

All problems solved with Lindo 6.1

1 a.

Reports Window			
OBJECTIVE FUNCTION VALUE			
1)	16.000000		
VARIABLE	VALUE	REDUCED COST	
C	16.000000	0.000000	
G	0.000000	0.000000	
B	12.000000	0.000000	
A	4.000000	0.000000	
F	13.000000	0.000000	
E	0.000000	0.000000	
D	0.000000	0.000000	
H	3.000000	0.000000	
ROW	SLACK OR SURPLUS	DUAL PRICES	
2)	0.000000	1.000000	
3)	0.000000	0.000000	
4)	1.000000	0.000000	
5)	22.000000	0.000000	
6)	0.000000	1.000000	

b.

NO. ITERATIONS= 0

LP OPTIMUM FOUND AT STEP 0

OBJECTIVE FUNCTION VALUE

1) 7.000000

VARIABLE	VALUE	REDUCED COST
A	7.000000	0.000000
G	0.000000	0.000000
B	12.000000	0.000000
F	13.000000	0.000000
E	15.000000	0.000000
C	16.000000	0.000000
D	2.000000	0.000000
H	3.000000	0.000000

NO. ITERATIONS= 0

LP OPTIMUM FOUND AT STEP 0

OBJECTIVE FUNCTION VALUE

1) 2.000000

VARIABLE	VALUE	REDUCED COST
D	2.000000	0.000000
G	0.000000	0.000000
B	12.000000	0.000000
A	7.000000	0.000000
F	13.000000	0.000000
E	15.000000	0.000000
C	16.000000	0.000000
H	3.000000	0.000000

LP OPTIMUM FOUND AT STEP 0

OBJECTIVE FUNCTION VALUE

1) 12.000000

VARIABLE	VALUE	REDUCED COST
B	12.000000	0.000000
G	0.000000	0.000000
A	7.000000	0.000000
F	13.000000	0.000000
E	15.000000	0.000000
C	16.000000	0.000000
D	2.000000	0.000000
H	3.000000	0.000000

NO. ITERATIONS= 1

LP OPTIMUM FOUND AT STEP 0

OBJECTIVE FUNCTION VALUE

1) 17.000000

VARIABLE	VALUE	REDUCED COST
F	17.000000	0.000000
G	0.000000	0.000000
B	12.000000	0.000000
A	7.000000	0.000000
E	19.000000	0.000000
C	16.000000	0.000000
D	2.000000	0.000000
H	3.000000	0.000000

NO. ITERATIONS= 0

LP OPTIMUM FOUND AT STEP 1

OBJECTIVE FUNCTION VALUE

1) 19.000000

VARIABLE	VALUE	REDUCED COST
E	19.000000	0.000000
G	0.000000	0.000000
B	12.000000	0.000000
A	7.000000	0.000000
F	17.000000	0.000000
C	16.000000	0.000000
D	2.000000	0.000000
H	3.000000	0.000000

NO. ITERATIONS= 0

LP OPTIMUM FOUND AT STEP 0

OBJECTIVE FUNCTION VALUE

1) 3.000000

VARIABLE	VALUE	REDUCED COST
H	3.000000	0.000000
G	0.000000	0.000000
B	12.000000	0.000000
A	7.000000	0.000000
F	17.000000	0.000000
E	19.000000	0.000000
C	16.000000	0.000000
D	2.000000	0.000000

2.

LP OPTIMUM FOUND AT STEP 0

OBJECTIVE FUNCTION VALUE

1) 120196.0

VARIABLE	VALUE	REDUCED COST
S	7000.000000	0.000000
P	13625.000000	0.000000
B	13100.000000	0.000000
C	8500.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	125.000000	0.000000
3)	0.000000	29.000000
4)	0.000000	27.200001
5)	0.000000	3.450000
6)	1000.000000	0.000000
7)	3625.000000	0.000000
8)	375.000000	0.000000
9)	2500.000000	0.000000
10)	0.000000	0.476000
11)	100.000000	0.000000
12)	2900.000000	0.000000

