

Lindo programs test run

Question no. 1

```
min t10 - t0
s.t.
t1 - t0 >= 8
t2 - t1 >= 5
t3 - t2 >= 3
t4 - t2 >= 4
t4 - t3 >= 0
t5 - t4 >= 12
t6 - t3 >= 3
t7 - t6 >= 4
t9 - t7 >= 1
t8 - t6 >= 5
t8 - t9 >= 0
t10 - t8 >= 10
t0 >= 0
t1 >= 0
t2 >= 0
t3 >= 0
t4 >= 0
t5 >= 0
t6 >= 0
t7 >= 0
t8 >= 0
t9 >= 0
t10 >= 0
end
```

LP OPTIMUM FOUND AT STEP 10

OBJECTIVE FUNCTION VALUE

1) 34.000000

| VARIABLE | VALUE | REDUCED COST |
|----------|-----------|--------------|
| T10 | 34.000000 | 0.000000 |
| T0 | 0.000000 | 0.000000 |
| T1 | 8.000000 | 0.000000 |
| T2 | 13.000000 | 0.000000 |
| T3 | 16.000000 | 0.000000 |
| T4 | 17.000000 | 0.000000 |
| T5 | 29.000000 | 0.000000 |
| T6 | 19.000000 | 0.000000 |
| T7 | 23.000000 | 0.000000 |
| T9 | 24.000000 | 0.000000 |
| T8 | 24.000000 | 0.000000 |

Question no. 2

```

min 3st + 5sy + yt + 2ty + 6tx + 6yz + 7zx + 4yx
s.t.
st + sy = 1
tx + yx + zx = 1
st + yt - ty - tx = 0
sy + ty - yt - yx - yz = 0
yz - zs + xz - zx = 0
end
inte 10

```

LP OPTIMUM FOUND AT STEP 3
OBJECTIVE VALUE = 9.00000000

NEW INTEGER SOLUTION OF 9.00000000 AT BRANCH 0 PIVOT 3
RE-INSTALLING BEST SOLUTION...

OBJECTIVE FUNCTION VALUE

1) 9.000000

| VARIABLE | VALUE | REDUCED COST |
|----------|----------|--------------|
| ST | 1.000000 | 3.000000 |
| SY | 0.000000 | 5.000000 |
| YT | 0.000000 | 1.000000 |
| TY | 1.000000 | 2.000000 |
| TX | 0.000000 | 6.000000 |
| YZ | 0.000000 | 6.000000 |
| ZX | 0.000000 | 7.000000 |
| YX | 1.000000 | 4.000000 |
| ZS | 0.000000 | 0.000000 |
| XZ | 0.000000 | 0.000000 |

Question no. 3

Min $c_1 + c_2 + c_3 + c_4$

S.T.

