LINGO TUTORIAL 1

WHAT IS LINGO :

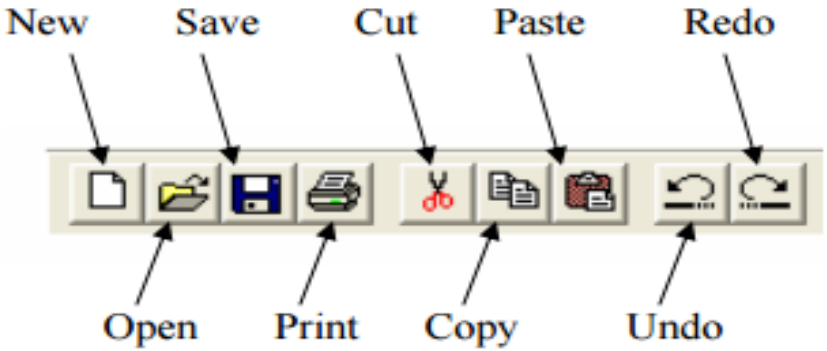
LINGO is a software tool designed to efficiently build and solve linear, nonlinear, and integer optimization models.

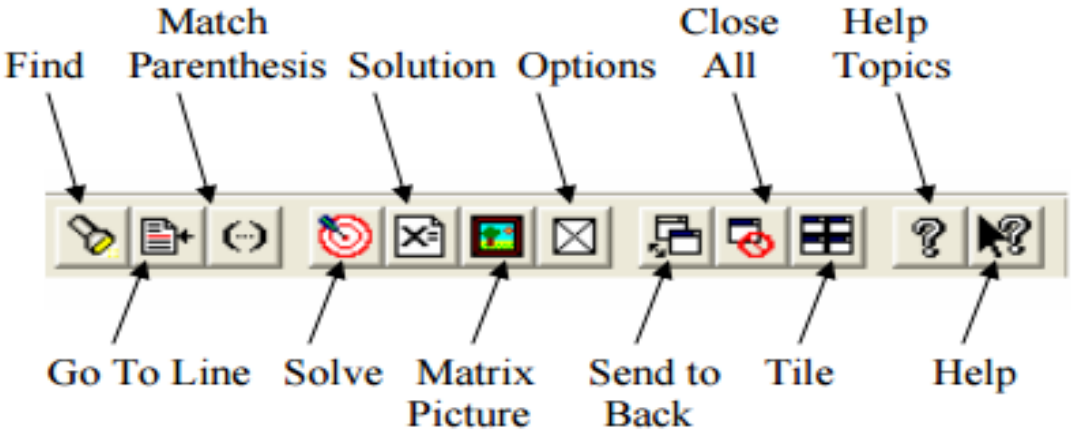
CREATING A LINGO MODEL:

An optimization model consists of three parts:

- Objective function: This is a single formula that describes exactly what the model should optimize.
- Variables: These are the quantities that can be changed to produce the optimal value of the objective function.
- Constraints: These are formulas that define the limits on the values of the variables.

A single toolbar located at the top of the main LINGO window contains many of the same commands as listed above. These commands can be accessed simply by using the mouse to click on the icon representing them. The following pictures detail which icons correspond to which commands.





PRIMARY RULES

- Comments in the model are initiated with an exclamation mark (!) and appear in green text.
- Each LINGO statement must end in a semi-colon (;).
- Operators and functions in LINGO appear with blue text.
- All other text is shown in black.
- Variable names must begin with a letter (A-Z).
- characters in the variable name may be letters, numbers (0-9), or the underscore character (_).
- Variable names can be up to 32 characters in length.

LINGO OPERATORS:

- Exponentiation: ^
- Multiplication: *
- Division: /
- Addition: +
- Subtraction: -
- The relational operators are used when defining the constraints for a model. They are as follows:
  - The expression is equal: =
  - The left side of the expression is less than or equal to the right side: <=
  - The left side of the expression is greater than or equal to the right side: >=

COMMON LINGO ERROR MESSAGES:

- Unable to open file: filename.
  Retype filename correctly.

