Section 7.1 HW Sols

No. 7.1
Date 1

Problem 1

	inches bread	oz meat	Profit
small	6	2	.80
Large	10	4	1.20
Supply	1320	480	

$$\begin{array}{r} 110 \\ 12 \\ \hline 220 \\ 110 \\ \hline 1320 \end{array} \qquad \begin{array}{r} 30 \\ 16 \\ \hline 180 \\ 30 \\ \hline 480 \end{array}$$

x = # small sandwiches made each day

y = # Large sandwiches made each day

Maximize:

$$.80x + 1.20y$$

subject to:

$$6x + 10y \leq 1320$$
$$2x + 4y \leq 480$$
$$x \geq 0$$
$$y \geq 0$$

Problem 2

	Lb Fresh Fruit	Lb Frozen Frt	profit
Deluxe	2.5	.5	5
Special	1	2	7
Supply	46	20	

x = # of batches of Salad Deluxe

y = # of batches of Daily Special

Maximize

$$5x + 7y$$

Subject to

$$2.5x + 1y \leq 46$$

$$.5x + 2y \leq 20$$

$$x \geq 8$$

$$y \geq 0$$

No. 7.1

Date 3

Problem

3

	Nitrate	phosphate	potash	profit
25-10-5	25	10	5	7
8-10-10	8	10	10	5
Supply	12000	10000	7000	

1 ton = 2000 lb

$\frac{2000}{6}$ $\frac{2000}{5}$ $\frac{2000}{3.5}$

12000 10000 7000

x = # sacks of 25-10-5

y = # sacks of 8-10-10

Maximize

$7x + 5y$

Subject to

$25x + 8y \leq 12000$

$10x + 10y \leq 10000$

$5x + 10y \leq 7000$

$x \geq 0$ $y \geq 0$

oblem

4

	minutes Finishing frame	minutes balancing wheels	Profit
California	15	5	15
Florida	10	20	18
Supply	7200	7200	

120
60
7200

x = # California skates made per day
y = # Florida skates made per day

Maximize

$$15x + 18y$$

Subject to

$$15x + 10y \leq 7200$$
$$5x + 20y \leq 7200$$
$$x \geq 0$$
$$y \geq 0$$

oblem

5

	gal Maple Base	Lb sugar	Profit
Extra Maple syrup	2	4	5
Regular maple syrup	5	2	3
supply	10000	8800	

$x =$ # gal Extra Maple syrup made each week

$y =$ # gal Regular Maple syrup made each week

Maximize

$$5x + 3y$$

Subject to

$$0 \leq x \leq 1800$$

$$0 \leq y$$

$$2x + 5y \leq 10000$$

$$4x + 2y \leq 8800$$

6 Ref to #5. include the requirement

$$x \geq y$$

oblem

7

x = # Lb material purchased from subsidiary
y = # Lb material purchased from ind supplier

Minimize

$$.8x + 1.0y$$

Subject to

$$x + y \geq 45000$$

$$x \leq 35000$$

$$y \geq \frac{1}{2}x$$

$$x \geq 0$$

$$y \geq 0$$

blem

8

	Lb steel	hours Labor	Profit
desk	75	2	20
filing cabinet	50	3	15
Supply	36000	1500	

1 ton = 2000 Lb

$$\begin{array}{r} 2000 \\ \times\ 18 \\ \hline 36000 \end{array}$$

x = # desks made

y = # filing cabinets made

Maximize

$$20x + 15y$$

Subject to

$$x \leq 400$$

$$75x + 50y \leq 36000$$

$$2x + 3y \leq 1500$$

$$x \geq 0$$

$$y \geq 0$$

Problem 9

	gal skim milk	Lb sugar	gal cream	profit
regular ice cream	.6	1	.4	1
Low Cal ice cream	.7	.3	.4	1.20
Supply	800	400	400	

x = # gal regular ice cream produced per day

y = # gal Low Cal ice cream produced per day

Maximize

$$x + 1.2y$$

Subject to

$$.6x + .7y \leq 800$$
$$x + .3y \leq 400$$
$$.4x + .4y \leq 400$$
$$x \geq 0$$
$$y \geq 0$$

Problem

10

	Lb nitrates	Lb phosphate	Lb potash	profit
20-5-5 (Lawn)	20	5	5	6
10-15-10 (garden)	10	15	10	4
5-5-5 (tree)	5	5	5	3
Supply	14000	8000	6000	

$1 \text{ ton} = 2000 \text{ Lb}$

$\frac{2000}{\frac{7}{14000}}$ $\frac{2000}{\frac{4}{8000}}$ $\frac{2000}{\frac{3}{6000}}$

x = # sacks of Lawn fertilizer
y = # sacks of garden fertilizer
z = # sacks of tree fertilizer

