



Changing the rules of business™

# **ILOG CPLEX 10.1**

## **Interactive Optimizer**

**July 2006**

## **COPYRIGHT NOTICE**

ILOG CPLEX 10.1 Copyright © 1997-2006, by ILOG S.A., 9 Rue de Verdun, 94253 Gentilly Cedex, France, and ILOG, Inc., 1080 Linda Vista Ave., Mountain View, California 94043, USA. All rights reserved.

### **General Use Restrictions**

This document and the software described in this document are the property of ILOG and are protected as ILOG trade secrets. They are furnished under a license or nondisclosure agreement, and may be used or copied only within the terms of such license or nondisclosure agreement.

No part of this work may be reproduced or disseminated in any form or by any means, without the prior written permission of ILOG S.A, or ILOG, Inc.

### **Trademarks**

ILOG, the ILOG design, CPLEX, and all other logos and product and service names of ILOG are registered trademarks or trademarks of ILOG in France, the U.S. and/or other countries.

All other company and product names are trademarks or registered trademarks of their respective holders.

Java and all Java-based marks are either trademarks or registered trademarks of Sun Microsystems, Inc. in the United States and other countries.

Microsoft and Windows are either trademarks or registered trademarks of Microsoft Corporation in the United States and other countries.

document version 10.1

## ***Table of Contents***

<b>Interactive Optimizer Commands</b> .....	<b>5</b>
<b>Managing Parameters in the Interactive Optimizer</b> .....	<b>16</b>
<b>Saving a Parameter Specification File</b> .....	<b>16</b>
<b>Index</b> .....	<b>19</b>



# Interactive Optimizer Commands

This manual lists the commands of the Interactive Optimizer of ILOG CPLEX. For an introduction to the Interactive Optimizer, see the manual *Getting Started*, especially the tutorial for the Interactive Optimizer.

This manual begins with a table that lists Interactive Optimizer commands in alphabetic order with their primary options. For some commands, it also tells where examples of their use can be found in the *ILOG CPLEX User's Manual* or *Getting Started*.

These topics follow the table:

- ◆ *Managing Parameters in the Interactive Optimizer* on page 16
- ◆ *Saving a Parameter Specification File* on page 16

Interactive Optimizer Command		Options	Example
add			<i>Adding Constraints and Bounds</i> on page 60 in <i>Getting Started</i>
baropt			<i>Using Alternative Optimizers</i> on page 50 in <i>Getting Started</i>
baropt	dualopt		

## Interactive Optimizer Commands

Interactive Optimizer Command		Options	Example
baropt	primopt		
baropt	stop		
change	bounds		<i>Changing Bounds on page 63 in Getting Started</i>
change	coefficient		<i>Changing Coefficients on page 64 in Getting Started</i>
change	delete		<i>Deleting on page 64 in Getting Started</i>
change	delete	constraints	
change	delete	qconstraints	
change	delete	indconstraints	
change	delete	sos	
change	delete	variables	
change	delete	equality	
change	delete	greater-than	
change	delete	less-than	
change	name		<i>Changing Constraint or Variable Names on page 62 in Getting Started</i>
change	objective		<i>Objective &amp; RHS Coefficients on page 64 in Getting Started</i>
change	problem	<i>type</i>	<i>Using the MIP Solution on page 268 Changing Problem Type in QPs on page 220 Diagnosing QP Infeasibility on page 223 in User's Manual</i>
change	qp term		<i>Changing Quadratic Terms on page 221 in User's Manual</i>
change	rhs		<i>Objective &amp; RHS Coefficients on page 64 in Getting Started</i>
change	sense		<i>Changing Sense on page 62 in Getting Started</i>
change	type		<i>Changing Variable Type on page 248 in User's Manual</i>
conflict			