- Invalid input: A syntax error has occurred.
  Check the line LINGO suggests for missing semi-colons.

- Unmatched parenthesis.
  Close the parenthesis set .

- No relational operator found.
  Make sure all constraints contain =, <=, >= .

- Unterminated condition.
  Put a colon at the end of each conditional statement in a set operator

- The model’s dimensions exceed the capacity of this version.

- No feasible solution found.
  Check model’s consistency and constraints.

- Unbounded solution.
  Add constraints.

- Unrecognized variable name: variable name.

  Check spelling.

A SIMPLE EXAMPLE:

Find the solution of the following LP model by using LINGO

MAX = 3x1+x2;

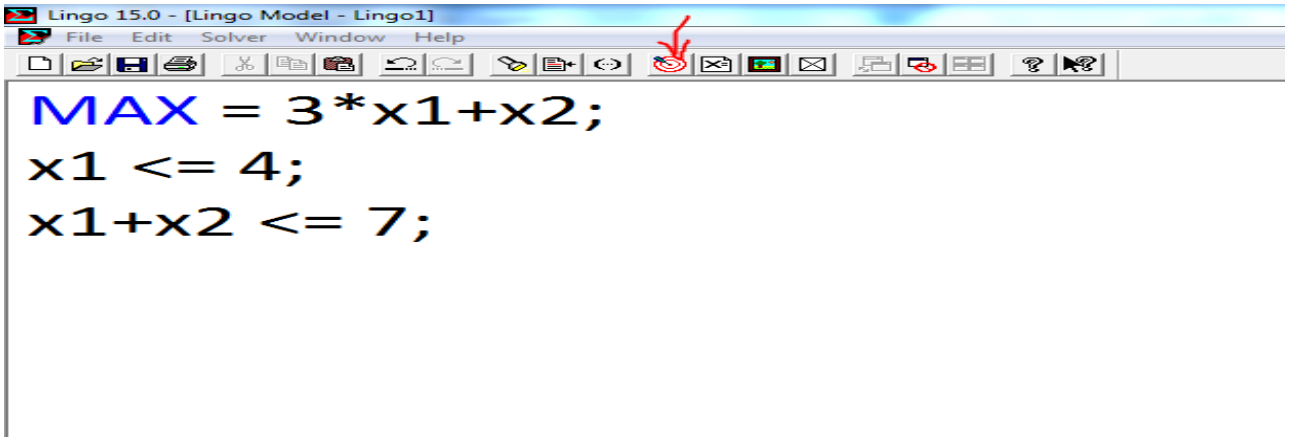
S.T.

