2$
 s.t. $4y_1 + y_2 = 6$
 $9y_1 + y_2 - z_1 = 10$
 $7y_1 + 3y_2 - z_2 = 9$
 $10y_1 + 40y_2 = 20$
 $y_i \geq 0 \quad i = 1, 2, 5, 6$
 $y_1 = 1.4\bar{6}$
 $y_2 = 0.13\bar{3}$
 $z_1 = 3.3\bar{3}$
 $z_2 = 1.6\bar{6}$

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- (a) It should be zero.
- (b) It should not be zero.
- (c) Calculate the dual optimal solution, for those who are not zero, must be the bottleneck tasks.