Interactive Optimizer Command		Options	Example
display	conflict	all	
display	conflict	constraints	
display	conflict	indicators	
display	conflict	qconstraints	
display	conflict	sos	
display	conflict	variables	
display	problem	all	<i>Displaying a Problem on page 42 in Getting Started</i>
display	problem	binaries	<i>Interactive Optimizer Display Options for MIP Problems on page 246 in User's Manual</i>
display	problem	bounds	<i>Displaying Bounds on page 46 in Getting Started</i>
display	problem	constraints	<i>Displaying Constraints on page 46 in Getting Started</i>
display	problem	generals	<i>Interactive Optimizer Display Options for MIP Problems on page 246 in User's Manual</i>
display	problem	histogram	<i>Detecting and Eliminating Dense Columns on page 198 in User's Manual or Displaying a Histogram of NonZero Counts on page 47 in Getting Started</i>
display	problem	indicators	
display	problem	integers	<i>Interactive Optimizer Display Options for MIP Problems on page 246 in User's Manual</i>
display	problem	names	<i>Displaying Variable or Constraint Names on page 44 in Getting Started</i>
display	problem	qconstraints	
display	problem	qpvariables	
display	problem	semi-continuous	
display	problem	sos	

## Interactive Optimizer Commands

Interactive Optimizer Command		Options	Example
display	problem	stats	<i>Solve the Problem You Intended on page 138 or Interactive Optimizer Display Options for MIP Problems on page 246 in User's Manual</i>
display	problem	variable	
display	sensitivity	lb	<i>Performing Sensitivity Analysis on page 51 in Getting Started</i>
display	sensitivity	objective	<i>Performing Sensitivity Analysis on page 51 in Getting Started</i>
display	sensitivity	rhs	<i>Performing Sensitivity Analysis on page 51 in Getting Started</i>
display	sensitivity	ub	<i>Performing Sensitivity Analysis on page 51 in Getting Started</i>
display	settings		<i>Displaying Parameter Settings on page 59 in Getting Started</i>
display	settings	all	<i>Displaying Parameter Settings on page 59 in Getting Started</i>
display	settings	changed	<i>Displaying Parameter Settings on page 59 in Getting Started</i>
display	solution	basis	
display	solution	bestbound	
display	solution	dual	
display	solution	kappa	<i>Measuring Problem Sensitivity with Basis Condition Number on page 175 in User's Manual</i>
display	solution	objective	
display	solution	quality	<i>Coping with an Ill-Conditioned Problem or Handling Unscaled Infeasibilities on page 178 or Understanding Solution Quality from the Barrier LP Optimizer on page 193 in User's Manual</i>
display	solution	reduced	
display	solution	slacks	<i>Displaying Post-Solution Information on page 50 in Getting Started</i>
display	solution	qcslacks	

Interactive Optimizer Command		Options	Example
display	solution	variables	<i>Displaying Post-Solution Information on page 50 in Getting Started</i>
enter			<i>Entering a Problem on page 38 in Getting Started</i>
feasopt	constraints		
feasopt	variables		
feasopt	all		
help			<i>Using Help on page 36 in Getting Started</i>
mipopt			<i>Using the Mixed Integer Optimizer on page 249 in User's Manual</i>
netopt			<i>Example: Network Optimizer in the Interactive Optimizer on page 207 or CPX_ALG_HYBNETOPT on page 284 in User's Manual</i>
optimize			<i>Solving a Problem on page 48 in Getting Started</i>
primopt			<i>Using Alternative Optimizers on page 50 in Getting Started</i>
quit			<i>Quitting ILOG CPLEX on page 66 in Getting Started</i>
read	<i>filename</i>	<i>type</i>	<i>Starting from an Advanced Basis on page 166 or Understanding the Network Log File on page 208 in User's Manual</i>
set	advance		<i>Starting from an Advanced Basis on page 166 in User's Manual</i>
set	barrier		<i>Using the Barrier Optimizer on page 188 in User's Manual</i>
set	barrier	algorithm	<i>Using the Barrier Optimizer on page 188 or Choosing an Ordering Algorithm on page 198 in User's Manual</i>
set	barrier	colnonzeros	<i>Detecting and Eliminating Dense Columns on page 198 in User's Manual</i>
set	barrier	convergetol	