$X_{11} + X_{12} + X_{13} + X_{14} = 1$

$X_{21} + X_{22} + X_{23} + X_{24} = 1$

$X_{31} + X_{32} + X_{33} + X_{34} = 1$

$X_{41} + X_{42} + X_{43} + X_{44} = 1$

$X_{51} + X_{52} + X_{53} + X_{54} = 1$

$X_{61} + X_{62} + X_{63} + X_{64} = 1$

$X_{71} + X_{72} + X_{73} + X_{74} = 1$

$X_{81} + X_{82} + X_{83} + X_{84} = 1$

$X_{91} + X_{92} + X_{93} + X_{94} = 1$

$X_{101} + X_{102} + X_{103} + X_{104} = 1$

$X_{111} + X_{112} + X_{113} + X_{114} = 1$

$X_{11} + X_{21} \leq 1$

$X_{12} + X_{22} \leq 1$

$X_{13} + X_{23} \leq 1$

$X_{14} + X_{24} \leq 1$

$X_{11} + X_{31} \leq 1$

$X_{12} + X_{32} \leq 1$
 $X_{13} + X_{33} \leq 1$
 $X_{14} + X_{34} \leq 1$
 $X_{21} + X_{41} \leq 1$
 $X_{22} + X_{42} \leq 1$
 $X_{23} + X_{43} \leq 1$
 $X_{24} + X_{44} \leq 1$
 $X_{21} + X_{31} \leq 1$
 $X_{22} + X_{32} \leq 1$
 $X_{23} + X_{33} \leq 1$
 $X_{24} + X_{34} \leq 1$
 $X_{31} + X_{41} \leq 1$
 $X_{32} + X_{42} \leq 1$
 $X_{33} + X_{43} \leq 1$
 $X_{34} + X_{44} \leq 1$
 $X_{31} + X_{81} \leq 1$
 $X_{32} + X_{82} \leq 1$
 $X_{33} + X_{83} \leq 1$
 $X_{34} + X_{84} \leq 1$
 $X_{41} + X_{51} \leq 1$
 $X_{42} + X_{52} \leq 1$
 $X_{43} + X_{53} \leq 1$
 $X_{44} + X_{54} \leq 1$
 $X_{41} + X_{81} \leq 1$
 $X_{42} + X_{82} \leq 1$
 $X_{43} + X_{83} \leq 1$
 $X_{44} + X_{84} \leq 1$
 $X_{41} + X_{61} \leq 1$
 $X_{42} + X_{62} \leq 1$
 $X_{43} + X_{63} \leq 1$
 $X_{44} + X_{64} \leq 1$
 $X_{81} + X_{51} \leq 1$
 $X_{82} + X_{52} \leq 1$
 $X_{83} + X_{53} \leq 1$
 $X_{84} + X_{54} \leq 1$
 $X_{81} + X_{71} \leq 1$
 $X_{82} + X_{72} \leq 1$
 $X_{83} + X_{73} \leq 1$
 $X_{84} + X_{74} \leq 1$
 $X_{81} + X_{91} \leq 1$
 $X_{82} + X_{92} \leq 1$
 $X_{83} + X_{93} \leq 1$
 $X_{84} + X_{94} \leq 1$
 $X_{51} + X_{61} \leq 1$
 $X_{52} + X_{62} \leq 1$
 $X_{53} + X_{63} \leq 1$
 $X_{54} + X_{64} \leq 1$
 $X_{51} + X_{71} \leq 1$
 $X_{52} + X_{72} \leq 1$
 $X_{53} + X_{73} \leq 1$
 $X_{54} + X_{74} \leq 1$
 $X_{61} + X_{71} \leq 1$
 $X_{62} + X_{72} \leq 1$

$X_{63} + X_{73} \leq 1$
 $X_{64} + X_{74} \leq 1$
 $X_{71} + X_{101} \leq 1$
 $X_{72} + X_{102} \leq 1$
 $X_{73} + X_{103} \leq 1$
 $X_{74} + X_{104} \leq 1$
 $X_{101} + X_{111} \leq 1$
 $X_{102} + X_{112} \leq 1$
 $X_{103} + X_{113} \leq 1$
 $X_{104} + X_{114} \leq 1$
 $X_{11} - c_1 \leq 0$
 $X_{12} - c_2 \leq 0$
 $X_{13} - c_3 \leq 0$
 $X_{14} - c_4 \leq 0$
 $X_{21} - c_1 \leq 0$
 $X_{22} - c_2 \leq 0$
 $X_{23} - c_3 \leq 0$
 $X_{24} - c_4 \leq 0$
 $X_{31} - c_1 \leq 0$
 $X_{32} - c_2 \leq 0$
 $X_{33} - c_3 \leq 0$
 $X_{34} - c_4 \leq 0$
 $X_{41} - c_1 \leq 0$
 $X_{42} - c_2 \leq 0$
 $X_{43} - c_3 \leq 0$
 $X_{44} - c_4 \leq 0$
 $X_{51} - c_1 \leq 0$
 $X_{52} - c_2 \leq 0$
 $X_{53} - c_3 \leq 0$
 $X_{54} - c_4 \leq 0$
 $X_{61} - c_1 \leq 0$
 $X_{62} - c_2 \leq 0$
 $X_{63} - c_3 \leq 0$
 $X_{64} - c_4 \leq 0$
 $X_{71} - c_1 \leq 0$
 $X_{72} - c_2 \leq 0$
 $X_{73} - c_3 \leq 0$
 $X_{74} - c_4 \leq 0$
 $X_{81} - c_1 \leq 0$
 $X_{82} - c_2 \leq 0$
 $X_{83} - c_3 \leq 0$
 $X_{84} - c_4 \leq 0$
 $X_{91} - c_1 \leq 0$
 $X_{92} - c_2 \leq 0$
 $X_{93} - c_3 \leq 0$
 $X_{94} - c_4 \leq 0$
 $X_{101} - c_1 \leq 0$
 $X_{102} - c_2 \leq 0$
 $X_{103} - c_3 \leq 0$
 $X_{104} - c_4 \leq 0$
 $X_{111} - c_1 \leq 0$
 $X_{112} - c_2 \leq 0$
 $X_{113} - c_3 \leq 0$

