EJEMPLOS DE PLANTEAMIENTOS CON BINARIAS

Una empresa fabrica 3 productos, cuyo proceso de fabricación pasa por tres departamentos, en la siguiente tabla se muestran las necesidades en horas de cada departamento para la producción de cada unidad de producto:

PRODUCTO	Departamento 1	Departamento 2	Departamento 3
A	1,50	2,00	0,25
B	3,00	1,00	0,25
C	2,00	2,50	0,25

En un determinado periodo y con la plantilla existente se disponen de 450 horas en el Departamento 1, de 350 en el 2 y de 50 en el 3. Los márgenes brutos por unidad de producto son de 25€ para A, de 28€ para B y de 30€ para el producto C.

a. Plantear el modelo de programación lineal que permita encontrar las producciones óptimas maximizando el margen bruto y teniendo en cuenta las limitaciones horarias.

$$\text{Max } Z= 25X_1+28X_2+30X_3$$
Sujeto a:
$$1{,}50X_1+3{,}00X_2+2{,}00X_3\leq 450$$
$$2{,}00X_1+1{,}00X_2+2{,}50X_3\leq 350$$
$$0{,}25X_1+0{,}25X_2+0{,}25X_3\leq 50$$
$$X_1,X_2,X_3\geq 0$$
X_1,X_2,X_3 Enteras

b. En el modelo anterior incorporar la existencia de unos costes de preparación a la producción (Costes Fijos) que ascienden a 400€ para A, 550€ para B y 550€ para C.

$$\text{Max } Z= 25X_1+28X_2+30X_3-400Y_1-550Y_2-550Y_3$$
Sujeto a:
$$1{,}50X_1+3{,}00X_2+2{,}00X_3\leq 450$$
$$2{,}00X_1+1{,}00X_2+2{,}50X_3\leq 350$$
$$0{,}25X_1+0{,}25X_2+0{,}25X_3\leq 50$$
$$X_1-M_1Y_1\leq 0$$
$$X_2-M_2Y_2\leq 0$$
$$X_3-M_3Y_3\leq 0$$
$X_1,X_2,X_3\geq 0$, Y_1, Y_2, $Y_3\in\{0,1\}$
X_1,X_2,X_3 Enteras

c. Calcular unos valores coherentes para M_1, M_2 y M_3.

d. La empresa se plantea hacer horas extras, por tanto puede eliminar las limitaciones horarias de los tres departamentos. Incorporar este hecho al modelo del apartado b y c.

Max $Z = 25X_1+28X_2+30X_3-400Y_1-550Y_2-550Y_3$
Sujeto a:
$1{,}50X_1+3{,}00X_2+2{,}00X_3-450 \leq M_4(1-Y_4)$
$2{,}00X_1+1{,}00X_2+2{,}50X_3-350 \leq M_5(1-Y_5)$
$0{,}25X_1+0{,}25X_2+0{,}25X_3-50 \leq M_6(1-Y_6)$
$X_1-M_1Y_1 \leq 0$
$X_2-M_2Y_2 \leq 0$
$X_3-M_3Y_3 \leq 0$
$Y_4+Y_5+Y_6 \leq 3$
$X_1, X_2, X_3 \geq 0$; $Y_1, Y_2, Y_3, Y_4, Y_5, Y_6 \in \{0,1\}$
X_1, X_2, X_3 Enteras