## Interactive Optimizer Commands

Interactive Optimizer Command		Options	Example
set	barrier	crossover	
set	barrier	display level	<i>Using the Barrier Optimizer on page 188 or Numeric Instability Due to Elimination of Too Many Dense Columns on page 202 in User's Manual</i>
set	barrier limits	corrections	<i>Change the Limit on Barrier Corrections on page 201 in User's Manual</i>
set	barrier limits	growth	
set	barrier limits	iterations	
set	barrier limits	objrange	<i>Difficulties with Unbounded Problems on page 203 in User's Manual</i>
set	barrier limits	threads	
set	barrier	ordering	
set	barrier	qcpconvergetol	
set	barrier	startalg	
set	clocktype		
set	conflict	display level	
set	defaults		<i>Resetting Defaults on page 59 in Getting Started</i>
set	emphasis	memory	<i>Lack of Memory on page 171 or Memory Emphasis: Letting the Optimizer Use Disk for Storage on page 196 in User's Manual</i>
set	emphasis	mip	<i>Emphasizing Feasibility and Optimality on page 249 in User's Manual</i>
set	emphasis	numerical	<i>Numerical Emphasis Settings on page 173 (LP) or Numerical Emphasis Settings on page 200 (barrier) in User's Manual</i>
set	feasopt	tolerance	
set	logfile	filename	<i>Filing Iteration Logs on page 49 in Getting Started</i>
set	lpmethod		

Interactive Optimizer Command		Options	Example
set	mip cuts	all	
set	mip cuts	class	<i>Parameters for Controlling Cuts on page 261 in User's Manual</i>
set	mip cuts	cliques	
set	mip cuts	covers	
set	mip cuts	disjunctive	
set	mip cuts	flowcovers	
set	mip cuts	gomory	
set	mip cuts	gubcovers	
set	mip cuts	implied	
set	mip cuts	mircut	
set	mip cuts	pathcut	
set	mip	display	
set	mip	interval	
set	mip limits	aggforcut	
set	mip limits	cutpasses	
set	mip limits	cutsfactor	<i>Parameters Affecting Cuts on page 261 in User's Manual</i>
set	mip limits	gomorycand	
set	mip limits	gomorypass	
set	mip limits	nodes	<i>Parameters to Limit MIP Optimization on page 252 in User's Manual</i>
set	mip limits	polishtime	
set	mip limits	probetime	
set	mip limits	repairtries	
set	mip limits	solutions	<i>Parameters to Limit MIP Optimization on page 252 in User's Manual</i>
set	mip limits	strongcand	

## Interactive Optimizer Commands

Interactive Optimizer Command		Options	Example
set	mip limits	strongit	
set	mip limits	strongthreads	
set	mip limits	submipodelim	
set	mip limits	threads	
set	mip limits	treememory	<i>Reset the Tree Memory Parameter on page 279 in User's Manual</i>
set	mip	ordtype	
set	mip strategy	backtrack	<i>Parameters for Controlling Branch &amp; Cut Strategy on page 255 in User's Manual</i>
set	mip strategy	bbinterval	<i>Parameters for Controlling Branch &amp; Cut Strategy on page 255 in User's Manual</i>
set	mip strategy	branch	<i>Parameters for Controlling Branch &amp; Cut Strategy on page 255 in User's Manual</i>
set	mip strategy	dive	
set	mip strategy	file	
set	mip strategy	heuristicfreq	<i>Heuristics on page 262 in User's Manual</i>
set	mip strategy	lbheuristic	
set	mip strategy	nodeselect	<i>Parameters for Controlling Branch &amp; Cut Strategy on page 255 in User's Manual</i>
set	mip strategy	order	
set	mip strategy	presolvenode	
set	mip strategy	probe	<i>Probing on page 258 in User's Manual</i>
set	mip strategy	rinsheur	<i>relaxation induced neighborhood search (RINS)</i>
set	mip strategy	startalgorithm	
set	mip strategy	subalgorithm	<i>NodeAlg Parameter on page 284 in User's Manual</i>
set	mip strategy	variableselect	<i>Parameters for Controlling Branch &amp; Cut Strategy on page 255 in User's Manual</i>
set	mip tolerances	absmipgap	