Maximize

$$6x + 4y + 3z$$

Subject to

$$20x + 10y + 5z \leq 14000$$
$$5x + 15y + 5z \leq 8000$$
$$5x + 10y + 5z \leq 6000$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem 11

x = # subject hours used
y = # consultation minutes used

Maximize

$$x + \frac{1}{25}y$$

subject to

$$y \leq 50x$$
$$y \geq 30x$$
$$x \leq 15$$
$$x \geq 6$$
$$y \leq 200$$
$$x \geq 0$$
$$y \geq 0$$

Problem 12

	days guide time	hours support staff	Profit
North Fork	20	50	18000
Blue River Gorge	40	10	3000
Supply	1680	600	

x = # trips on North Fork

y = # trips on Blue River Gorge

Maximize

$$18000x + 3000y$$

Subject to

$$x \geq 0 \qquad y \geq 0$$

$$y \geq 25$$

$$20x + 40y \leq 1680$$

$$50x + 10y \leq 600$$

Best choice is

$x = 7, \quad y = 25$

Profit is 201.000 $

Problem

13

	# doctors	#nurses	Rate
full team	1	3	180 inoc/hr
half team	1	2	100 inoc/hr
supply	200	450	

x = # full teams
y = # half teams

Maximize

$$180x + 100y$$

subject to

$$x + y \leq 200$$
$$3x + 2y \leq 450$$
$$x \geq 0$$
$$y \geq 0$$

Problem 14

	# minutes for frame assembly	# minutes for wheel installation	# minutes for decoration	Profit
StarStreak	20	10	14	15
SuperStreak	10	15	18	21
Supply	7200	5400	4500	

$$\begin{array}{r} 120 \\ 60 \\ \hline 7200 \end{array} \qquad \begin{array}{r} 90 \\ 60 \\ \hline 5400 \end{array} \qquad \begin{array}{r} {\scriptstyle 3}\\ 75 \\ 60 \\ \hline 4500 \end{array}$$

x = # of starstreak bikes made per day

y = # of superstreak bikes made per day

Maximize

$$15x + 21y$$

subject to

$$\begin{aligned} 20x + 10y &\leq 7200 \\ 10x + 15y &\leq 5400 \\ 14x + 18y &\leq 4500 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

Problem 15

	square feet 200lb test cardbd	Square feet Liner bd	Profit
standard container	1	3	$.30
heavy duty container	5	1	$.40
Supply	5000	4500	

x = # standard containers made each week

y = # heavy duty containers made each week

Maximize

$$.3x + .4y$$

Subject to

$$x \geq 500$$

$$1x + 5y \leq 5000$$

$$3x + 1y \leq 4500$$

$$x \geq 0$$

$$y \geq 0$$

Problem

16 With ref to #15, further require

$$y \leq x$$

$$y \geq 200$$

Problem 17

	oz plastic	minutes for clothes	minutes for sp features	dollar Profit per doll
Scary Harry	4	3	2	1.00
Horrible Harriet	3	4	4	1.25
Glob	9	1	3	1.50
Supply	160	50	50	

x = # Scary Harry dolls made per hour
y = # Horrible Harriet dolls made per hour
z = # Globs made per hour

Maximize

$$1x + 1.25y + 1.50z$$

Subject to

$$4x + 3y + 9z \leq 160$$
$$3x + 4y + z \leq 50$$
$$2x + 4y + 3z \leq 50$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem 18

	oz plastic	minutes for clothes	minutes for sp features	dollar profit
Scary Harry	5	2	3	1.10
Horrible Harriet	3	4	4	1.30
Glob	10	1	6	2.00
Supply	192	55	45	

x = # Scary Harry dolls made per hour

y = # Horrible Harriet dolls made per hour

z = # Globs made per hour

Maximize

$$1.1x + 1.3y + 2.0z$$

Subject to

$$5x + 3y + 10z \leq 192$$
$$2x + 4y + z \leq 55$$
$$3x + 4y + 6z \leq 45$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem

19 Referring to problem 18

For $x = 5$, $y = 5$, $z = 10$

$5(5) + 3(5) + 10(10) \leq 192$ ✓

$2(5) + 4(5) + 1(10) \leq 55$ ✓

$3(5) + 4(5) + 6(10) \leq 45$ NO

Not feasible

For $x = 10$, $y = 3$, $z = 2$

$5(10) + 3(3) + 10(2) \leq 192$ ✓

$2(10) + 4(3) + 1(2) \leq 55$ ✓

$3(10) + 4(3) + 6(2) \leq 45$ NO

Not feasible

Problem

20

	Lb Liner bd	Lb finish cdbd	hours Labor	dollar Profit
1 Shipping box	$\frac{3}{2}$	$\frac{3}{10}$	$\frac{2}{100}$	.09
1 mailing tube	$\frac{1}{12}$	$\frac{1}{20}$	$\frac{1}{300}$	.01
1 retail box	$\frac{6}{10}$	$\frac{4}{10}$	$\frac{1}{20}$	.10
Supply	300	120	10	

x = # shipping boxes made each day
y = # mailing tubes made each day
z = # retail boxes made each day