Resolver los modelos de los apartados a., b. (c.) y d. utilizando SAS/OR.

```
libname t4 '.';
data t4.exem_int;
 input _row_ $7. x1 x2 x3 _type_ $ _rhs_;
      datalines;
Obj     25     28     30        MAX        .
res1    1.50   3.00   2.00      LE       452
res2    2.00   1.00   2.50      LE       352
res3    0.25   0.25   0.25      LE        53
limsup  10000  10000  10000     UPPERBD    .
enteras 1      2      3         INTEGER    .
;
run;

proc lp data=t4.exem_int;
run;

data t4.exem_int_binCF;
 input _row_ $7. x1 x2 x3 y1 y2 y3 _type_ $ _rhs_;
      datalines;
Obj     25     28     30     -400    -550   -550      MAX        .
res1    1.50   3.00   2.00      0       0      0       LE       450
res2    2.00   1.00   2.50      0       0      0       LE       350
res3    0.25   0.25   0.25      0       0      0       LE        50
CF1     1      0      0     -10000     0      0       LE         0
CF2     0      1      0         0  -10000     0       LE         0
CF3     0      0      1         0       0  -10000     LE         0
limsup  10000  10000  10000     .       .      .       UPPERBD    .
enteras 1      2      3         .       .      .       INTEGER    .
bin     .      .      .         1       2      3       BINARY     .
;
run;

proc lp data=t4.exem_int_binCF;
run;
```

```
data t4.exem_int_binCF_RES;
 input _row_ $7. x1 x2 x3 y1 y2 y3 y4 y5 y6 _type_ $ _rhs_;
      datalines;
Obj     25     28     30     -400   -550  -550      0    0    0     MAX        .
res1    1.50   3.00   2.00     0     0     0      10000  0    0     LE      10450
res2    2.00   1.00   2.50     0     0     0        0   10000 0     LE      10350
res3    0.25   0.25   0.25     0     0     0        0     0   10000 LE      10050
CF1     1      0      0    -10000    0     0        0     0   0     LE         0
CF2     0      1      0        0  -10000   0        0     0   0     LE         0
CF3     0      0      1        0     0  -10000      0     0   0     LE         0
un      0      0      0        0     0     0        1     1   1     GE         1
limsup  10000  10000  10000    .     .     .        .     .   .     UPPERBD    .
enteras 1      2      3        .     .     .        .     .   .     INTEGER    .
bin     .      .      .        1     2     3        4     5   6     BINARY     .
;
run;

proc lp data=t4.exem_int_binCF_RES MAXIT=500;
run; libname t4 '.';
data t4.exem_int;
 input _row_ $7. x1 x2 x3 _type_ $ _rhs_;
      datalines;
Obj     25     28     30        MAX        .
res1    1.50   3.00   2.00      LE       450
res2    2.00   1.00   2.50      LE       350
res3    0.25   0.25   0.25      LE        50
limsup  10000  10000  10000     UPPERBD    .
enteras 1      2      3         INTEGER    .
;
run;

proc lp data=t4.exem_int;
run;

data t4.exem_int_binCF;
 input _row_ $7. x1 x2 x3 y1 y2 y3 _type_ $ _rhs_;
      datalines;
Obj     25     28     30     -400   -550  -550      MAX        .
res1    1.50   3.00   2.00     0     0     0        LE       450
res2    2.00   1.00   2.50     0     0     0        LE       350
res3    0.25   0.25   0.25     0     0     0        LE        50
CF1     1      0      0    -10000    0     0        LE         0
CF2     0      1      0     0     -10000   0        LE         0
CF3     0      0      1     0          0  -10000     LE         0
limsup  10000  10000  10000    .     .     .        UPPERBD    .
enteras 1      2      3        .     .     .        INTEGER    .
bin     .      .      .        1     2     3        BINARY     .
;
run;

proc lp data=t4.exem_int_binCF;
run;
```

```
data t4.exem_int_binCF_RES;
 input _row_ $7. x1 x2 x3 y1 y2 y3 y4 y5 y6 _type_ $ _rhs_;
      datalines;
Obj     25     28     30     -400   -550  -550      0    0    0     MAX        .
res1    1.50   3.00   2.00     0     0     0      10000  0    0     LE     10450
res2    2.00   1.00   2.50     0     0     0        0   10000 0     LE     10350
res3    0.25   0.25   0.25     0     0     0        0     0   10000 LE     10050
CF1     1      0      0     -10000    0     0        0     0   0     LE         0
CF2     0      1      0        0  -10000   0        0     0   0     LE         0
CF3     0      0      1        0     0  -10000      0     0   0     LE         0
un      0      0      0        0     0     0        1     1   1     LE         3
limsup  10000  10000  10000    .     .     .        .     .   .     UPPERBD    .
enteras 1      2      3        .     .     .        .     .   .     INTEGER    .
bin     .      .      .        1     2     3        4     5   6     BINARY     .
;
run;

proc lp data=t4.exem_int_binCF_RES MAXIT=500;
run;
```