Interactive Optimizer Command		Options	Example
set	mip tolerances	integrality	
set	mip tolerances	lowercutoff	
set	mip tolerances	mipgap	
set	mip tolerances	objdifference	<i>Time Wasted on Overly Tight Optimality Criteria on page 277 in User's Manual</i>
set	mip tolerances	reobjdifference	
set	mip tolerances	uppercutoff	
set	network	display	<i>Understanding the Network Log File on page 208 in User's Manual</i>
set	network	iterations	<i>Limiting Iterations in the Network Optimizer on page 209 in User's Manual</i>
set	network	netfind	
set	network	pricing	<i>Selecting a Pricing Algorithm for the Network Optimizer on page 209 in User's Manual</i>
set	network tolerances	feasibility	<i>Controlling Tolerance on page 209 in User's Manual</i>
set	network tolerances	optimality	
set	output	<i>channel</i>	
set	output	mpslong	
set	output	logonly	<i>Interpreting Solution Quality on page 179 in User's Manual</i>
set	preprocessing	aggregator	<i>Preprocessing on page 164 Preprocessing and Memory Requirements on page 172 Parameters for Controlling MIP Preprocessing on page 265 in User's Manual</i>
set	preprocessing	boundstrength	<i>Parameters for Controlling MIP Preprocessing on page 265 in User's Manual</i>
set	preprocessing	coeffreduce	<i>Parameters for Controlling MIP Preprocessing on page 265 Example: Optimizing a Basic MIP Problem on page 285 in User's Manual</i>

## Interactive Optimizer Commands

Interactive Optimizer Command		Options	Example
set	preprocessing	dependency	<i>Preprocessing on page 164 (continuous) Preprocessing on page 197 (discrete) in User's Manual</i>
set	preprocessing	dual	<i>Using a Starting-Point Heuristic on page 199 in User's Manual</i>
set	preprocessing	fill	<i>Preprocessing on page 164 in User's Manual</i>
set	preprocessing	linear	
set	preprocessing	numpass	
set	preprocessing	presolve	<i>Preprocessing and Memory Requirements on page 172 (continuous) in User's Manual Parameters for Controlling MIP Preprocessing on page 265 in User's Manual</i>
set	preprocessing	qpmakepsd	
set	preprocessing	reduce	<i>Preprocessing on page 164 (continuous) or Preprocessing and Feasibility on page 343 (discrete) in User's Manual</i>
set	preprocessing	relax	<i>Parameters for Controlling MIP Preprocessing on page 265 in User's Manual</i>
set	preprocessing	repeatpresolve	
set	preprocessing	symmetry	
set	qpmethod		
set	read	constraints	
set	read	datacheck	<i>Displaying Problem Statistics on page 43 in Getting Started</i>
set	read	nonzeroes	
set	read	qpnonzeroes	
set	read	scale	<i>Scaling on page 169 in User's Manual</i>
set	read	variables	
set	sifting	algorithm	
set	sifting	display	

Interactive Optimizer Command		Options	Example
set	sifting	iterations	
set	simplex	crash	<i>Cralnd Parameter Settings for the Primal Simplex Optimizer on page 170 in User's Manual</i>
set	simplex	dgradient	
set	simplex	display	
set	simplex limits	iterations	
set	simplex limits	lowerobj	
set	simplex limits	perturbation	<i>Stalling Due to Degeneracy on page 176 in User's Manual</i>
set	simplex limits	singularity	<i>Repeated Singularities on page 175 in User's Manual</i>
set	simplex limits	upperobj	
set	simplex	perturbation	<i>Stalling Due to Degeneracy on page 176 in User's Manual</i>
set	simplex	pgradient	
set	simplex	pricing	
set	simplex	refactor	<i>Refactoring Frequency and Memory Requirements on page 172 in User's Manual</i>
set	simplex tolerances	feasibility	<i>Maximum Bound Infeasibility: Identifying Largest Bound Violation on page 180 in User's Manual</i>
set	simplex tolerances	markowitz	<i>Inability to Stay Feasible on page 177 in User's Manual</i>
set	simplex tolerances	optimality	<i>Maximum Reduced-Cost Infeasibility on page 180 in User's Manual</i>
set	threads		
set	timelimit		<i>Parameters to Limit MIP Optimization on page 252 in User's Manual</i>
set	workdir	<i>prompt for directory</i>	<i>Memory Emphasis: Letting the Optimizer Use Disk for Storage on page 196 in User's Manual</i>

