Chapter 3 Homework Solutions

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1. x = number of servings of the casserole
   y = number of servings of the salad

   Objective Function:
   Minimize $C = 250x + 30y$

   Constraints:
   $3x + 6y \geq 23$
   $9x + 1y \geq 28$
   $x \geq 0$
   $y \geq 0$

2. x = amount invested in project A
   y = amount invested in project B
   z = amount invested in project C

   Objective Function:
   Maximize $R = .1x + .18y + .24z$

   Constraints:
   $x + y + z \leq 3000000$
   $.2x + .2y - .8z \geq 0$
   $.6x - .4y - .4z \geq 0$
   $x - .6y - .6z \geq 0$
   $x, y, z \geq 0$

   Note: the three of the contraints have been simplified. Here is the work for the statement: "...Phillip has decided to put not more than 20% of the total investment in project C."
   $z \leq 0.20(x + y + z)$
   $z \leq 0.20x + 0.20y + 0.20z$
   $0 \leq 0.20x + 0.20y + 0.20z - 1z$
   $0 \leq 0.20x + 0.20y - 0.80z$
   or $.2x + .2y - .8z \geq 0$

3. x = number of cassette tapes ordered
   y = number of lps ordered
   z = number of compact disks ordered

   Objective Function:
   Minimize $C = 2.75x + 9y + 8.25z$

   Constraints:
   $x + y + z \geq 375$
   $.6x + .6y - .4z \leq 0$
   $x, y, z \geq 0$

4. x = number of type A golf bags made
   y = number of type B golf bags made
   z = number of type C golf bags made

   Objective Function:
   Maximize $R = 75x + 85y + 95z$

   Constraints:
   $20x + 20y + 25z \leq 4200$
   $25x + 15y + 25z \leq 4800$
   $25x + 45y + 45z \leq 6600$
   $x \geq 25$
   $x, y, z \geq 0$

5. x = number of chests ordered
   y = number of desks ordered
   z = number of silverware boxes ordered

   Objective Function:
   Maximize $P = 180x + 300y + 45z$

   Constraints:
   $x + y + z \leq 200$
   $270x + 310y + 90z \leq 5000$
   $7x + 18y + 1.5z \leq 1500$
   $x, y, z \geq 0$

6. x = number of units of fund A bought.
   y = number of units of fund B bought.

   Objective function:
   Minimize: $R = 2x + 1.5y$

   Constraints:
   $15x + 12y \leq 42000$
   $.06x + .05y \geq 24000$
   $x, y \geq 0$

7. x = the number of one bedroom units
   y = the number of two bedroom units(townhouses)
   z = the number of three bedroom units(townhouses)

   Objective function:
   Maximize $R = 500x + 800y + 1200z$

   constraints:
   $x + y + z \leq 192$
   $y + z \geq 2x$
   $x, y, z \geq 0$

8. x = number of model A baskets produced
   y = number of model B baskets produced

   Objective Function:
   Maximize $P = 4x + 5y$

   Constraints:
   $110x + 90y \leq 9900$
   $2x + 3y \leq 210$
   $x, y \geq 0$

9. x = number of servings of vanilla pudding
   y = number of servings of chocolate pudding

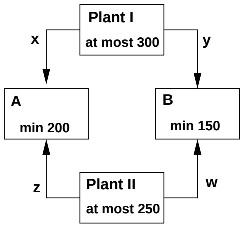
   Objective Function:
   Maximize $P = 11x + 6y$

   Constraints:
   $2x + 3y \leq 1200$
   $34x + 19y \leq 9840$
   $x \leq 200$
   $x, y \geq 0$

10. x = the number of pianos shipped from Plant I to warehouse A
    y = the number of pianos shipped from Plant I to warehouse B

$z =$ the number of pianos shipped from Plant II to warehouse A
$w =$ the number of pianos shipped from Plant II to warehouse B

or use a picture to define the variables



Objective Function:
Minimize $C = 60x + 70y + 80z + 50w$ (

Constraints:
$x + y \leq 300$
$z + w \leq 250$
$x + z \geq 200$
$y + w \geq 150$
$x, y, z, w \geq 0$

11. x = the number of pounds of coffee shipped from Seattle to Salt Lake City
y = the number of pounds of coffee shipped from Seattle to Reno
z = the number of pounds of coffee shipped from San Jose to Salt Lake City
w = the number of pounds of coffee shipped from San Jose to Reno

Objective function:
Minimize $C = 2.5x + 3y + 4z + 2w$

Constraints:
$x + y \leq 700$
$z + w \leq 500$
$x + z \geq 400$
$y + w \geq 350$
$x, y, z, w \geq 0$

12. To determine the inequality, pick a point in the feasible region and then see which sign ($\leq$, $\geq$, $<$, or $>$) will make the statemetn true.

