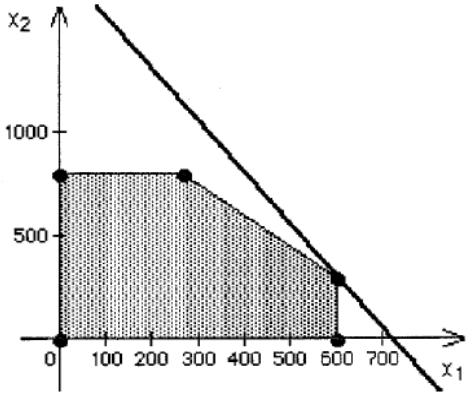
題號 3.1-9

3.1-9.

(a) Let x_1 be the number of units on special risk insurance and x_2 be the number of units on mortgages.

$$\begin{aligned} \text{maximize} \quad & z = 5x_1 + 2x_2 \\ \text{subject to} \quad & 3x_1 + 2x_2 \leq 2400 \\ & x_2 \leq 800 \\ & 2x_1 \leq 1200 \\ & x_1 \geq 0, x_2 \geq 0 \end{aligned}$$

(b) Optimal Solution: $(x_1^*, x_2^*) = (600, 300)$ and $Z^* = 3600$



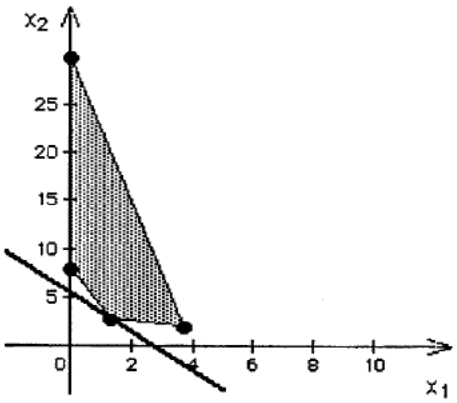
(c) The relevant two equations are $3x_1 + 2x_2 = 2400$ and $2x_1 = 1200$, so $x_1 = 600$ and $x_2 = \frac{1}{2}(2400 - 3x_1) = 300$, $z = 5x_1 + 2x_2 = 3600$.

題號 3.4-8 (a) (b)

3.4-8.

(a) $$\begin{aligned} \text{minimize} \quad & C = 8S + 4P \\ \text{subject to} \quad & 5S + 15P \geq 50 \\ & 20S + 5P \geq 40 \\ & 15S + 2P \leq 60 \\ & S, P \geq 0 \end{aligned}$$

(b) Optimal Solution: $(S, P) = (x_1^*, x_2^*) = (1.3, 2.9)$ and $C^* = 21.82$



題號 3.4-10(a)

3.4-10.

(a) Let f_1 = number of full-time consultants working the morning shift (8 a.m.-4 p.m.),
f_2 = number of full-time consultants working the afternoon shift (Noon-8 p.m.),
f_3 = number of full-time consultants working the evening shift (4 p.m.-midnight),
p_1 = number of part-time consultants working the first shift (8 a.m.-noon),
p_2 = number of part-time consultants working the second shift (Noon-4 p.m.),
p_3 = number of part-time consultants working the third shift (4 p.m.-8 p.m.),
p_4 = number of part-time consultants working the fourth shift (8 p.m.-midnight).

$$\text{minimize} \quad C = (40 \times 8)(f_1 + f_2 + f_3) + (30 \times 4)(p_1 + p_2 + p_3 + p_4)$$

$$\begin{aligned}
\text{subject to} \quad & f_1 + p_1 \geq 4 \\
& f_1 + f_2 + p_2 \geq 8 \\
& f_2 + f_3 + p_3 \geq 10 \\
& f_3 + p_4 \geq 6 \\
& f_1 \geq 2p_1 \\
& f_1 + f_2 \geq 2p_2 \\
& f_2 + f_3 \geq 2p_3 \\
& f_3 \geq 2p_4 \\
& f_1, f_2, f_3, p_1, p_2, p_3, p_4 \geq 0
\end{aligned}$$

題號 3.4-14(a)

3.4-14.

(a) Let x_{ij} be the number of tons of cargo type $i = 1, 2, 3, 4$ stowed in compartment $j =$ F (front), C (center), B (back).

$$\begin{aligned}
\text{maximize} \quad & P = 320(x_{1F} + x_{1C} + x_{1B}) + 400(x_{2F} + x_{2C} + x_{2B}) \\
& \quad + 360(x_{3F} + x_{3C} + x_{3B}) + 290(x_{4F} + x_{4C} + x_{4B})
\end{aligned}$$