X114 - c4 <= 0
END
INTE 48

OBJECTIVE FUNCTION VALUE

1) 3.000000

| VARIABLE | VALUE | REDUCED COST |
|----------|----------|--------------|
| C1 | 1.000000 | 1.000000 |
| C2 | 1.000000 | 1.000000 |
| C3 | 1.000000 | 1.000000 |
| C4 | 0.000000 | 1.000000 |
| X11 | 1.000000 | 0.000000 |
| X12 | 0.000000 | 0.000000 |
| X13 | 0.000000 | 0.000000 |
| X14 | 0.000000 | 0.000000 |
| X21 | 0.000000 | 0.000000 |
| X22 | 0.000000 | 0.000000 |
| X23 | 1.000000 | 0.000000 |
| X24 | 0.000000 | 0.000000 |
| X31 | 0.000000 | 0.000000 |
| X32 | 1.000000 | 0.000000 |
| X33 | 0.000000 | 0.000000 |
| X34 | 0.000000 | 0.000000 |
| X41 | 1.000000 | 0.000000 |
| X42 | 0.000000 | 0.000000 |
| X43 | 0.000000 | 0.000000 |
| X44 | 0.000000 | 0.000000 |
| X51 | 0.000000 | 0.000000 |
| X52 | 1.000000 | 0.000000 |
| X53 | 0.000000 | 0.000000 |
| X54 | 0.000000 | 0.000000 |
| X61 | 0.000000 | 0.000000 |
| X62 | 0.000000 | 0.000000 |
| X63 | 1.000000 | 0.000000 |
| X64 | 0.000000 | 0.000000 |
| X71 | 1.000000 | 0.000000 |
| X72 | 0.000000 | 0.000000 |
| X73 | 0.000000 | 0.000000 |
| X74 | 0.000000 | 0.000000 |
| X81 | 0.000000 | 0.000000 |
| X82 | 0.000000 | 0.000000 |
| X83 | 1.000000 | 0.000000 |
| X84 | 0.000000 | 0.000000 |
| X91 | 0.000000 | 0.000000 |
| X92 | 1.000000 | 0.000000 |
| X93 | 0.000000 | 0.000000 |
| X94 | 0.000000 | 0.000000 |
| X101 | 0.000000 | 0.000000 |
| X102 | 1.000000 | 0.000000 |
| X103 | 0.000000 | 0.000000 |
| X104 | 0.000000 | 0.000000 |

| | | |
|------|----------|----------|
| X111 | 0.000000 | 0.000000 |
| X112 | 0.000000 | 0.000000 |
| X113 | 1.000000 | 0.000000 |
| X114 | 0.000000 | 0.000000 |

Question no. 6

max psv1 + psv2

s.t.

psv1 <= 16

psv2 <= 13

pv1v3 <= 12

pv2v1 <= 4

pv2v4 <= 14

pv3v2 <= 9

pv3t <= 20

pv4v3 <= 7

pv4t <= 4

psv1 + pv2v1 - pv1v3 = 0

psv2 + pv3v2 - pv2v1 - pv2v4 = 0

pv1v3 + pv4v3 - pv3v2 - pv3t = 0

pv2v4 - pv4v3 - pv4t = 0

psv1 >= 0

psv2 >= 0

pv1v3 >= 0

pv2v1 >= 0

pv2v4 >= 0

pv3t >= 0

pv3v2 >= 0

pv4v3 >= 0

pv4t >= 0

end

OBJECTIVE FUNCTION VALUE

1) 23.00000

| VARIABLE | VALUE | REDUCED COST |
|----------|-----------|--------------|
| PSV1 | 12.000000 | 0.000000 |
| PSV2 | 11.000000 | 0.000000 |
| PV1V3 | 12.000000 | 0.000000 |
| PV2V1 | 0.000000 | 0.000000 |
| PV2V4 | 11.000000 | 0.000000 |
| PV3V2 | 0.000000 | 1.000000 |
| PV3T | 19.000000 | 0.000000 |
| PV4V3 | 7.000000 | 0.000000 |
| PV4T | 4.000000 | 0.000000 |