NO. ITERATIONS= 0

```

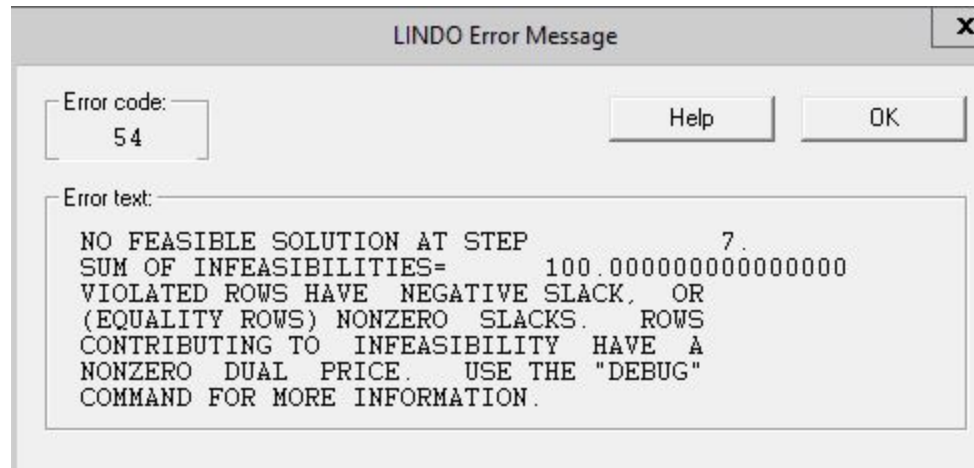
MAX
3.45s + 2.32p + 2.81b + 3.25c
ST
0.125s <= 1000
0.08p + 0.05b + 0.03c <= 2000
0.05b + 0.07c <= 1250
s <= 7000
s >= 6000
p >= 10000
p <= 14000
c >= 6000
c <= 8500
b >= 13000
b <= 16000
END

```

3 a. Cost = 17100

Reports Window		<untitled>	
LP OPTIMUM FOUND AT STEP 9			
OBJECTIVE FUNCTION VALUE			
1)	17100.00		
VARIABLE	VALUE		
COST	17100.000000	min cost	
COSTPW	9000.000000	ST	
P1W1	150.000000	costpw - 10p1w1 - 15p1w2 - 11p2w1 - 8p2w2 - 13p3w1 - 8p3w2 - 9p3w3 - 14p4w2 - 8p4w3 = 0	
P1W2	0.000000	costwr - 5w1r1 - 6w1r2 - 7w1r3 - 10w1r4 - 12w2r3 - 8w2r4 - 10w2r5 - 14w2r6 - 14w3r4 - 12w3r5 - 12w3r6 - 6w3r7 = 0	
P2W1	200.000000	cost - costpw - costwr = 0	
P2W2	250.000000	p1 = 150	
P3W1	0.000000	p2 = 450	
P3W2	150.000000	p3 = 250	
P3W3	100.000000	p4 = 150	
P4W2	0.000000	p1 - p1w1 - p1w2 = 0	
P4W3	150.000000	p2 - p2w1 - p2w2 = 0	
COSTWR	8100.000000	p3 - p3w1 - p3w2 - p3w3 = 0	
W1R1	100.000000	p4 - p4w2 - p4w3 = 0	
W1R2	150.000000	r1 = 100	
W1R3	100.000000	r2 = 150	
W1R4	0.000000	r3 = 100	
W2R3	0.000000	r4 = 200	
W2R4	200.000000	r5 = 200	
W2R5	200.000000	r6 = 150	
W2R6	0.000000	r7 = 100	
W3R4	0.000000	r1 - w1r1 = 0	
W3R5	0.000000	r2 - w1r2 = 0	
W3R6	150.000000	r3 - w1r3 - w2r3 = 0	
W3R7	100.000000	r4 - w1r4 - w2r4 - w3r4 = 0	
P1	150.000000	r5 - w2r5 - w3r5 = 0	
P2	450.000000	r6 - w2r6 - w3r6 = 0	
P3	250.000000	r7 - w3r7 = 0	
P4	150.000000	p1w1 + p2w1 + p3w1 - w1r1 - w1r2 - w1r3 - w1r4 = 0	
R1	100.000000	p1w2 + p2w2 + p3w2 + p4w2 - w2r3 - w2r4 - w2r5 - w2r6 = 0	
R2	150.000000	p3w3 + p4w3 - w3r4 - w3r5 - w3r6 - w3r7 = 0	
R3	100.000000	END	
R4	200.000000		
R5	200.000000		
R6	150.000000		
R7	100.000000		