$x1 \leq 4$

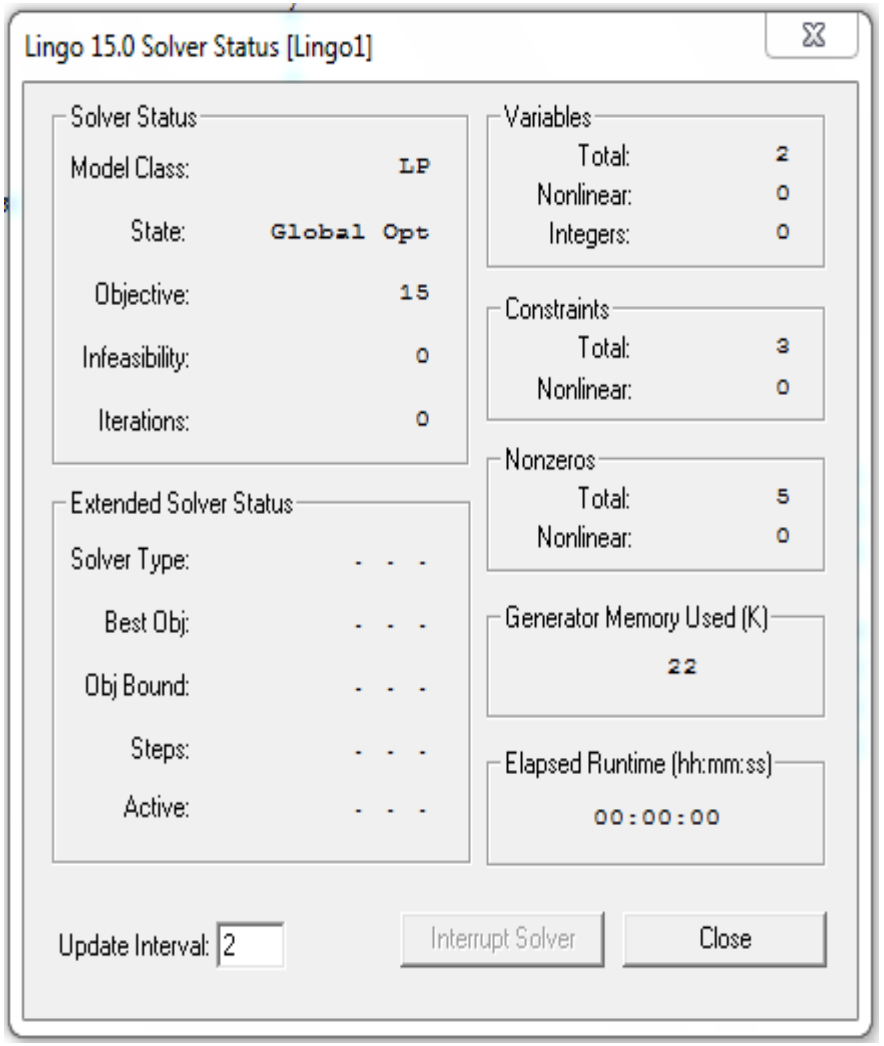
$x1+x2 \leq 7$

$X1,X2 \geq 0$

The LINGO model has been entered into the LINGO Model window, the model can be solved by clicking the Solve button on the toolbar, by selecting LINGO Solve from the menus.