$$\begin{aligned}
\text{subject to} \quad & x_{1F} + x_{2F} + x_{3F} + x_{4F} \leq 12 \\
& x_{1C} + x_{2C} + x_{3C} + x_{4C} \leq 18 \\
& x_{1B} + x_{2B} + x_{3B} + x_{4B} \leq 10 \\
& x_{1F} + x_{1C} + x_{1B} \leq 20 \\
& x_{2F} + x_{2C} + x_{2B} \leq 16 \\
& x_{3F} + x_{3C} + x_{3B} \leq 25 \\
& x_{4F} + x_{4C} + x_{4B} \leq 13 \\
& 500x_{1F} + 700x_{2F} + 600x_{3F} + 400x_{4F} \leq 7,000 \\
& 500x_{1C} + 700x_{2C} + 600x_{3C} + 400x_{4C} \leq 9,000 \\
& 500x_{1B} + 700x_{2B} + 600x_{3B} + 400x_{4B} \leq 5,000 \\
& \tfrac{1}{12}(x_{1F} + x_{2F} + x_{3F} + x_{4F}) - \tfrac{1}{18}(x_{1C} + x_{2C} + x_{3C} + x_{4C}) = 0 \\
& \tfrac{1}{12}(x_{1F} + x_{2F} + x_{3F} + x_{4F}) - \tfrac{1}{10}(x_{1B} + x_{2B} + x_{3B} + x_{4B}) = 0 \\
\text{and} \quad & x_{1F}, x_{2F}, x_{3F}, x_{4F}, x_{1C}, x_{2C}, x_{3C}, x_{4C}, x_{1B}, x_{2B}, x_{3B}, x_{4B} \geq 0
\end{aligned}$$

題號 3.4-15 (a)

3.4-15.

(a) Let x_{ij} be the number of hours operator i is assigned to work on day j for $i = KC, DH, HB, SC, KS, NK$ and $j = M, Tu, W, Th, F$.

minimize $$\begin{aligned} Z = \; & 25(x_{KC,M} + x_{KC,W} + x_{KC,F}) + 26(x_{DH,Tu} + x_{DH,Th}) + \\ & 24(x_{HB,M} + x_{HB,Tu} + x_{HB,W} + x_{HB,F}) + \\ & 23(x_{SC,M} + x_{SC,Tu} + x_{SC,W} + x_{SC,F}) + \\ & 28(x_{KS,M} + x_{KS,W} + x_{KS,Th}) + 30(x_{NK,Th} + x_{NK,F}) \end{aligned}$$

subject to

$$x_{KC,M} \le 6,\ x_{KC,W} \le 6,\ x_{KC,F} \le 6$$
$$x_{DH,Tu} \le 6,\ x_{DH,Th} \le 6$$
$$x_{HB,M} \le 4,\ x_{HB,Tu} \le 8,\ x_{HB,W} \le 4,\ x_{HB,F} \le 4$$
$$x_{SC,M} \le 5,\ x_{SC,Tu} \le 5,\ x_{SC,W} \le 5,\ x_{SC,F} \le 5$$
$$x_{KS,M} \le 3,\ x_{KS,W} \le 3,\ x_{KS,Th} \le 8$$
$$x_{NK,Th} \le 6,\ x_{NK,F} \le 2$$

$$x_{KC,M} + x_{KC,W} + x_{KC,F} \ge 8$$
$$x_{DH,Tu} + x_{DH,Th} \ge 8$$
$$x_{HB,M} + x_{HB,Tu} + x_{HB,W} + x_{HB,F} \ge 8$$
$$x_{SC,M} + x_{SC,Tu} + x_{SC,W} + x_{SC,F} \ge 8$$
$$x_{KS,M} + x_{KS,W} + x_{KS,Th} \ge 7$$
$$x_{NK,Th} + x_{NK,F} \ge 7$$

$$x_{KC,M} + x_{HB,M} + x_{SC,M} + x_{KS,M} = 14$$
$$x_{DH,Tu} + x_{HB,Tu} + x_{SC,Tu} = 14$$
$$x_{KC,W} + x_{HB,W} + x_{SC,W} + x_{KS,W} = 14$$
$$x_{DH,Th} + x_{HB,Th} + x_{NK,Th} = 14$$
$$x_{KC,F} + x_{HB,F} + x_{SC,F} + x_{NK,F} = 14$$

$x_{ij} \ge 0$ for all i, j.

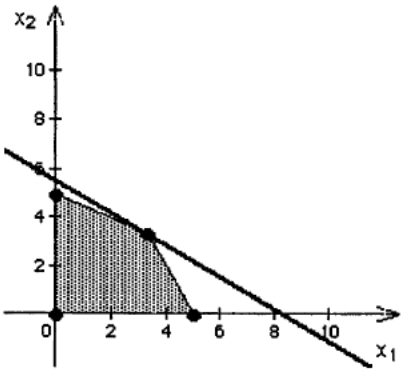
題號 3.5-2 (a)(b)

3.5-2.

(a) maximize $P = 20x_1 + 30x_2$

subject to
$$\begin{aligned} 2x_1 + \ \ x_2 &\le 10 \\ 3x_1 + \ 3x_2 &\le 20 \\ 2x_1 + \ 4x_2 &\le 20 \\ x_1, x_2 &\ge 0 \end{aligned}$$

(b) Optimal Solution: $(x_1^*, x_2^*) = \left(3\frac{1}{3}, 3\frac{1}{3}\right)$ and $P^* = 166.67$



題號 3.5-4 (a) (b)

3.5-4.

(a) minimize $C = 60x_1 + 50x_2$

subject to
$$\begin{aligned} 5x_1 + 3x_2 &\ge 60 \\ 2x_1 + 2x_2 &\ge 30 \\ 7x_1 + 9x_2 &\ge 126 \end{aligned}$$

and $x_1, x_2 \ge 0$

(b) Optimal Solution: $(x_1^*, x_2^*) = (6.75, 8.75)$ and $C^* = 842.50$