b. The solution is infeasible because warehouse 3 is the only warehouse that ships to retailers 5, 6 and 7 which require 450 fridges total. Factories 3 and 4 are the only ones that can reach warehouse 3 and they only produce 400 between them.





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```
min cost
ST
costpw - 10p1w1 - 15p1w2 - 11p2w1 - 8p2w2 - 13p3w1 - 8p3w2 - 9p3w3 - 14p4w2 - 8p4w3 = 0
costwr - 5w1r1 - 6w1r2 - 7w1r3 - 10w1r4 - 12w2r3 - 8w2r4 - 10w2r5 - 14w2r6 - 14w3r4 - 12w3r5 - 12w3r6 - 6w3r7 = 0
cost - costpw - costwr = 0
p1 = 150
p2 = 450
p3 = 250
p4 = 150
p1 - p1w1 - p1w2 = 0
p2 - p2w1 - p2w2 = 0
p3 - p3w1 - p3w2 - p3w3 = 0
p4 - p4w2 - p4w3 = 0
r1 = 100
r2 = 150
r3 = 100
r4 = 200
r5 = 200
r6 = 150
r7 = 100
r1 - w1r1 = 0
r2 - w1r2 = 0
r3 - w1r3 - w2r3 = 0
r4 - w1r4 - w2r4 - w3r4 = 0
r5 - w2r5 - w3r5 = 0
r6 - w2r6 - w3r6 = 0
r7 - w3r7 = 0
p1w1 + p2w1 + p3w1 - w1r1 - w1r2 - w1r3 - w1r4 = 0
p1w2 + p2w2 + p3w2 + p4w2 - w2r3 - w2r4 - w2r5 - w2r6 = 0
p3w3 + p4w3 - w3r4 - w3r5 - w3r6 - w3r7 = 0
p1w2=0
p2w2=0
p3w2=0
p4w2=0
END
```

C. Cost = 18300

Reports Window	
LP OPTIMUM FOUND AT STEP 7	
OBJECTIVE FUNCTION VALUE	
1)	18300.00
VARIABLE	VALUE
COST	18300.000000
COSTPW	9600.000000
P1W1	150.000000
P1W2	0.000000
P2W1	350.000000
P2W2	100.000000
P3W1	0.000000
P3W2	0.000000
P3W3	250.000000
P4W2	0.000000
P4W3	150.000000
COSTWR	8700.000000
W1R1	100.000000
W1R2	150.000000
W1R3	100.000000
W1R4	150.000000
W2R3	0.000000
W2R4	50.000000
W2R5	50.000000
W2R6	0.000000
W3R4	0.000000
W3R5	150.000000
W3R6	150.000000
W3R7	100.000000
P1	150.000000
P2	450.000000
P3	250.000000
P4	150.000000
R1	100.000000
R2	150.000000
R3	100.000000
R4	200.000000
R5	200.000000
R6	150.000000
R7	100.000000

<untitled>	
min cost	
ST	
costpw - 10p1w1 - 15p1w2 - 11p2w1 - 8p2w2 - 13p3w1 - 8p3w2 - 9p3w3 - 14p4w2 - 8p4w3 = 0	
costwr - 5w1r1 - 6w1r2 - 7w1r3 - 10w1r4 - 12w2r3 - 8w2r4 - 10w2r5 - 14w2r6 - 14w3r4 - 12w3r5 - 12w3r6 - 6w3r7 = 0	
cost - costpw - costwr = 0	
p1 = 150	
p2 = 450	
p3 = 250	
p4 = 150	
p1 - p1w1 - p1w2 = 0	
p2 - p2w1 - p2w2 = 0	
p3 - p3w1 - p3w2 - p3w3 = 0	
p4 - p4w2 - p4w3 = 0	
r1 = 100	
r2 = 150	
r3 = 100	
r4 = 200	
r5 = 200	
r6 = 150	
r7 = 100	
r1 - w1r1 = 0	