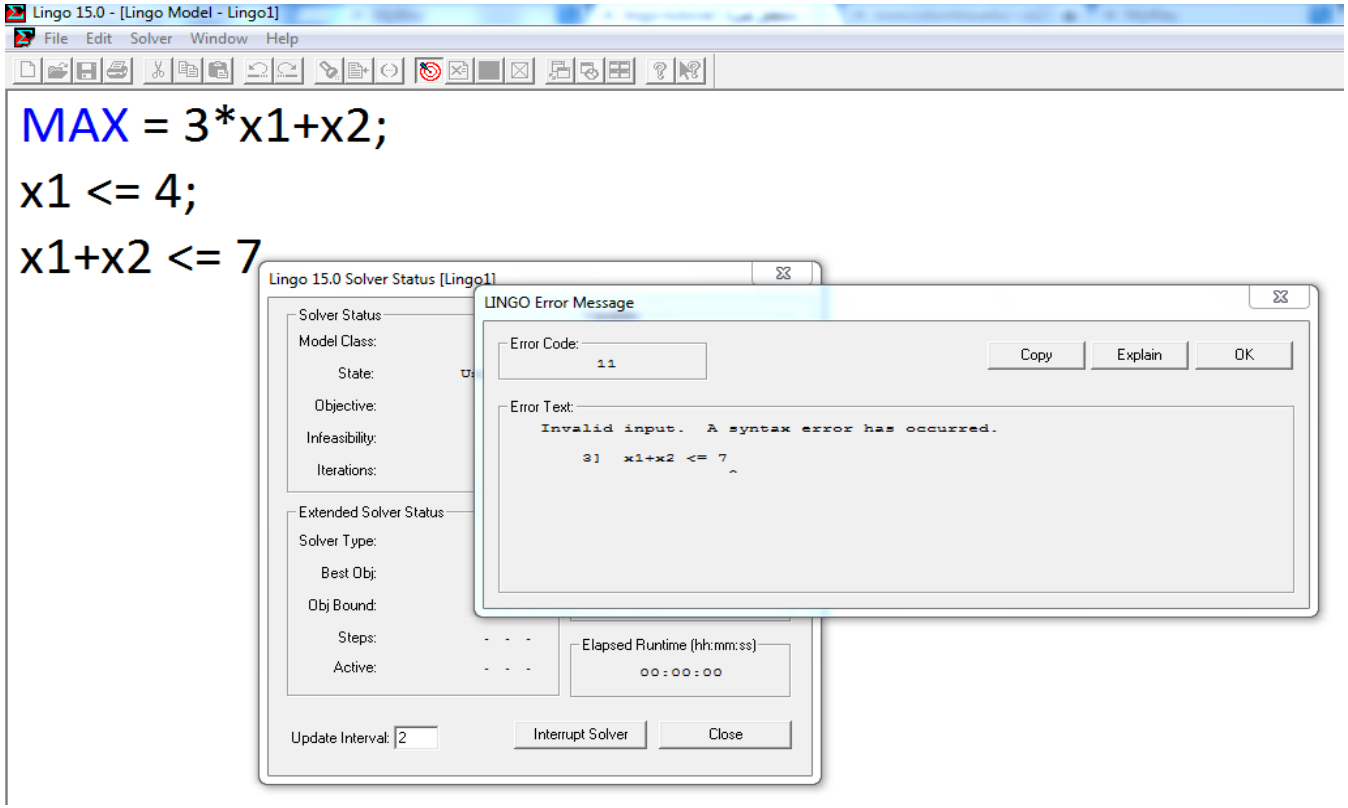


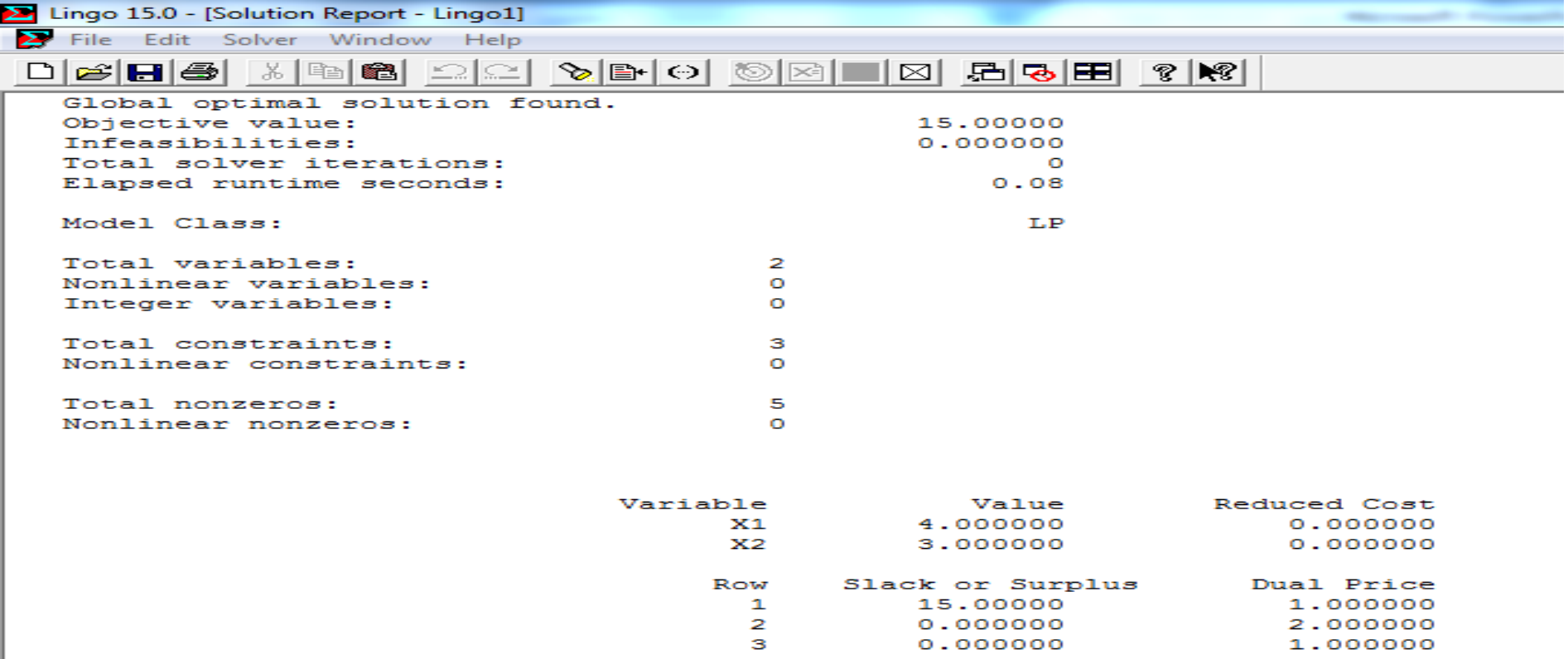
- If no errors are found, then the LINGO Solver Status window appears.



