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Suggested Solution for Pre-lecture Problems for Lecture 2

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1. The graphic solution is shown in Figure 1. We may push the indifference line and find out the optimal solution $(x_1, x_2) = (16, 0)$.

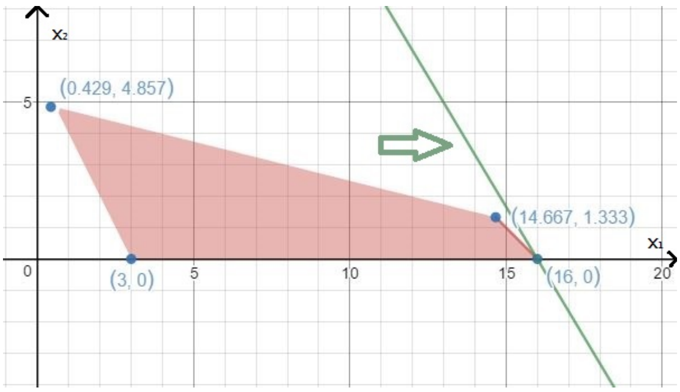

Figure 1: Graphical solution for Problem 1

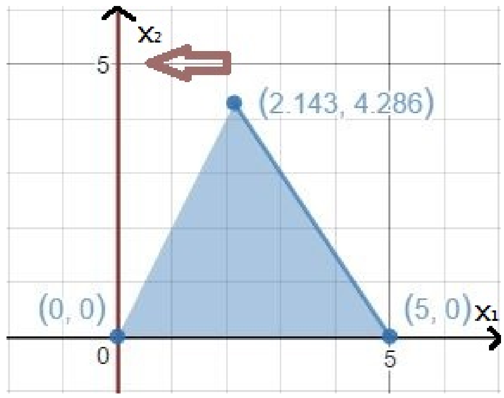

Figure 2: Graphical solution for Problem 3

2. Let x_1 and y_1 be the numbers of tables and chairs produced by Bob, x_2 and y_2 be the numbers of tables and chairs produced by his two employees, respectively. The problem can then be formulated as

$$\begin{aligned} \max \quad & 200(x_1 + x_2) + 80(y_1 + y_2) - 50[2(x_1 + x_2) + (y_1 + y_2)] = 100(x_1 + x_2) + 30(y_1 + y_2) \\ \text{s.t.} \quad & \frac{1}{0.5}x_1 + y_1 \leq 12 \\ & \frac{1}{0.3}x_1 + \frac{1}{0.8}x_2 \leq 8 \times 2 \\ & x_i, y_i \geq 0 \quad \forall i = 1, 2. \end{aligned}$$

3. (a) Let x_1 and x_2 be the numbers of tables and chairs produced, respectively. The problem can then be formulated as

$$\begin{aligned} \max \quad & 100x_1 + 80x_2 - 40(3x_1 + 2x_2) = -20x_1 \\ \text{s.t.} \quad & 3x_1 + 2x_2 \leq 15 \\ & \frac{1}{0.6}x_1 + x_2 \leq 12 \\ & x_2 \leq 2x_1 \\ & x_i \geq 0 \quad \forall i = 1, 2. \end{aligned}$$

   (b) The graphical solution is shown in Figure 2. We may push the indifference line and find out the optimal solution $(x_1, x_2) = (0, 0)$. Since producing both tables and chairs are not beneficial, we suggest Tom not to produce any of them.