r2 - w1r2 = 0	
r3 - w1r3 - w2r3 = 0	
r4 - w1r4 - w2r4 - w3r4 = 0	
r5 - w2r5 - w3r5 = 0	
r6 - w2r6 - w3r6 = 0	
r7 - w3r7 = 0	
p1w1 + p2w1 + p3w1 - w1r1 - w1r2 - w1r3 - w1r4 = 0	
p1w2 + p2w2 + p3w2 + p4w2 - w2r3 - w2r4 - w2r5 - w2r6 = 0	
p3w3 + p4w3 - w3r4 - w3r5 - w3r6 - w3r7 = 0	
p1w2 + p2w2 + p3w2 + p4w2 = 100	
END	

4. A

LINDO

File Edit Solve Reports Window Help

Reports Window

LP OPTIMUM FOUND AT STEP 1
OBJECTIVE VALUE = 8.07999992

FIX ALL VARS.(2) WITH RC > 0.000000E+00
SET V1 TO >= 1 AT 1, BND= -9.040 TWIN=-0.1000E+31 5
SET V4 TO <= 8 AT 2, BND= -10.00 TWIN=-0.1000E+31 6

NEW INTEGER SOLUTION OF 10.0000000 AT BRANCH 2 PIVOT 6
BOUND ON OPTIMUM: 9.000000
DELETE V4 AT LEVEL 2
DELETE V1 AT LEVEL 1
RELEASE FIXED VARIABLES
FIX ALL VARS.(2) WITH RC > 0.000000E+00
SET V3 TO >= 2 AT 1, BND= -9.280 TWIN=-0.1000E+31 12
DELETE V3 AT LEVEL 1
RELEASE FIXED VARIABLES
FIX ALL VARS.(1) WITH RC > 0.000000E+00
SET V1 TO <= 0 AT 1, BND= -9.000 TWIN= -9.840 19
SET V2 TO >= 2 AT 2, BND= -9.680 TWIN=-0.1000E+31 21
DELETE V2 AT LEVEL 2
DELETE V1 AT LEVEL 1
RELEASE FIXED VARIABLES
ENUMERATION COMPLETE. BRANCHES= 5 PIVOTS= 26

LAST INTEGER SOLUTION IS THE BEST FOUND
RE-INSTALLING BEST SOLUTION...

OBJECTIVE FUNCTION VALUE		
1)	10.00000	

VARIABLE	VALUE	REDUCED COST
V1	2.000000	1.000000
V2	0.000000	1.000000
V3	0.000000	1.000000
V4	8.000000	1.000000
TOTAL	10.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	-1.000000
3)	0.000000	0.000000

NO. ITERATIONS= 26
BRANCHES= 5 DETERM.= 1.000E 0

<untitled>

```

min total
ST
total - v1 - v2 - v3 - v4 = 0
v1 + 5v2 + 10v3 + 25v4 = 202
END
GIN v1
GIN v2
GIN v3
GIN v4

```

b.

MAX
Reports Window

LAST INTEGER SOLUTION IS THE BEST FOUND
RE-INSTALLING BEST SOLUTION...

OBJECTIVE FUNCTION VALUE

1) 14.000000

VARIABLE	VALUE	REDUCED COST
V1	0.000000	1.000000
V2	0.000000	1.000000
V3	2.000000	1.000000
V4	3.000000	1.000000
V5	9.000000	1.000000
TOTAL	14.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	-1.000000
3)	0.000000	0.000000

NO. ITERATIONS= 97
BRANCHES= 34 DETERM.= 1.000E 0

MAX
<untitled>

```
min total
ST
total - v1 - v2 - v3 - v4 - v5 = 0
v1 + 3v2 + 7v3 + 12v4 + 27v5 = 293
END
GIN v1
GIN v2
GIN v3
GIN v4
GIN v5
```