Maximize

$$.09x + .01y + .10z$$

Subject to

$$\frac{3}{2}x + \frac{1}{12}y + \frac{6}{10}z \leq 300$$

$$\frac{3}{10}x + \frac{1}{20}y + \frac{4}{10}z \leq 120$$

$$\frac{2}{100}x + \frac{1}{300}y + \frac{1}{20}z \leq 10$$

Problem

21

	#worms	# minnows	# Grasshoppers	dollar Profit
A	25	10	10	1.00
B	10	15	25	.75
C	50	5	5	1.25
Supply	1000	250	300	

x = # Bait packages type A
y = # Bait packages type B
z = # Bait packages type C

Maximize

$$1.00x + .75y + 1.25z$$

Subject to

$$25x + 10y + 50z \leq 1000$$
$$10x + 15y + 5z \leq 250$$
$$10x + 25y + 5z \leq 300$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem

22

	# hrs creative	# hrs tech	# hrs editing	dollar Profit
Science fiction games	16	14	5	200
Fantasy games	10	20	1	150
Supply	504	756	135	

x = # scenario of SciFi games created

y = # scenario of Fantasy games created

Maximize

$$200x + 150y$$

subject to

$$16x + 10y \leq 504$$

$$14x + 20y \leq 756$$

$$5x + 1y \leq 135$$

$$x \geq 0$$

$$y \geq 0$$

$$z \geq 0$$

oblem

23

	#hrs assembly	#hrs painting	# hrs Lock inst	dollar Profit
100 Small No Locks	1	1	0	2
100 Small with Lock	2	5	3	10
100 med with Lock	3	4	1	11
100 Large with Lock	6	8	4	20
supply	8	9	2	

x = # small widgets without lock (in 100's)
y = # small widgets with lock (in 100's)
z = # med widget with Lock (in 100's)
w = # large widgets with lock (in 100's)

Maximize

$$2x + 10y + 11z + 20w$$

subject to

$$x + 2y + 3z + 6w \leq 8$$
$$x + 5y + 4z + 8w \leq 9$$
$$0x + 3y + z + 4w \leq 2$$
$$x \geq 0 \quad y \geq 0 \quad z \geq 0$$

Problem 24

	# Regular Cabins	# Deluxe Cabins	dollar Cost
Nina	500	200	100 000
Pinta	400	400	120 000
Santa María	800	500	180 000
Demand	12000	8000	

x = # weeks scheduled for Nina
y = # weeks scheduled for Pinta
z = # weeks scheduled for Santa María

Minimize

$$100\,000x + 120\,000y + 180\,000z$$

Subject to

$$500x + 400y + 800z \geq 12000$$
$$200x + 400y + 500z \geq 8000$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

oblem

25

	oz dates	oz apricots	oz Candied fruit	dollar Profit
Deluxe Pack	16	24	12	3
Special pack	20	12	3	2
Standard pack	16	8	0	1.5
Supply	1200	900	360	

x = # Deluxe packs produced
y = # Special packs produced
z = # Standard packs produced

Maximize

$$3x + 2y + 1.5z$$

subject to

$$16x + 20y + 16z \leq 1200$$
$$24x + 12y + 8z \leq 900$$
$$12x + 3y + 0z \leq 360$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem

26 Referring to Problem 25, also require

$y \geq 20$

$x \leq 30$

Problem

27

	# tulips	# daffodils	# flowering shrubs	dollar profit
type 1	30	20	4	50
type 2	10	40	3	30
type 3	20	50	2	60
Supply	1000	800	100	

x = # type 1 layouts used
y = # type 2 layouts used
z = # type 3 layouts used

Maximize

$$50x + 30y + 60z$$

Subject to

$$30x + 10y + 20z \leq 1000$$
$$20x + 40y + 50z \leq 800$$
$$4x + 3y + 2z \leq 100$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem

28 Ref to #27, also require

$$x \leq 4$$

$$x \geq 5, \quad y \geq 5, \quad z \geq 5$$

oblem

29

	hrs Labor	hrs machine time	dollar profit
furniture	100	20	500
plywood	80	30	400
pulpwood	50	30	200
Supply	1000	500	

x = # units timber for furniture
y = # units timber for plywood
z = # units timber for pulpwood

Maximize

$$500x + 400y + 200z$$

Subject to

$$100x + 80y + 50z \leq 1000$$

$$20x + 30y + 30z \leq 500$$

$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$

Problem

30

	units A	units B	units C	dollar cost
food 1	100	5	20	40
food 2	60	8	10	20
food 3	100	12	30	50
Min req	300	20	100	

x = # units food 1 used
y = # units food 2 used
z = # units food 3 used

minimize

$$40x + 20y + 50z$$

Subject to

$$100x + 60y + 100z \geq 300$$
$$5x + 8y + 12z \geq 20$$
$$20x + 10y + 30z \geq 100$$
$$x \geq 0$$
$$y \geq 0$$
$$z \geq 0$$