REPORTS:

LINGO will notify you of any errors it has encountered. The best way to get information about these errors is to consult the Error Messages section in the software's proprietary tutorial.





This window shows the values of each variable that will produce the optimal value of the objective function. The reduced cost for any variable that is included in the optimal solution is always zero. For variables not included in the optimal solution, the reduced cost shows how much the value of the objective function would decrease (for a MAX problem) or increase (for a MIN problem) if one unit of that variable were to be included in the solution. For example, if the reduced cost of a certain variable was 5, then the optimal value of the MAX problem would decrease by 5 units if 1 unit of the variable were to be added.

Example 2 :
Solve the following LP by using LINGO.

Min $z = 6X_1+7X_2+3X_3+5X_4$

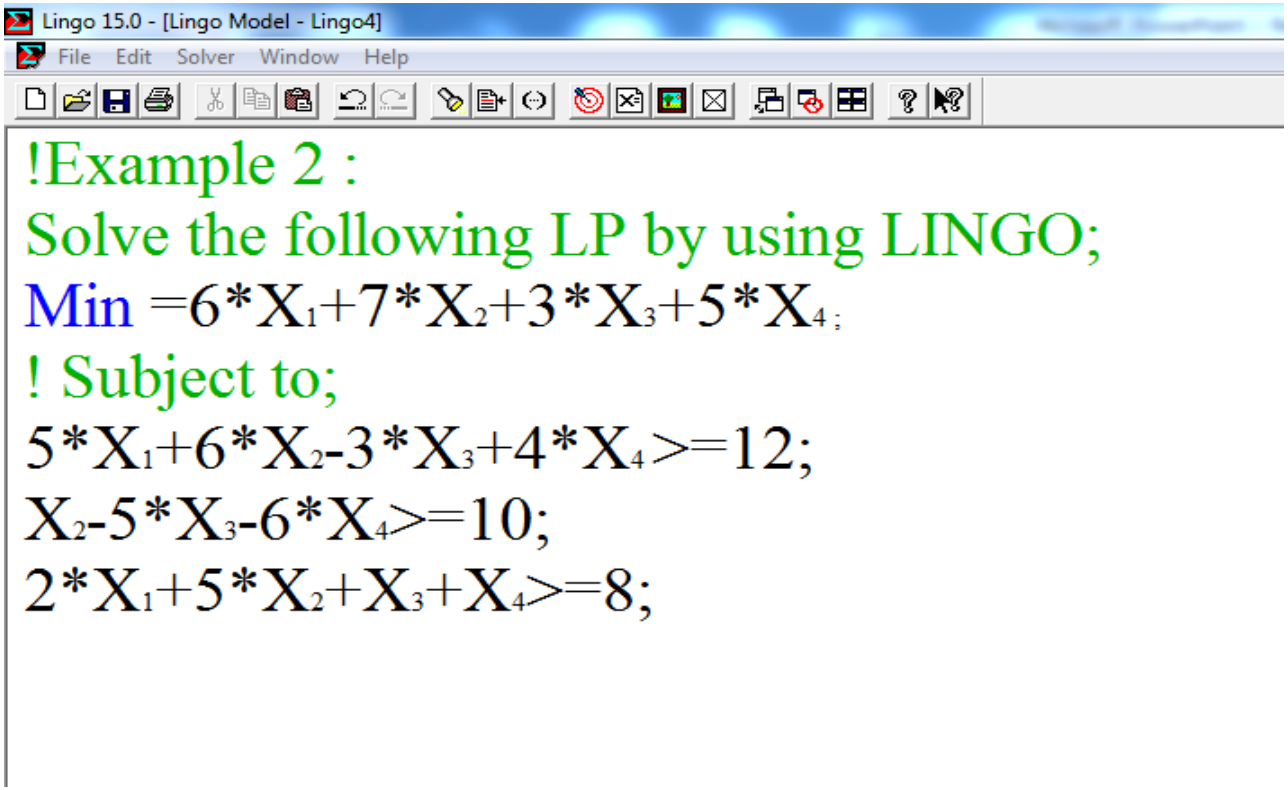
Subject to

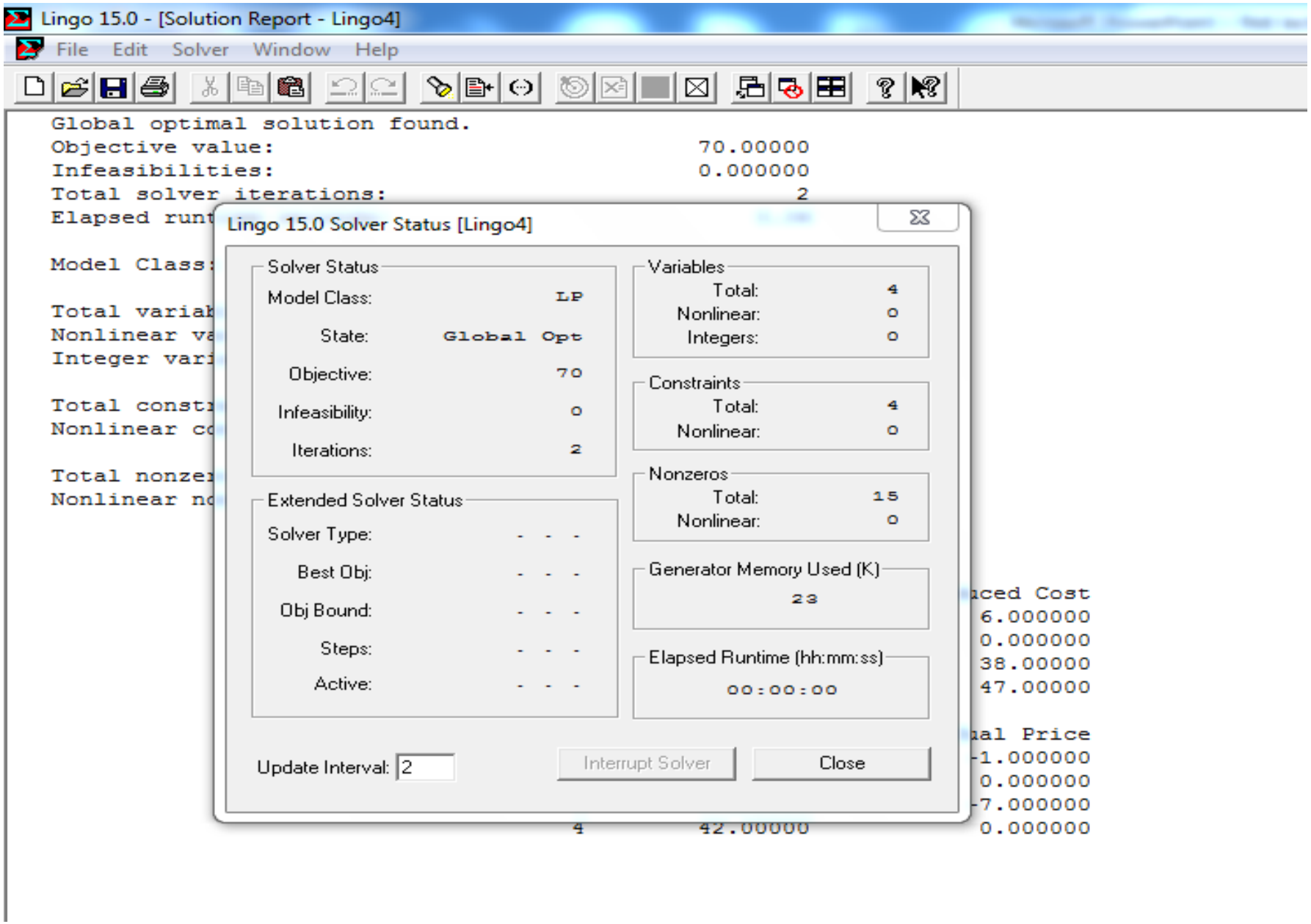
$5X_1+6X_2-3X_3+4X_4 \geq 12$

$X_2-5X_3-6X_4 \geq 10$

$2X_1+5X_2+X_3+X_4 \geq 8$

$X_1, X_2, X_3, X_4 \geq 0$


Lingo 15.0 - [Lingo Model - Lingo4]
File Edit Solver Window Help
!Example 2 :
Solve the following LP by using LINGO;
Min =6*X1+7*X2+3*X3+5*X4;
! Subject to;
5*X1+6*X2-3*X3+4*X4>=12;
X2-5*X3-6*X4>=10;
2*X1+5*X2+X3+X4>=8;


Lingo 15.0 - [Solution Report - Lingo4]