The LP Procedure

Problem Summary

Objective Function	Max Obj
Rhs Variable	_rhs_
Type Variable	_type_
Problem Density (%)	66.67

Variables	Number
Integer	3
Slack	3
Total	6

Constraints	Number
LE	3
Objective	1
Total	4

The LP Procedure

Solution Summary

Integer Optimal Solution

Objective Value	5540
Phase 1 Iterations	0
Phase 2 Iterations	3
Phase 3 Iterations	0
Integer Iterations	0
Integer Solutions	1

Initial Basic Feasible Variables	5
Time Used (seconds)	0
Number of Inversions	4
Epsilon	1E-8
Infinity	1.797693E308
Maximum Phase 1 Iterations	100
Maximum Phase 2 Iterations	100
Maximum Phase 3 Iterations	99999999
Maximum Integer Iterations	100
Time Limit (seconds)	120

The LP Procedure

Variable Summary

Col	Variable Name	Status	Type	Price	Activity	Reduced Cost
1	x1	BASIC	INTEGER	25	60	0
2	x2	BASIC	INTEGER	28	80	0
3	x3	BASIC	INTEGER	30	60	0
4	res1		SLACK	0	0	-5.2
5	res2		SLACK	0	0	-4.8
6	res3		SLACK	0	0	-30.4

The LP Procedure

Constraint Summary

Row	Constraint Name	Type	S/S Col	Rhs	Activity	Dual Activity
1	Obj	OBJECTVE	.	0	5540	.
2	res1	LE	4	450	450	5.2
3	res2	LE	5	350	350	4.8
4	res3	LE	6	50	50	30.4

The LP Procedure

Problem Summary

Objective Function	Max Obj
Rhs Variable	_rhs_
Type Variable	_type_
Problem Density (%)	29.17
Variables	Number
Integer	3
Binary	3
Slack	6
Total	12

Constraints	Number
LE	6
Objective	1
Total	7

The LP Procedure

Integer Iteration Log

Iter	Problem	Condition	Objective	Branched	Value	Sinfeas	Active	Proximity
1	0	ACTIVE	5529.9	y2	0.008	0.02	2	.
2	-1	ACTIVE	4984.3	y3	0.006	0.012	3	.
3	2	ACTIVE	4746	y1	0.01	0.01	4	.
4	-3	SUBOPTIMAL	4350	.	.	.	2	143.5
5	-2	FATHOMED	4437.6	.	.	.	1	143.5
6	1	FATHOMED	4368	.	.	.	0	.

The LP Procedure

Solution Summary

Integer Optimal Solution

Objective Value	4350
Phase 1 Iterations	0
Phase 2 Iterations	6
Phase 3 Iterations	6
Integer Iterations	6
Integer Solutions	1
Initial Basic Feasible Variables	8
Time Used (seconds)	0
Number of Inversions	6
Epsilon	1E-8
Infinity	1.797693E308
Maximum Phase 1 Iterations	100
Maximum Phase 2 Iterations	100
Maximum Phase 3 Iterations	99999999
Maximum Integer Iterations	100
Time Limit (seconds)	120

The LP Procedure

Variable Summary

Col	Variable Name	Status	Type	Price	Activity	Reduced Cost
1	x1	BASIC	INTEGER	25	100	0
2	x2	BASIC	INTEGER	28	100	0
3	x3	DEGEN	INTEGER	30	0	0