Interactive Optimizer Command		Options	Example
set	workmem	<i>prompt for new value of working memory available</i>	<i>Memory Emphasis: Letting the Optimizer Use Disk for Storage on page 196 or Parameters to Limit MIP Optimization on page 252 in User's Manual</i>
tranopt			
write	<i>filenames</i>	<i>type</i>	<i>Preprocessing on page 164 (continuous) or Repeated Singularities on page 175 or Difficulty Solving Subproblems: Overcoming Degeneracy on page 283 or Saving QP Problems on page 220 in User's Manual</i>
xecute	command		<i>Executing Operating System Commands on page 66 in Getting Started</i>

---

## Managing Parameters in the Interactive Optimizer

To see the current value of a parameter that interests you in the Interactive Optimizer, use the command `display settings`. The command `display settings changed` lists only those parameters where the value is not the default value. The command `display settings all` lists all parameters and their values.

To change the value of a parameter in the Interactive Optimizer, use the command `set` followed by options to indicate the parameter and the value you want it to assume.

In the reference manual of ILOG CPLEX Parameters, you will find the name of each parameter and its options in the Interactive Optimizer, along with the name of the parameter in Concert Technology and the Callable Library. That manual also describes the purpose of each parameter and documents its possible settings.

In the reference manual of the ILOG CPLEX Callable Library, the group `optim.cplex.manageparameters` documents the Callable Library routines that access parameters.

---

## Saving a Parameter Specification File

You can tell the ILOG CPLEX Interactive Optimizer to read customized parameter settings from a *parameter specification file*. By default, ILOG CPLEX expects a parameter specification file to be named `cplex.par`, and it looks for that file in the directory where it is executing. However, you can rename the file, or tell ILOG CPLEX to look for it in

another directory by setting the system environment variable `CplexParFile` to the full path name of your parameter specification file. You set that environment variable in the customary way for your platform. For example, on a UNIX platform, you might use a shell command to set the environment variable, or on a personal computer running Microsoft Windows, you might click on the System icon in the control panel, then select the environment tab from the available system properties tabs, and then define the variable there.

During initialization in the Interactive Optimizer, ILOG CPLEX locates any available parameter specification file (by checking the current execution directory for `cplex.par` and by checking the environment variable `CplexParFile`) and reads that file. As it opens the file, ILOG CPLEX displays the message “Initial parameter values are being read from `cplex.par`” (or from the parameter specification file you specified). As ILOG CPLEX displays that message on the screen, it also writes the message to the log file. If ILOG CPLEX cannot open the file, it displays no message, records no note in the log file, and uses default parameter settings.

You can use a parameter specification file to change any parameter or parameters accessible by the `set` command in the Interactive Optimizer. The parameter types, names, and options are those used by the `set` command in the Interactive Optimizer.

To create a parameter specification file, you can use either of these alternatives:

- ◆ Use an ordinary text editor to create a file where each line observes the following syntax:

*parameter-name option value*

- ◆ Use the command `display settings` in the Interactive Optimizer to generate a list of current parameter settings. Those settings will be recorded in the log file. You can then edit the log file with your preferred text editor to create your parameter specification file.

`display settings changed` lists parameters different from the default with their values.

`display settings all` lists all parameters with their values.

Each entry on a line must be separated by at least one space or tab. Blank lines in a parameter specification file are acceptable; there are no provisions for comments in the file. You may abbreviate parameter names to unique character sequences, as you do in the `set` command.

