

Math 521 HW F
(Assigned 10/22/2018)

1. Consider the LP

$$\begin{array}{ll} \text{Maximize} & z_P = 2x_1 + 3x_2 \\ \text{s.t.} & \begin{cases} -x_1 + x_2 \leq 5 \\ x_1 + 3x_2 \leq 35 \\ x_1 \leq 20 \\ x_1, x_2 \geq 0 \end{cases} \end{array}$$

- Derive the dual LP "from scratch" as we did in class.
- Solve (using whatever method you wish) both the primal and dual LPs.
- Try to define the dual of the dual LP (using similar ideas to how you defined dual LP from scratch in part a). Did you recover the original primal LP?

2. Consider the LP

$$\begin{array}{ll} \text{Maximize} & z = 2x_1 + 4x_2 + x_3 + x_4 \\ \text{s.t.} & \begin{cases} x_1 + 3x_2 + x_4 \leq 8 + d \\ 2x_1 + x_2 \leq 6 \\ x_2 + 4x_3 + x_4 \leq 6 \\ x_j \geq 0 \quad (j=1, \dots, 4) \end{cases} \end{array}$$

($d=0$)

- Solve the LP. Write final tableau.
- Solve the LP w/ the first inequality ≤ 8 replaced by $\leq 8+d$, for $d=5$ (ie $8 \rightarrow 13$). Write Final Tableau.
- Solve the LP with $d=20$ (ie $8 \rightarrow 28$). Write Final Tableau.

② Rewrite the primal LP in equality form, then take dual. Is the dual LP equivalent to the dual LP from part ①?

- Consider problem 3 from last HW (zero-sum game theory). Write the dual LP (dual to the LP used to optimize strategy for player R). Show this is equivalent to the LP for player C's strategy.