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$Z = 4a + b$

s.a.

r1: $a + b \leq 150$
r2: $2a + b \leq 80$
r3: $a \geq 0$
r4: $b \geq 0$

Z=4a+b+0h1+0h2

r1: a+b+h1=150
r2: 2a+b+h2=80

Maximizar

		Cj	4	1	0	0		Cocientes
			a	b	h1	h2		
	0	h1	1	1	1	0	150	150
	0	h2	2	1	0	1	80	40
		Zj	0	0	0	0	0	
		Cj-Zj	4	1	0	0		

			Cj						
-a+h1	0	h1	0	1/2	1	- 1/2	110	
1/2h2	4	a	1	1/2	0	1/2	40	
		Zj	4	2	0	2	160	
		Cj-Zj	0	-1	0	-2		

		Comprobacion	
a=	40	a+b+h1=150	150
b=	0	2a+b+h2=80	80
h1=	110		
h2=	0		
Zj=	160		

Minimizar

		Cj	4	1	0	0	
			a	b	h1	h2	
	0	h1	1	1	1	0	150
	0	h2	2	1	0	1	80
		Zj	0	0	0	0	0
		Cj-Zj	4	1	0	0	

		Comprobacion	
a=	0	a+b+h1=150	150
b=	0	2a+b+h2=80	80
h1=	150		
h2=	80		
Zj=	0		

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2. $Z = x + 3y$

s.a.

r1: $x + y \geq 10$
r2: $2x + 2y \leq 25$
r3: $x \leq 8$
r4: $x \geq 0$
r5: $y \geq 0$

$Z = x + 3y + 0h_1 + 0h_2 + 0h_3 - MA_1$

r1: $x + y - h_1 + A_1 = 10$
r2: $2x + 2y + h_2 = 25$
r3: $x + h_3 = 8$

Maximizar

	Cj	1	3	0	0	0	-M		Cocientes
		x	y	h1	h2	h3	A1		
-M	A1	1	1	-1	0	0	1	10	10
0	h2	2	2	0	1	0	0	25	12 1/2
0	h3	1	0	0	0	1	0	8	#¡DIV/0!
	Zj	-M	-M	M	0	0	-M	-10M	
	Cj-Zj	1+M	3+M	-M	0	0	0		

		Cj	1	3	0	0	0	-M		Cocientes
1/1*A1	3	y	1	1	-1	0	0	1	10	-10
-2y+h2	0	h2	0	0	2	1	0	-2	5	2 1/2
	0	h3	1	0	0	0	1	0	8	#¡DIV/0!
		Zj	3	3	-3	0	0	3	30	
		Cj-Zj	-2	0	3	0	0	-M-3		

		Cj	1	3	0	0	0	-M		
1*h1+y	3	y	1	1	0	1/2	0	0	12 1/2	
1/2*h2	0	h1	0	0	1	1/2	0	-1	2 1/2	
	0	h3	1	0	0	0	1	0	8	
		Zj	3	3	0	1 1/2	0	0	37 1/2	
		Cj-Zj	-2	0	0	-1 1/2	0	-M		

	Comprobacion	
x=	0	x+y-h1+A1=10 ... 10
y=	12 1/2	2x+2y+h2=25 ... 25
h1=	2 1/2	x+h3=8 ... 8
h2=	0	
h3=	8	
A1=	0	
Zj=	37 1/2	

Minimizar

	Cj	1	3	0	0	0	+M		Cocientes
		x	y	h1	h2	h3	A1		
+M	A1	1	1	-1	0	0	1	10	10
0	h2	2	2	0	1	0	0	25	12.5
0	h3	1	0	0	0	1	0	8	8
	Zj	+M	+M	-M	0	0	+M	10M	
	Cj-Zj	1-M	3-M	+M	0	0	0		

		Cj	1	3	0	0	0	+M		Cocientes
-1*x+A1	+M	A1	0	1	-1	0	-1	1	2	2
-2*x+h2	0	h2	0	2	0	1	-2	0	9	4.5
	1	x	1	0	0	0	1	0	8	#¡DIV/0!
		Zj	1	+M	-M	0	1-M	+M	8+2M	
		Cj-Zj	0	3-M	+M	0	-1+M	0		

		Cj	1	3	0	0	0	+M		
	3	y	0	1	-1	0	-1	1	2	
-2*y+h2	0	h2	0	0	2	1	0	-2	5	
	1	x	1	0	0	0	1	0	8	
		Zj	1	3	-3	0	-2	3	14	
		Cj-Zj	0	0	3	0	2	+M-3		

	Comprobacion	
x=	8	x+y-h1+A1=10 ... 10
y=	2	2x+2y+h2=25 ... 25
h1=	0	x+h3=8 ... 8
h2=	5	
h3=	0	
A1=	0	
Zj=	14	

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3. $Z = 0.1x + 0.5y$ Z=0.1x+0.5y+0h1+0h2+0h3

s.a.

