HW4
Answer key

Section 3.5 p89 #2(a,b,c), 3, 6(a), 7

(2) a. Minimize $2x_1 + 4x_2 - 4x_3 + 7x_4$

S.t. $8x_1 - 2x_2 + x_3 - x_4 + x_5 = 50$

$3x_1 + 5x_2 + 2x_4 + x_6 = 150$

$x_1 - x_2 + 2x_3 - 4x_4 + x_7 = 100$

$x_1, x_2, x_3, x_4 \geq 0$

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	
x_5	8	-2	(1)	-1	1	0	0	50
x_6	3	5	0	2	0	1	0	150
x_7	1	-1	2	-4	0	0	1	100
	2	4	-4	7	0	0	0	0
x_3	8	-2	1	-1	1	0	0	50
x_6	3	5	0	2	0	1	0	150
x_7	-15	(3)	0	-2	-2	0	1	0
	34	-4	0	3	4	0	0	200
x_3	-2	0	1	-7/3	-1/3	0	2/3	50
x_6	28	0	0	16/3	10/3	1	-5/3	150
x_2	-5	1	0	-2/3	-2/3	0	1/3	0
	14	0	0	1/3	4/3	0	4/3	200

Minimum $z = -200$ @ $(0, 0, 50, 0)$

b. Minimize $-x_1 - 2x_2 + x_3$

S.t.

$x_2 + 4x_3 + x_4 = 36$

$5x_1 - 4x_2 + 2x_3 + x_5 = 60$

$3x_1 - 2x_2 + x_3 + x_6 = 24$

$x_1, x_2, x_3 \geq 0$

	x_1	x_2	x_3	x_4	x_5	x_6	
x_4	0	(1)	4	1	0	0	36
y_5	5	-4	2	0	1	0	60
y_6	3	-2	1	0	0	1	24
	-1	-2	1	0	0	0	0
y_2	0	1	4	1	0	0	36
y_5	5	0	10	4	1	0	204
x_6	(3)	0	9	2	0	1	96
	-1	0	9	2	0	0	72
x_2	0	1	4	1	0	0	36
y_5	0	0	-5	2	1	-5/3	44
x_1	1	0	3	2/3	0	1/3	32
	0	0	12	8/3	0	1/3	104

Maximum $z=104$ @ $(32, 36, 0)$

c.) minimize $-5x_1 + 4x_2 + x_3$

s.t. $x_1 + x_2 - 3x_3 + x_4 = 8$

$2x_2 - 2x_3 + x_5 = 7$

$-x_1 - 2x_2 + 4x_3 + x_6 = 6$

$x_1, x_2, x_3 \geq 0$

	x_1	x_2	x_3	x_4	x_5	x_6	
x_4	(1)	1	-3	1	0	0	8
y_5	0	2	-2	0	1	0	7
x_6	-1	-2	4	0	0	1	6
	-5	4	1	0	0	0	0
x_1	1	1	-3	1	0	0	8
x_5	0	2	-2	0	1	0	7
x_6	0	-1	(1)	1	0	1	14
	0	9	-14	5	0	0	40
x_1	1	-2	0	4	0	3	50
y_5	0	0	0	2	1	2	35
x_3	0	-1	1	1	0	1	14
	0	-5	0	19	0	14	236

unbounded objective function

(3) minimize $-x_4 + x_5$

s.t $x_1 + x_4 - 2x_5 = 1$

$x_2 + x_4 = 6$

$x_3 + 2x_4 - 3x_5 = 4$

$x_1, x_2, x_3, x_4, x_5 \geq 0$

	x_1	x_2	x_3	x_4	x_5	
x_1	1	0	0	(1)	-2	1
x_2	0	1	0	1	0	6
x_3	0	0	1	2	-3	4
	0	0	0	-1	1	0
x_4	1	0	0	1	-2	1
x_2	-1	1	0	0	2	5
x_3	-2	0	1	0	(1)	2
	1	0	0	0	-1	1
x_4	-3	0	2	1	0	5
x_2	(3)	1	-2	0	0	1
x_5	-2	0	1	0	1	2
	-1	0	1	0	0	3
x_4	0	1	0	1	0	6
x_1	1	1/3	-2/3	0	0	1/3
x_5	0	2/3	-1/3	0	1	8/3
	0	1/3	1/3	0	0	10/3

Maximum $z = 10/3$ @ $(1/3, 0, 0, 6, 8/3)$

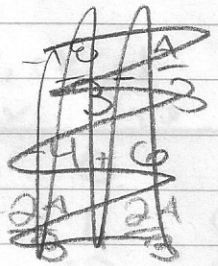
⑥ a.) minimize $-4x_1 - 12x_2 - 8x_3$

subject to $3x_1 + 2x_2 - 6x_3 + x_4 = 20$

$3x_1 + 6x_2 + 4x_3 + x_5 = 30$

$x_1, x_2, x_3, x_4, x_5 \geq 0$

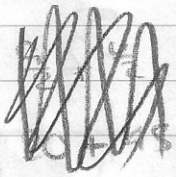
	x_1	x_2	x_3	x_4	x_5	
x_4	3	2	-6	1	0	20
x_5	3	(6)	4	0	1	30
	-4	-12	-8	0	0	0
x_4	2	0	$-22/3$	1	$-1/3$	10
x_2	$1/2$	1	$2/3$	0	$1/6$	5
	2	0	0	0	2	60



Solution 1: (0, 5, 0) $z = 60$

Other solution →

	x_1	x_2	x_3	x_4	x_5	
x_4	3	2	-6	1	0	20
x_5	3	6	(4)	0	1	30
	-4	-12	-8	0	0	0
x_4	$15/2$	11	0	1	$3/2$	65
x_3	$3/4$	$3/2$	1	0	$1/4$	$15/2$
	2	0	0	0	2	60



maximum $z = 60$ @ $(0, 0, 15/2)$

⑦ a. $(t, 0, t)$ $t \geq 0$

$t + 0 + (-2t) = -t \leq 7$ ✓ bc $t \geq 0$

$-3t + 0 + 2t = -t \leq 3$ ✓ bc $t \geq 0$

$t, 0, t \geq 0$ ✓

So $(t, 0, t)$ $t \geq 0$ is feasible

b. $2x_2 + x_3 = 0 + t = t$

t is unbounded $(t \geq 0)$
so the objective function is unbounded