$5x + 3y \geq 30$
$x - y \geq 0$
$x \geq 5$

Also could include $x \geq 0$

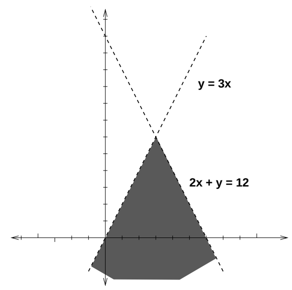
13. To determine the inequality, pick a point in the feasible region and then see which sign ($\leq$, $\geq$, $<$, or $>$) will make the statemetn true.

$y < 9$
$x \geq 0$
$y \geq 0$
$x + y \leq 11$
$15x + 7y \leq 105$
$x - y < 3$

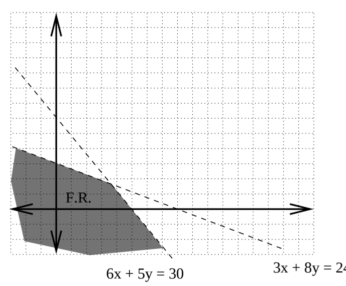
14. First determine the equation of the line. Then determine the inequality, pick a point in the feasible region and then see which sign ($\leq$, $\geq$, $<$, or $>$) will make the statemetn true.

$y \leq 7$
$y \geq 0$
$x + y \geq 7$
$-x + y \leq 1$

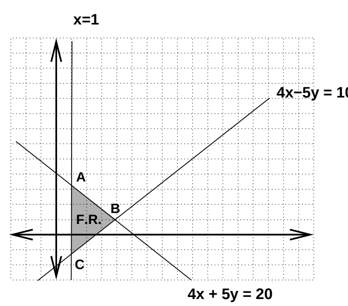
15. Corner Points: none, since all lines are dotted lines



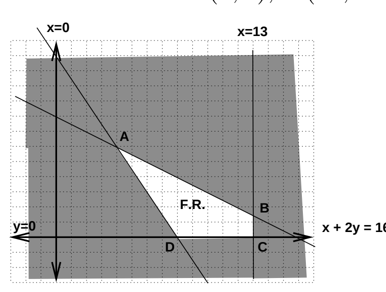
16. Corner Points: none, since all lines are dotted lines



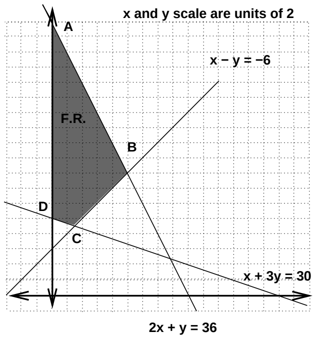
17. Corner Points: $A(1, 3.2)$, $B(3.75, 1)$, and $C(1, -1.2)$



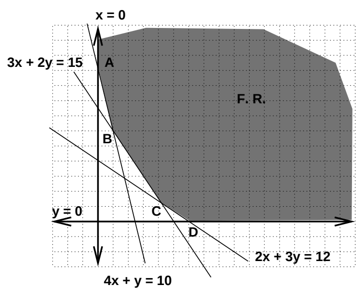
18. Corner Points: $A(4, 6)$, $B(13, 1.5)$, $C(13, 0)$, and $D(8, 0)$



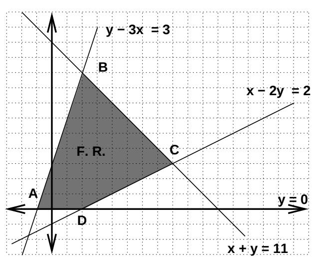
19. Corner Points: $A(0,36)$, $B(10,16)$, $C(3,9)$, and $D(0,10)$



