qpuser

Table of Contents

IBM QP Solutions 1
User Guide for IBM Optimization Linear Solutions 3
IBM QP User Guide 5
IBM QP User Guide 10

[User's Guide | Download | Bottom of page]

IBM QP Solutions

The QP Solutions product includes two standalone solver programs incorporating library modules to solve quadratic programming problems, with linear constraints and a convex quadratic objective. OSLQSLV uses a two-stage, simplex based algorithm to mimimize the quadratic objective, while OSLQBSLV uses the interior point solver to mimimize a regularized form of the quadratic objective. Brief descriptions of the algorithms incorporated into these programs are included in the opening sections of the Library Users Guide.

Both OSLQSLV and OSLQBSLV accept many command line parameters (which may be retrieved from a parameter file) to specify program options. The program options available in all the application programs include: the size of the program workspace (limited only by available memory), whether the objective is to be minimized or maximized, names of input and/or output files, and specification of new values for OSL control variables. All the settable control variables are accessible by this means. Control variables and their uses are explained in the library User's Guide.

All the application programs accept problem data (in MPS format) from *stdin*, and direct output to *stdout*. Input data may be piped in from another program, which generates the data or retrieves it from some other source, or it may be read from a file. Output may be directed into a file or piped into another program, in the usual way, or written directly to an output file whose name has been supplied as a program option.

For further information about using the IBM QP Solutions solvers, click on User Guide, to view the document, or on Download to obtain a trial copy of the program and a sample MPS data set.

If you would like to have softcopy of the html user guide on your PC, click here to download the zipped postscript HTML (26KB)

If you prefer to handle hardcopy of documentation click here to download either a postscript (213KB) or zipped postscript (68KB) version of the documentation.

Notes:	1. Viewing these postcript files is problematical. An inability to view them satisfactorily does not necessarily mean that they will not print correctly. 2. There are no hypertext links in the postcript files, and so the cross references are undetectable.

[**Top of Page | Previous Page | User's Guide**]

IBM Optimization Solutions and Library Quadratic Programming Solutions

[Oslqslv Guide | Oslqbslv Guide | Download]

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Each of the OSL Quadratic Programming Solutions modules:

1. Oslqslv for solving QP problems using simplex methods,
2. Oslqbslv for solving QP problems using interior point methods,

has its own user's guide. The following comments apply to both programs.

Usage Examples:

Example 1

oslqslv "?" > qslv.opt

This puts the list of keywords options for the oslqslv program, with explanations of their meanings and default values, into the file named "qslv.opt."

Example 2

oslqbslv -dspace=500000 -imaxiterb=70 -input=test1.mps -output=test1.out

The oslqbslv program is started and instructed to take input data from the file named "test1.mps." Output will be directed to the file named "test1.out." The program workspace will be set to 500000 16 byte words, and the value of the integer control variable *Imaxiterb* will be set to 70, which will make oslqbslv switch to a simplex method after 70 interior point barrier iterations.

Example 3

oslqslv @option.fil

The oslqslv program is started, and instructed to take its options from the file named "option.fil."

An options file should contain program options, one per line, as they would be entered on-line ***without the preceding minus sign***.

[Oslqslv Guide | Oslqbslv Guide | Download]

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IBM Optimization Solutions and Library QP Solutions User Guide

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Name: oslqslv

Purpose: To solve Quadratic Programming problems using the simplex method
Usage: oslqslv [?] [-keyword=value] [...] [@keyword_file]
keyword_file: Name of file containing "-keyword=value" strings.
(Each "-keyword=value" string in this file must be on a separate line.)

Valid Keywords and Default Values:

maxmin = min|max - default: min
input = input_mps_file - default: standard input
output = listing_file - default: standard output
dspace = value - default: 400000
isolmask = value - default: 0
iprtinfomask = value - default: 31
scale = yes|no - default: yes
imaxiter = value - default: 9999999
osli_n_ = value - default: a function of n
oslr_n_ = value - default: a function of n
oslc_n_ = value - default: a function of n

See the library User's Guide for more information on Control variables.

Explanation of Keywords:

maxmin : Solve as a maximization or minimization problem.
input : Name of file containing input data - MPS format.
output : Name of file to receive messages.
dspace : Size in double words of the work area.
isolmask : Matrix bit mask for EKKPRTS print function.

= 1 : selects the rows
= 2 : selects the columns
= 4 : selects the nonzero elements of the model
= 8 : selects the infeasible elements of the model
= 15 or 0 or 16 : selects the entire matrix

Iprtinfomask : Solution information bit mask for EKKPRTS print function.

