11.2 Let: $x_j = \begin{cases} 1 & \text{if Investment j is selected} \\ 0 & \text{otherwise} \end{cases}$

maximize profit $= 18x_1 + 12x_2 + 7x_3 + 24x_4 + 11x_5 + 15x_6 + 9x_7 + 6x_8$

subject to

$26x_1 + 34x_2 + 18x_3 + 45x_4 + 31x_5 + 39x_6 + 23x_7 + 13x_8 \le 120$

$x_1 + x_4 \le 1$

$x_6 \le x_3$

x binary

11.3 (a) Let $x = 3y_1 + 5y_2 + 13y_3 + 21y_4$ where $y_1 + y_2 + y_3 + y_4 = 1$, **y** binary.

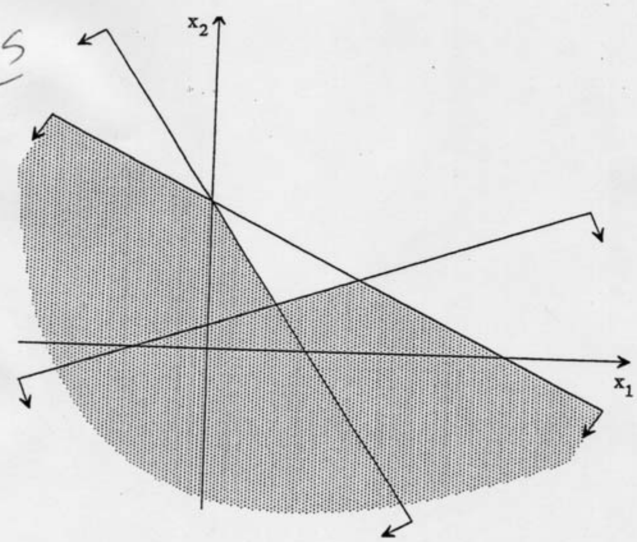
(b) Let M be an arbitrarily large positive number. Then an equivalent linear integer formulation is:

$a_1x_1 + ... + a_2x_2 \ge b - My$

$a_1x_1 + ... + a_2x_2 \le -b + M(1 - y)$

y binary

11.5



(b) Let M be an arbitrarily large positive number. Then an equivalent linear integer formulation is as follows:

$x_1 + 2x_2 \le 12 + M(1 - y_1)$

$3x_1 + 2x_2 \le 12 + M(1 - y_2)$

$-x_1 + 3x_2 \le 3 + M(1 - y_3)$

$y_1 + y_2 + y_3 \ge 2$

11.9 Let: $y_j = \begin{cases} 1 & \text{if Investment Option j is chosen} \\ 0 & \text{otherwise} \end{cases}$

x_j = amount invested in Investment Option j

maximize return = $0.13x_1 + 0.09x_2 + 0.17x_3 + 0.10x_4 + 0.22x_5 + 0.12x_6$

subject to

$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 = 80{,}000{,}000$

$x_5 \le x_2 + x_4 + x_6$

$y_3 \le y_6$

$3y_1 \le x_1 \le 27y_1$

$2y_2 \le x_2 \le 12y_2$

$9y_3 \le x_3 \le 35y_3$

$1y_4 \le x_4 \le 15y_4$

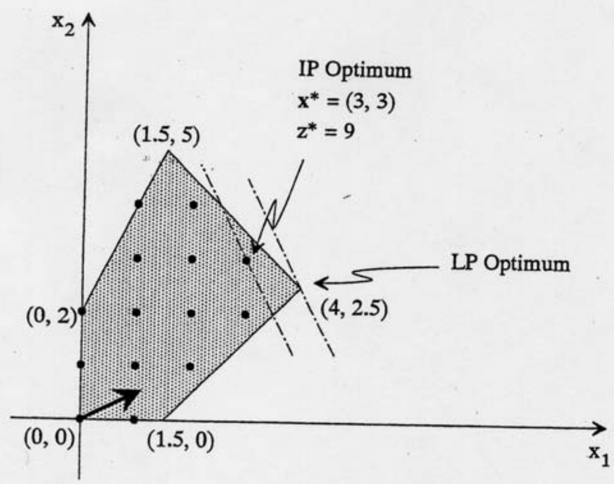
$12y_5 \le x_5 \le 46y_5$

$4y_6 \le x_6 \le 18y_6$

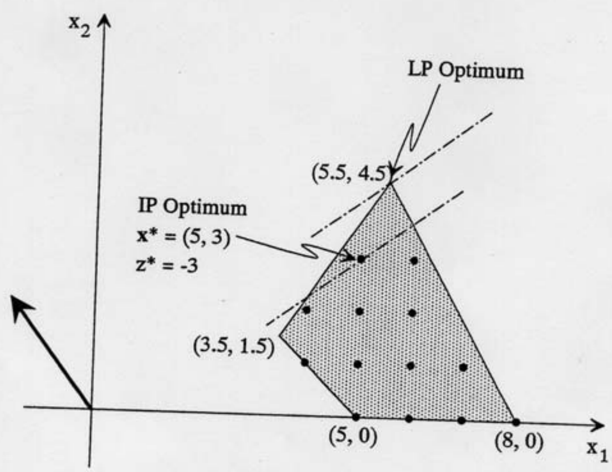
$\mathbf{x} \ge \mathbf{0}$

$\mathbf{y}$ binary

11.11 (a)



11.10 (a)



(b) Each of the rounded-off solutions $\{(5, 4), (5, 6), (6, 4), (6, 5)\}$ is infeasible.

(c) The following search tree summarizes the branch-and-bound enumeration.