As ILOG CPLEX reads a parameter specification file, if the parameter name and value are valid, ILOG CPLEX sets the parameter and writes a message about it to the screen and to the log file. If ILOG CPLEX encounters a repeated parameter, it uses the last value specified. ILOG CPLEX terminates under the following conditions:

- ◆ if it encounters a parameter that is unknown;
- ◆ if it encounters a parameter that is not unique;

## Interactive Optimizer Commands

- ◆ if the parameter is correctly specified but the value is missing, invalid, or out of range.

Here is an example of a parameter specification file that tells ILOG CPLEX to use wall clock rather than CPU time while limiting total run time to 60 seconds. It also instructs ILOG CPLEX to open a log file named `problem.log`.

```
clocktype 2
timelimit 60
logfile   problem.log
```

# Index

## A

accessing parameters in Interactive Optimizer **16**  
 aggregator **13**

## B

barrier optimizer **5, 9**  
     convergence tolerance **9**  
     corrections limit **10**  
     crossover **10**  
     dense columns and **9**  
     display levels in **10**  
     dual **5**  
     growth limit **10**  
     iteration limit **10**  
     objective range limit **10**  
     ordering **10**  
     primal **6**  
     QCP convergence tolerance **10**  
     starting algorithm **10**  
     thread limit **10**  
 basis  
     displaying **8**  
     setting advanced **9**  
 binary variable, displaying **7**  
 bound  
     changing **6**  
     displaying **7**  
     displaying best **8**

bound strength **13**

## C

changing  
     bounds **6**  
     coefficients **6**  
     names **6**  
     objective **6**  
     problem type **6**  
     QP term **6**  
     righthand side (RHS) **6**  
     sense **6**  
     variable type **6**  
 channel, output **13**  
 clock type **10**  
 coefficient, changing **6**  
 conflict **6**  
 constraint  
     displaying **7**  
     reading **14**  
 conventions in parameter specification file **17**  
 cplex.par parameter specification file **16**  
 CPLEXPARFILE environment variable **17**  
 creating parameter specification file **17**

## D

dense column  
     barrier and **9**

- histogram of **7**
- diagnosing infeasibility **6**
- directory, setting **15**
- displaying
  - basis **8**
  - best bounds **8**
  - binary variables **7**
  - dual solution **8**
  - general variables **7**
  - histogram **7**
  - integer variables **7**
  - kappa **8**
  - lower bound sensitivity **8**
  - names **7**
  - network optimizer **13**
  - objective **8**
  - objective sensitivity **8**
  - parameter settings **16, 17**
  - problem **7**
  - problem bounds **7**
  - problem constraints **7**
  - problem statistics **8**
  - problem variables **8**
  - QP variables **7**
  - RHS sensitivity **8**
  - semi-continuous variables **7**
  - settings **8**
  - sifting **14**
  - simplex **15**
  - slack **8**
  - slacks in QCP **8**
  - solution variables **9**
  - special ordered set (SOS) **7**
  - upper bound sensitivity **8**

## E

- environment
  - parameter specification file **17**
  - variable **17**
- example parameter specification file **18**

## F

- feasopt **9**

- feasopt tolerance **10**

## H

- help **9**
- histogram **7**

## I

- integer variable, displaying **7**
- Interactive Optimizer
  - accessing parameters in **16**
  - commands **5 to 16**
  - customized parameter settings **16**
  - setting parameters **16**

## K

- kappa **8**

## L

- log file **10**
  - parameter specifications and **17**

## M

- memory, setting **16**
- MIP
  - aggregation limit **11**
  - backtracking strategy **12**
  - branch and bound interval **12**
  - branch and cut strategy **12**
  - cliques and **11**
  - covers and **11**
  - cut factor limit **11**
  - cut passes limit **11**
  - cuts and **11**
  - disjunctive cuts **11**
  - dive strategy **12**
  - emphasis **10**
  - file strategy **12**
  - flow cuts **11**
  - Gomory cut candidate limit **11**
  - Gomory cut pass limit **11**

