OR$_H W9$

b06303077 Yu-Jo Chiang

May 7 2020

1. Problem 4

   (a) Yes, since there is only one constraint and the model will be unbounded if there is no constraint, we can conclude that if the optimal exists, the constraint will always binding at the optimal solution.

   (b) $\mathcal{L}(x|\lambda) = x_1^2 + x_2^2 + x_3^2 + \lambda(b - x_1 - 2x_2 - 3x_3)$ Lagrangian multiplier is $\lambda \leq 2$.

   (c) We have $x_1 : x_2 : x_3 = 6 : 3 : 2$, $\lambda(6 - x_1 - 2x_2 - 3x_3) = 0.(x_1, x_2, x_3) = (2, 1, \frac{2}{3})$

   (d) $(x_1, x_2, x_3) = (-\frac{14}{3}, -\frac{7}{3}, -\frac{14}{9})$.

2. Problem 7

   (a) the formulation

$$\begin{array}{ll} max & \sum_{i=1,2} (a_i - b_i q_i) q_i \\ s.t. & \sum_{i=1,2} q_1 \leq K \\ & K > 0 \\ & a_i, b_i, q_i \geq 0 \quad \forall i = 1, 2 \end{array}$$

   (b) Yes , this is a convex program.

   (c) $Q_1 = Q_2 = \frac{a}{2b}$.

   (d) When K gets larger the solution can be larger , this makes sence , because when the total supplies increase means you can sell more , which means you can profit more.

   (e) When a_i increase you can sell more , but when b_i increase you sell less. This makes sence , cause when a_i is bigger the price you can sell is higher , you may want to produce more , but if b_i increases the price fall, hence the quantity will fall too.