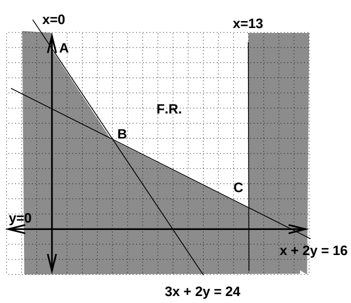
20. Corner Points: $A(0,10)$, $B(1,6)$, $C(4.2,1.2)$, and $D(6,0)$



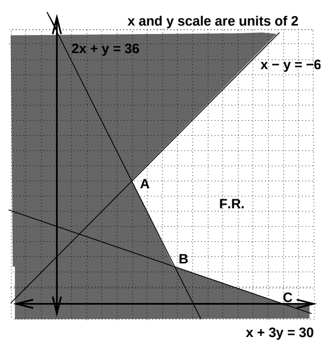
21. Corner Points: $A(-1,0)$, $B(2,9)$, $C(8,3)$, and $D(2,0)$



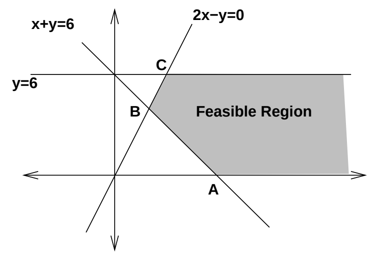
22. Corner Points: $A(0,12)$, $B(4,6)$, and $C(13,1.5)$



23. Corner Points: $A(1,6)$, $B(15.6,4.8)$, and $C(30,0)$



24. Corner points: A(6,0), B(2,4), and C(3,6)



Since the region is unbounded create two imaginary corner points: D(10,6) and E(10,0).

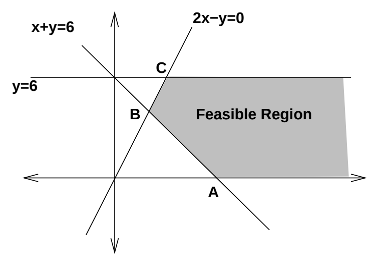
Values:

A	B	C	D	E
18	10	15	36	30

Since the minimum value occurs at a real corner point and not an imaginary one, we have a solution.

minimum value: 10 location: at point B.

25. Corner points: A(6,0), B(2,4), and C(3,6)



Since the region is unbounded create two imaginary corner points: D(10,6) and E(10,0).

Values:

A	B	C	D	E
24	16	24	52	40

since max value happens at an imaginary corner point, this problem does not have a solution.

26. The actual corner points to the feasible region are C, D, F, G and H.

    (a) Answer: minimum value = 12
    location of minimum = F or $(3,0)$

    (b) maximum value = 60
    location of maximum = point D and point G and all points in between or $\overline{DG}$

27. The actual corner points to the feasible region are J, M, O, and R. Since the region is unbounded, add two imaginary points $A(0,10)$ and $B(10,0)$

    (a) minimum value = 12
    location of minimum = R or $(6,0)$

    (b) minimum value = 12
    location of minimum = point J and point M and all points in between or $\overline{JM}$

    (c) since the maximum value occurs at B and this is a made-up corner point, then there is no solution.

28. The actual corner points to the feasible region are D, E, and F. Since the region is unbounded, add the imaginary corner points $M(10, 0)$ and $N(10, 7)$.

    (a) maximum value = 15
    location of maximum = E or $(6, 7)$

    (b) since the minimum value occures at M and this is a made-up corner point, then there is no solution.

29. The actual corner points to the feasible region are H, D, and F. Since the region is unbounded, add the corner points $M(1, -1)$ and $N(7, -1)$.

    maximum value = does not exist
    location of maximum = does not exist

30. The actual corner points are C, F, and H. Since the region is unbounded, add the imaginary corner points $M(3, 20)$ and $N(12, 20)$.

    minimum value = does not exist
    location of the minimum = does not exist

31. The actual corner points are A, B, D, F, and G. since the region is bounded, we do not need to add any imaginary corner points.

    Value: 9
    Location: $\overline{DF}$

32. 72 model A baskets and 22 model B baskets

33. 200 servings of vanilla and 160 servings of chocolate