4	y1		BINARY	-400	1	-400
5	y2		BINARY	-550	1	-550
6	y3		BINARY	-550	0	39450
7	res1		SLACK	0	0	-2
8	res2	BASIC	SLACK	0	50	0
9	res3		SLACK	0	0	-88
10	CF1	BASIC	SLACK	0	9900	0
11	CF2	BASIC	SLACK	0	9900	0
12	CF3		SLACK	0	0	-4

The LP Procedure

Constraint Summary

Row	Constraint Name	Type	S/S Col	Rhs	Activity	Dual Activity
1	Obj	OBJECTVE	.	0	4350	.
2	res1	LE	7	450	450	2
3	res2	LE	8	350	300	0
4	res3	LE	9	50	50	88
5	CF1	LE	10	0	-9900	0
6	CF2	LE	11	0	-9900	0
7	CF3	LE	12	0	0	4

The LP Procedure

Problem Summary

Objective Function	Max Obj
Rhs Variable	_rhs_
Type Variable	_type_
Problem Density (%)	25.00

Variables	Number
Integer	3
Binary	6
Slack	7
Total	16

Constraints	Number
LE	7
Objective	1
Total	8

The LP Procedure

Integer Iteration Log

Iter	Problem	Condition	Objective	Branched	Value	Sinfeas	Active	Proximity
1	0	ACTIVE	147640.08	y1	0.458	1.24389	2	.
2	1	ACTIVE	139721.57	x3	3745	1.29136	3	.
3	-2	ACTIVE	139699.8	y3	0.375	0.4734	3	.
4	-3	ACTIVE	139355.83	y2	0.099	0.0988	4	.
5	4	ACTIVE	123650	y4	0.217	0.217	5	.
6	5	SUBOPTIMAL	123650	.	.	.	3	23773.194
7	-4	ACTIVE	138860	y4	3E-4	0.0003	4	23773.194
8	7	SUBOPTIMAL	138860	.	.	.	2	8563.1944
9	2	ACTIVE	139716.43	y3	0.375	0.80658	3	8563.1944
10	9	FATHOMED	97341.75	.	.	.	2	8563.1944
11	-9	ACTIVE	139372.4	x2	986.7	0.43208	3	8563.1944
12	-11	ACTIVE	139366.72	x3	3745	0.59888	4	8563.1944
13	-12	INFEASIBLE	139365.05	.	.	.	3	8563.1944
14	12	ACTIVE	139361.03	x2	987.3	0.43233	4	8563.1944
15	14	FATHOMED	139351.72	.	.	.	3	8563.1944
16	-14	FATHOMED	139349.66	.	.	.	2	8563.1944
17	11	FATHOMED	139353.77	.	.	.	1	8563.1944
18	-1	ACTIVE	147423.19	x2	1194	0.78611	2	8561.0314
19	18	ACTIVE	147416.33	y2	0.119	0.1195	3	8550.9417
20	19	FATHOMED	128975	.	.	.	2	8550.9417
21	-19	ACTIVE	146932	y4	1E-4	0.0001	3	8550.9417
22	21	SUBOPTIMAL	146932	.	.	.	1	478.94167
23	-18	ACTIVE	147410.94	x1	4577	0.453	1	477.2475
24	23	ACTIVE	147409.25	x3	0.5	0.61973	2	475.55333
25	-24	ACTIVE	147407.55	x1	4575	0.45312	2	474.70625
26	25	ACTIVE	147406.71	x3	1.25	0.36981	3	472.165
27	-26	FATHOMED	147404.17	.	.	.	2	471.8775
28	26	ACTIVE	147403.88	x2	1195	0.28652	3	471.59
29	28	FATHOMED	147399.22	.	.	.	2	471.59
30	-28	ACTIVE	147385.5	x1	4573	0.45352	2	471.59
31	30	ACTIVE	147381.82	x2	1196	0.28692	3	471.59
32	31	FATHOMED	147377.17	.	.	.	2	471.59
33	-31	ACTIVE	147363.44	x1	4571	0.45392	2	471.59
34	33	ACTIVE	147359.77	x2	1197	0.28732	3	471.59
35	34	FATHOMED	147355.11	.	.	.	2	471.59
36	-34	ACTIVE	147341.39	x1	4569	0.45432	2	471.59
37	36	ACTIVE	147337.71	x2	1198	0.28772	3	471.59
38	37	FATHOMED	147333.06	.	.	.	2	471.59
39	-37	ACTIVE	147319.33	x1	4567	0.45472	2	471.59
40	39	ACTIVE	147315.66	x2	1199	0.28812	3	471.59
41	40	FATHOMED	147311	.	.	.	2	471.59
42	-40	ACTIVE	147297.28	x1	4565	0.45512	2	471.59
43	42	ACTIVE	147293.6	x2	1200	0.28852	3	471.59
44	43	FATHOMED	147288.95	.	.	.	2	471.59
45	-43	ACTIVE	147275.22	x1	4563	0.45552	2	471.59
46	45	ACTIVE	147271.55	x2	1201	0.28892	3	471.59
47	46	FATHOMED	147266.89	.	.	.	2	471.59
48	-46	ACTIVE	147253.17	x1	4561	0.45592	2	471.59
49	48	ACTIVE	147249.49	x2	1202	0.28932	3	471.59