File Edit Solver Window Help
Global optimal solution found.
Objective value: 70.00000
Infeasibilities: 0.000000
Total solver iterations: 2
Elapsed runt
Model Class:
Total variab
Nonlinear va
Integer vari
Total consti
Nonlinear co
Total nonzer
Nonlinear no
Lingo 15.0 Solver Status [Lingo4]
Solver Status
Model Class: LP
State: Global Opt
Objective: 70
Infeasibility: 0
Iterations: 2
Extended Solver Status
Solver Type: - - -
Best Obj: - - -
Obj Bound: - - -
Steps: - - -
Active: - - -
Variables
Total: 4
Nonlinear: 0
Integers: 0
Constraints
Total: 4
Nonlinear: 0
Nonzeros
Total: 15
Nonlinear: 0
Generator Memory Used (K)
23
Elapsed Runtime (hh:mm:ss)
00:00:00
Update Interval: 2
Interrupt Solver
Close
uced Cost
6.000000
0.000000
38.00000
47.00000
ual Price
-1.000000
0.000000
-7.000000
0.000000
4 42.00000

Lingo 15.0 - [Solution Report - Lingo1]

File Edit Solver Window Help

Global optimal solution found.

Objective value:	70.00000
Infeasibilities:	0.000000
Total solver iterations:	2
Elapsed runtime seconds:	0.05
Model Class:	LP
Total variables:	4
Nonlinear variables:	0
Integer variables:	0
Total constraints:	4
Nonlinear constraints:	0
Total nonzeros:	15
Nonlinear nonzeros:	0

Variable	Value	Reduced Cost
X1	0.000000	6.000000
X2	10.00000	0.000000
X3	0.000000	38.00000
X4	0.000000	47.00000

Row	Slack or Surplus	Dual Price
1	70.00000	-1.000000
2	48.00000	0.000000
3	0.000000	-7.000000
4	42.00000	0.000000