- Gomory cuts **11**
- GUB covers **11**
- heuristic frequency **12**
- implied cuts **11**
- interval **11**
- lb heuristic strategy **12**
- memory limit for tree **12**
- MIR cuts **11**
- node algorithm **12**
- node limit **11**
- node selection strategy **12**
- order strategy **12**
- path cuts **11**
- polishing time limit **11**
- presolve at nodes **12**
- probe strategy **12**
- probe time limit **11**
- repair try limit **11**
- RINS strategy **12**
- solution limit **11**
- starting algorithm **12**
- strong candidate limit **11**
- strong iteration limit **12**
- strong thread limit **12**
- subalgorithm **12**
- subnode limit **12**
- thread limit **12**
- tolerance
  - absolute gap **12**
  - gap **13**
  - integrality **13**
  - lower cut off **13**
  - objective difference **13**
  - relative objective difference **13**
  - upper cut off **13**
- variable selection strategy **12**
- MPS controlling precision of output **13**

## N

- name
  - changing **6**
  - displaying **7**
- network optimizer
  - displaying **13**

- iterations **13**
- pricing **13**
- tolerance
  - feasibility **13**
  - optimality **13**

## O

- objective
  - changing **6**
  - displaying **8**
  - displaying sensitivity **8**
- optimality tolerance **15**
- optimize command **9**
- output
  - controlling precision in MPS, REW files **13**
  - directing to log file **13**
  - setting channel for **13**
- output channel **13**

## P

- parameter
  - customized **16**
  - setting **16**
  - specification file **17**
- parameter specification file **16, 17, 18**
  - creating **17**
  - example **18**
  - syntax in **17**
- perturbation **15**
- preprocessing **14**
  - aggregator **13**
  - bound strength **13**
  - coefficient reduction **13**
  - dependency **14**
  - dual **14**
  - fill **14**
  - linearity **14**
  - positive semi-definite **14**
  - presolve and **14**
  - QP and PSD **14**
  - re-apply presolve after root **14**
  - reductions **14**
  - relaxation **14**

symmetry breaking **14**

problem

changing type **6**

displaying **7**

## Q

QCP

barrier convergence tolerance and **10**

QP **14**

changing term in **6**

displaying variables **7**

reading non zeroes **14**

quality, displaying solution **8**

quit command **9**

## R

read command **9**

reading

constraints **14**

data **14**

non zeroes **14**

non zeroes in QP **14**

scaling and **14**

variables **14**

relaxation induced neighborhood search (RINS) **12**

righthand side (RHS), changing **6**

## S

saving parameter specification file **16**

semi-continuous variable

displaying **7**

sense, changing **6**

sensitivity

displaying lower bound **8**

displaying objective **8**

displaying RHS **8**

displaying upper bound **8**

set Interactive Optimizer command **16**

setting

customized parameters **16**

output channel **13**

parameter specification file **16**

parameters **16**

sifting

algorithm for **14**

displaying **14**

iterations and **15**

simplex

crash indicator **15**

displaying **15**

dual gradient **15**

iteration limit **15**

lower objective limit **15**

perturbation limit **15**

perturbing **15**

pricing **15**

primal gradient **15**

refactoring frequency **15**

singularity limit **15**

tolerance

feasibility **15**

Markowitz **15**

optimality **15**

upper objective limit **15**

slack

displaying **8**

displaying in Interactive Optimizer **8**

displaying in QCP **8**

solution, displaying quality of **8**

special ordered set (SOS)

displaying **7**

statistics, displaying for problem **8**

## T

threads **15**

time limit **15**

tolerance

MIP

absolute gap **12**

gap **13**

integrality **13**

lower cut off **13**

objective difference **13**

relative objective difference **13**

upper cut off **13**

network optimizer

- feasibility **13**
- optimality **13**
- simplex
  - feasibility **15**
  - optimality **15**

## V

variable

- binary, displaying **7**
- changing type of **6**
- displaying **8**
- displaying general **7**
- displaying in solution **9**
- displaying QP **7**
- displaying semi-continuous **7**

## W

- working directory **15**
- working memory **16**
- writing files **16**

## X

- xecute command **16**