r1: $4x + 3y \leq 30$ r1:   4x+3y+h1=30

r2: $6x + y \leq 36$ r2:   6x+y+h2=36

r3: $x - y \leq 20$ r3:   x-y+h3=20

r4: $x \geq 0$

r5: $y \geq 0$

Maximizar

	Cj	0.1	0.5	0	0	0		
		x	y	h1	h2	h3		
0	h1	4	3	1	0	0	30	10
0	h2	6	1	0	1	0	36	36
0	h3	1	-1	0	0	1	20	-20
	Zj	0	0	0	0	0	0	
	Cj-Zj	0.1	0.5	0	0	0		

			Cj	0.1	0.5	0	0	0		
1/3h1	0.5	y	1	1/3	1		1/3	0	0	10
-h1+h2	0	h2	4	2/3	0	-	1/3	1	0	26
h1+h3	0	h3	2	1/3	0		1/3	0	1	30
		Zj		2/3	1/2		1/6	0	0	5
		Cj-Zj	-	17/30	0	-	1/6	0	0	

Comprobacion

x=	0	4x+3y+h1=30	30
y=	10	6x+y+h2=36	36
h1=	0	x-y+h3=20	20
h2=	26		
h3=	30		
Zj=	5		

Minimizar

Cj	0.1	0.5	0	0	0	
	x	y	h1	h2	h3	
h1	4	3	1	0	0	30
h2	6	1	0	1	0	36
h3	1	-1	0	0	1	20
Zj	0	0	0	0	0	0
Cj-Zj	0.1	0.5	0	0	0	

Comprobacion

x=	0	4x+3y+h1=30	30
y=	0	6x+y+h2=36	36
h1=	30	x-y+h3=20	20
h2=	36		
h3=	20		
Zj=	0		

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4. $Z = m + 2n$

$Z = m + 2n + 0h1 + 0h2 + 0h3$

s.a.

r1: $3m + n \leq 14$ r1:   3m+n+h1=14

r2: $m + 5n \leq 20$ r2:   m+5n+h2=20

r3: $m \leq n - 10$ r3:   m-n+h3=-10

r4: $m \geq 0$

r5: $n \geq 0$

Maximizar

		Cj	1	2	0	0	0		Cocientes
			m	n	h1	h2	h3		
	0	h1	3	1	1	0	0	14	14
	0	h2	1	5	0	1	0	20	4
	0	h3	1	-1	0	0	1	-10	10
		Zj	0	0	0	0	0	0	
		Cj-Zj	1	2	0	0	0		

		Cj	1	2	0	0	0		Cocientes
-n+h1	0	h1	2 4/5	0	1	- 1/5	0	10	3.571429
1/5*h2	2	n	1/5	1	0	1/5	0	4	20
1*n+h3	0	h3	1 1/5	0	0	1/5	1	-6	-5
		Zj	2/5	2	0	2/5	0	8	
		Cj-Zj	3/5	0	0	- 2/5	0		

		Cj	1	2	0	0	0		Cocientes
5/14*h1	1	m	1	0	5/14	- 1/14	0	3 4/7	#¡DIV/0!
-1/5*m+n	2	n	0	1	- 1/14	3/14	0	3 2/7	3.285714
-6/5*m+h3	0	h3	0	0	- 3/7	2/7	1	-10 2/7	#¡DIV/0!
		Zj	1	0	- 1/2	1/2	2	-17	
		Cj-Zj	0	2	1/2	- 1/2	-2		

		Cj	1	2	0	0	0		
	1	m	1	0	5/14	- 1/14	0	3 4/7	
	2	n	0	1	- 1/14	3/14	0	3 2/7	
	0	h3	0	0	- 3/7	2/7	1	-10 2/7	
		Zj	1	2	3/14	5/14	0	10 1/7	
		Cj-Zj	0	0	- 3/14	- 5/14	0		

Comprobacion

m=	3	4/7
n=	3	2/7
h1=	0	
h2=	0	
h3=	-10	2/7
Zj	10	1/7

3m+n+h1=14   14
m+5n+h2=20   20
m-n+h3=-10   -10

Minimizar

		Cj	1	2	0	0	0	
			m	n	h1	h2	h3	
	0	h1	3	1	1	0	0	14
	0	h2	1	5	0	1	0	20
	0	h3	1	-1	0	0	1	-10
		Zj	0	0	0	0	0	0
		Cj-Zj	1	2	0	0	0	

Comprobacion

m=	0
n=	0
h1=	14
h2=	20
h3=	-10
Zj	0

3m+n+h1=14   14
m+5n+h2=20   20
m-n+h3=-10   -10

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Z=4x+3x+0h1+0h2+0h3+0h4+0h5-MA4-MA5

5. $Z = 4x + 3y$

s.a.