50	24	ACTIVE	147403.59	x2	1195	0.45313	4	462.275
51	50	FATHOMED	147394.28	.	.	.	3	460.5625
52	-50	ACTIVE	147388.89	x1	4575	0.4534	3	449.535
53	52	ACTIVE	147381.54	x2	1196	0.45353	4	440.22
54	53	FATHOMED	147372.22	.	.	.	3	438.5075
55	-53	ACTIVE	147366.83	x1	4573	0.4538	3	427.48
56	55	ACTIVE	147359.48	x2	1197	0.45393	4	418.165
57	56	FATHOMED	147350.17	.	.	.	3	416.4525
58	-56	ACTIVE	147344.78	x1	4571	0.4542	3	405.425
59	58	ACTIVE	147337.43	x2	1198	0.45433	4	396.11
60	59	FATHOMED	147328.11	.	.	.	3	394.3975
61	-59	ACTIVE	147322.72	x1	4569	0.4546	3	383.37
62	61	ACTIVE	147315.37	x2	1199	0.45473	4	374.055
63	62	FATHOMED	147306.06	.	.	.	3	372.3425
64	-62	ACTIVE	147300.67	x1	4567	0.455	3	361.315
65	64	ACTIVE	147293.32	x2	1200	0.45513	4	352
66	65	FATHOMED	147284	.	.	.	3	350.2875
67	-65	ACTIVE	147278.61	x1	4565	0.4554	3	339.26
68	67	ACTIVE	147271.26	x2	1201	0.45553	4	329.945
69	68	FATHOMED	147261.95	.	.	.	3	328.2325
70	-68	ACTIVE	147256.56	x1	4563	0.4558	3	317.205
71	70	ACTIVE	147249.21	x2	1202	0.45593	4	312.835
72	71	FATHOMED	147239.89	.	.	.	3	312.835
73	-71	ACTIVE	147234.5	x1	4561	0.4562	3	312.835
74	73	ACTIVE	147227.15	x2	1203	0.45633	4	312.835
75	74	FATHOMED	147217.84	.	.	.	3	312.835
76	-74	ACTIVE	147212.45	x1	4559	0.4566	3	312.835
77	76	ACTIVE	147205.1	x2	1204	0.45673	4	312.835
78	77	FATHOMED	147195.78	.	.	.	3	312.835
79	-77	ACTIVE	147190.39	x1	4557	0.457	3	312.835
80	79	ACTIVE	147183.04	x2	1205	0.45713	4	312.835
81	80	FATHOMED	147173.73	.	.	.	3	312.835
82	-80	ACTIVE	147168.34	x1	4555	0.4574	3	312.835
83	82	ACTIVE	147160.99	x2	1206	0.45753	4	312.835
84	83	FATHOMED	147151.67	.	.	.	3	312.835
85	-83	ACTIVE	147146.28	x1	4553	0.4578	3	312.835
86	85	ACTIVE	147138.93	x2	1207	0.45793	4	312.835
87	86	FATHOMED	147129.62	.	.	.	3	312.835
88	-86	ACTIVE	147124.23	x1	4551	0.4582	3	312.835
89	88	ACTIVE	147116.88	x2	1208	0.45833	4	312.835
90	89	FATHOMED	147107.56	.	.	.	3	312.835
91	-89	ACTIVE	147102.17	x1	4549	0.4586	3	312.835
92	91	ACTIVE	147094.82	x2	1209	0.45873	4	312.835
93	92	FATHOMED	147085.51	.	.	.	3	312.835
94	-92	ACTIVE	147080.12	x1	4547	0.459	3	312.835
95	94	ACTIVE	147072.77	x2	1210	0.45913	4	312.835
96	95	FATHOMED	147063.45	.	.	.	3	312.835
97	-95	ACTIVE	147058.06	x1	4545	0.4594	3	312.835
98	97	ACTIVE	147050.71	x2	1211	0.45953	4	312.835
99	98	FATHOMED	147041.4	.	.	.	3	312.835
100	-98	ACTIVE	147036.01	x1	4543	0.4598	3	312.835
101	100	ACTIVE	147028.66	x2	1212	0.45993	4	312.835
102	101	FATHOMED	147019.34	.	.	.	3	312.835
103	-101	ACTIVE	147013.95	x1	4541	0.4602	3	312.835
104	103	ACTIVE	147006.6	x2	1213	0.46033	4	312.835

105	104	FATHOMED	146997.29	.	.	.	3	312.835
106	-104	ACTIVE	146991.9	x1	4539	0.4606	3	312.835
107	106	ACTIVE	146984.55	x2	1214	0.46073	4	312.835
108	107	FATHOMED	146975.23	.	.	.	3	312.835
109	-107	ACTIVE	146969.84	x1	4537	0.461	3	312.835
110	109	ACTIVE	146962.49	x2	1215	0.46113	4	312.835
111	49	FATHOMED	147244.84	.	.	.	3	306.465
112	-49	ACTIVE	147231.11	x1	4559	0.45632	3	295.4375
113	112	ACTIVE	147227.44	x2	1203	0.28972	4	290.78
114	113	FATHOMED	147222.78	.	.	.	3	284.41
115	-113	ACTIVE	147209.06	x1	4557	0.45672	3	273.3825
116	115	ACTIVE	147205.38	x2	1204	0.29012	4	268.725
117	116	FATHOMED	147200.73	.	.	.	3	262.355
118	-116	ACTIVE	147187	x1	4555	0.45712	3	251.3275
119	118	ACTIVE	147183.33	x2	1205	0.29052	4	246.67
120	119	FATHOMED	147178.67	.	.	.	3	240.3
121	-119	ACTIVE	147164.95	x1	4553	0.45752	3	229.2725
122	121	ACTIVE	147161.27	x2	1206	0.29092	4	224.615
123	122	FATHOMED	147156.62	.	.	.	3	218.245
124	-122	ACTIVE	147142.89	x1	4551	0.45792	3	207.2175
125	124	ACTIVE	147139.22	x2	1207	0.29132	4	202.56
126	125	FATHOMED	147134.56	.	.	.	3	196.19
127	-125	ACTIVE	147120.84	x1	4549	0.45832	3	185.1625
128	127	ACTIVE	147117.16	x2	1208	0.29172	4	180.505
129	128	FATHOMED	147112.51	.	.	.	3	174.135
130	-128	ACTIVE	147098.78	x1	4547	0.45872	3	163.1075
131	130	ACTIVE	147095.11	x2	1209	0.29212	4	158.45
132	131	FATHOMED	147090.45	.	.	.	3	152.08
133	-131	ACTIVE	147076.73	x1	4545	0.45912	3	141.0525
134	133	ACTIVE	147073.05	x2	1210	0.29252	4	136.395
135	134	FATHOMED	147068.4	.	.	.	3	130.025
136	-134	ACTIVE	147054.67	x1	4543	0.45952	3	118.9975
137	136	ACTIVE	147051	x2	1211	0.29292	4	114.34
138	137	FATHOMED	147046.34	.	.	.	3	107.97
139	-137	ACTIVE	147032.62	x1	4541	0.45992	3	96.9425
140	139	ACTIVE	147028.94	x2	1212	0.29332	4	92.285
141	140	FATHOMED	147024.29	.	.	.	3	85.915
142	-140	ACTIVE	147010.56	x1	4539	0.46032	3	74.8875
143	142	ACTIVE	147006.89	x2	1213	0.29372	4	70.23
144	143	FATHOMED	147002.23	.	.	.	3	63.86
145	-143	ACTIVE	146988.51	x1	4537	0.46072	3	52.8325
146	145	ACTIVE	146984.83	x2	1214	0.29412	4	48.175
147	146	FATHOMED	146980.18	.	.	.	3	41.805
148	-146	ACTIVE	146966.45	x1	4535	0.46112	3	30.7775
149	148	ACTIVE	146962.78	x2	1215	0.29452	4	26.12
150	149	FATHOMED	146958.12	.	.	.	3	21.175
151	110	FATHOMED	146953.18	.	.	.	2	19.75
152	-149	ACTIVE	146944.4	x1	4533	0.46152	2	19.4625
153	-110	FATHOMED	146947.79	.	.	.	1	8.7225
154	152	ACTIVE	146940.72	x2	1216	0.29492	1	4.065
155	154	FATHOMED	146936.07	.	.	.	0	.