r1: $3x + 2y \leq 25$

r2: $x \leq 5$

r3: $8x \leq 21 - 6y$

r4: $x \geq -2$

r5: $y \geq 1$

r1:   3x+2y+h1=25
r2:   x+h2=5
r3:   8x+6y+h3=21
r4:   x-h4+A4=-2
r5:   y-h5+A5=1

Maximizar

	Cj	4	3	0	0	0	0	0	-M	-M			Cociente
		x	y	h1	h2	h3	h4	h5	A4	A5			
0	h1	3	2	1	0	0	0	0	0	0	25		8.333333333
0	h2	1	0	0	1	0	0	0	0	0	5		5
0	h3	8	6	0	0	1	0	0	0	0	21		2.625
-M	A4	1	0	0	0	0	-1	0	1	0	-2		-2
-M	A5	0	1	0	0	0	0	-1	0	1	1		#¡DIV/0!
	Zj	-M	-M	0	0	0	+M	+M	-M	-M	+M		
	Cj-Zj	4+M	3+M	0	0	0	-M	-M	0	0			

			Cj	4	3	0	0	0	0	0	0	0			
-3*x+h1	0	h1	0	- 1/4	1	0	- 3/8	0	0	0	0	17 1/8		-68 1/2
-1*x+h2	0	h2	0	- 3/4	0	1	- 1/8	0	0	0	0	2 3/8		-3 1/6
1/8*h3	4	x	1	3/4	0	0	1/8	0	0	0	0	2 5/8		3 1/2
-1*x+A4	-M	A4	0	- 3/4	0	0	- 1/8	-1	0	1	0	-4 5/8		6 1/6
	-M	A5	0	1	0	0	0	0	-1	0	1	1		1
		Zj	4	15/4-M	0	0	1/2+1/8M	+M	+M	-M	-M	21/2+29/8M		(168+58M)/(60-16M)
		Cj-Zj	0	-3/4-M	0	0	-1/2+1/8M	-M	-M	0	0			

			Comprobacion	
x=	2	5/8	3x+2y+h1=25	25
y=	0		x+h2=5	5
h1=	17	1/8	8x+6y+h3=21	21
h2=	2	3/8	x-h4+A4=-2	-2
h3=	0		y-h5+A5=1	1
h4=	0			
h5=	0			
A4=	-4	5/8		
A5=	1			
Zj=	21/2+29/8M			

Minimizar

	Cj	4	3	0	0	0	0	0	+M	+M			
		x	y	h1	h2	h3	h4	h5	A4	A5			
0	h1	3	2	1	0	0	0	0	0	0	25		12.5
0	h2	1	0	0	1	0	0	0	0	0	5		#¡DIV/0!
0	h3	8	6	0	0	1	0	0	0	0	21		3.5
+M	A4	1	0	0	0	0	-1	0	1	0	-2		#¡DIV/0!
+M	A5	0	1	0	0	0	0	-1	0	1	1		1
	Zj	+M	+M	0	0	0	-M	-M	+M	+M	-M		-1
	Cj-Zj	4-M	3-M	0	0	0	+M	+M	0	0			

				3	0	1	0	0	0	2	0	-2	23		7.666666667
-2*y+h1	0	h1	3	0	1	0	0	0	2	0	-2	23		7.666666667
	0	h2	1	0	0	1	0	0	0	0	0	5		5
-6y+h3	0	h3	8	0	0	0	1	0	6	0	-6	15		1.875
	+M	A4	1	0	0	0	0	-1	0	1	0	-2		-2
	3	y	0	1	0	0	0	0	-1	0	1	1		#¡DIV/0!
		Zj	+M	3	0	0	0	-M	-3	+M	3	3-2M		
		Cj-Zj	4-M	0	0	0	0	+M	3	0	+M-3			

				0	0	1	0	- 3/8	0	- 1/4	0	1/4	17 3/8	
-3*x+h1	0	h1	0	0	1	0	- 3/8	0	- 1/4	0	1/4	17 3/8
-x+h2	0	h2	0	0	0	1	- 1/8	0	- 3/4	0	3/4	3 1/8
1/8*h3	4	x	1	0	0	0	1/8	0	3/4	0	- 3/4	1 7/8
-x+A4	+M	A4	0	0	0	0	- 1/8	-1	- 3/4	1	3/4	-3 7/8
	3	y	0	1	0	0	0	0	-1	0	1	1
		Zj	4	3	0	0	1/2-1/8M	-M	-3/4M	+M	3/4M	+21/2-17/8M
		Cj-Zj	0	0	0	0	-1/2+1/8M	+M	+3/4M	0	1/4M	

			Comprobacion	
x=	1	7/8	3x+2y+h1=25	25
y=	1		x+h2=5	5
h1=	17	3/8	8x+6y+h3=21	21
h2=	3	1/8	x-h4+A4=-2	-2
h3=	0		y-h5+A5=1	1
h4=	0			
h5=	0			
A4=	-3	7/8		
A5=	0			
Zj=	+21/2-17/8M			