The LP Procedure

Solution Summary

Integer Optimal Solution

Objective Value	146932
Phase 1 Iterations	0
Phase 2 Iterations	6
Phase 3 Iterations	156
Integer Iterations	155
Integer Solutions	3
Initial Basic Feasible Variables	9
Time Used (seconds)	0
Number of Inversions	60
Epsilon	1E-8
Infinity	1.797693E308
Maximum Phase 1 Iterations	500
Maximum Phase 2 Iterations	500
Maximum Phase 3 Iterations	500
Maximum Integer Iterations	500
Time Limit (seconds)	120

The LP Procedure

Variable Summary

Col	Variable Name	Status	Type	Price	Activity	Reduced Cost
1	x1	BASIC	INTEGER	25	4578	0
2	x2		INTEGER	28	1194	15.5
3	x3		INTEGER	30	0	-1.305
4	y1		BINARY	-400	1	-400
5	y2		BINARY	-550	1	-550
6	y3	DEGEN	BINARY	-550	0	0
7	y4	ALTER	BINARY	0	0	0
8	y5		BINARY	0	0	-125000
9	y6	ALTER	BINARY	0	0	0
10	res1	BASIC	SLACK	0	1	0
11	res2		SLACK	0	0	-12.5
12	res3	BASIC	SLACK	0	8607	0
13	CF1	BASIC	SLACK	0	5422	0
14	CF2	BASIC	SLACK	0	8806	0
15	CF3		SLACK	0	0	-0.055
16	un	BASIC	SLACK	0	3	0

The LP Procedure

Constraint Summary

Row	Constraint Name	Type	S/S Col	Rhs	Activity	Dual Activity
1	Obj	OBJECTVE	.	0	146932	.
2	res1	LE	10	10450	10449	0
3	res2	LE	11	10350	10350	12.5
4	res3	LE	12	10050	1443	0
5	CF1	LE	13	0	-5422	0
6	CF2	LE	14	0	-8806	0
7	CF3	LE	15	0	0	0.055
8	un	LE	16	3	0	0