= 1 : selects the statistics
= 2 : selects iteration count, value of the objective function and the problem status
= 4 : selects the names of the columns and rows
= 8 : selects the status of each variable
= 16 : selects the row and column solution values
= 32 : selects the dual values and reduced costs
= 64 : selects the lower bounds
= 128 : selects the upper bounds
= 256 : selects the input costs
= 512 : selects the matrix elements
= 0 : selects the first six options (i.e., same as 63).

scale : Use EKKSCAL function to scale the coefficient matrix.
imaxiter : The maximum number of iterations that will be performed.
osli_n_ : Integer Control variable n; 0 < n < 62
oslr_n_ : Real Control variable n; 0 < n < 46
oslc_n_ : Character Control variable n; 0 < n < 11

Example 1

oslqslv ?

This command results in the display of valid keywords, their meanings along with the default values.

Example 2

oslqslv -imaxiter=20000 < test1.mps > test1.out

The oslqslv program is started using test1.mps as input data. Output is directed to the file test1.out. The program will stop after 20000 iterations.

Example 3

If the file key_file.001 contains the following 4 lines:

- maxmin=max
- imaxiter=20000
- isolmask=7
- osli_36_=132

then the command:

```
oslqslv -dspace=1000000 @key_file.001 < test1.mps > test1.out
```

will start oslqslv with a work area of 1 million double words. The problem is solved as a maximization problem. The program will stop after 20000 iterations. The ekkprts() print function will select only non-zero columns and rows. The maximum number of characters on each line of output is 132.

Example 4

The command:

```
oslqslv -dspace=1000000 @key_file.001 -input=test1.mps -output=test1.out
```

is equivalent to:

```
oslqslv -dspace=1000000 @key_file.001 < test1.mps > test1.out
```

Example 5

The quadratic part of the objective function of the following problem:

Minimize

```
x1 + 2.4*x2 - x3 + 1.1*x4
  + (x1*x1 + 2*x2*x2 + 1.5*x3*x3 + x4*x4 + x1*x2 -2*x2*x3)
```

Subject to:

```
3*x1 + x2       - 2*x4 >= 2.5
     x2 +   x3 + 4*x4  = 4.0

0 <= x1 <= 3;  x2 <= 2;  x3 >= 0;  x4 >= 0;
```

can be written as (1/2) x Qx where Q is:

```
.-          -.
| 2  1  0  0 |
| 1  4 -2  0 |
| 0 -2  3  0 |
| 0  0  0  2 |
.-          -.
```

The MPS file for this problem is shown below. This example is from the book "Optimization with IBM OSL" by M.S. Hung, W.O. Rom, and A.D. Waren, Boyd and Fraser Publishing Co., 1994 (ISBN 0-89426-244-0). Please note, however, that the optimal solution shown in the output listing on page 310 of this book is incorrect. The output listing shown on pages 309-310 correspond to a different problem.

MPS file for QP1

```
NAME        QP1
ROWS
 N  OBJ
 G  ROW1
 E  ROW2
COLUMNS
    X1       OBJ          1.0D0   ROW1          3.0D0
    X2       OBJ          2.4D0   ROW1          1.0D0
    X2       ROW2           1.D0
    X3       OBJ         -1.D0    ROW2          1.D0
    X4       OBJ         1.1 D0   ROW1          -2.D0
    X4       ROW2           4.D0
RHS
    BVEC     ROW1          2.5D0   ROW2           4.D0
BOUNDS
 UP BNDU     X1             3.D0
 UP BNDU     X2             2.D0
 LO BNDU     X2            -1.D31
ENDATA
NAME        QP1
QSECTION
    X1       X1           2.D0     X2           1.D0
    X2       X1           1.D0     X2           4.D0
    X2       X3          -2.D0
    X3       X2          -2.D0     X3           3.D0
    X4       X4           2.D0
ENDATA
```

---

oslqslv USAGE NOTES

1. If oslqslv is having difficulty with a problem, then you should increase the size of work area, using the "dspace" keyword, and try solving the problem again.
2. oslqslv uses the library I/O function ekkmps() to read the linear part of the problem and ekkqmps() to read the quadratic part. The same input file is used for both ekkmps() and ekkqmps() so the records for the quadratic data must follow the ENDATA record for the linear components. The Q matrix appears after a QSECTION indicator record, which must be preceded by a NAME indicator record. The format for the Q matrix is similar to that for the usual MPS COLUMNS section. The Q matrix data records must also be followed by an ENDATA record.

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Name: oslqbslv

Purpose: To solve Quadratic Programming problems using interior point methods
Usage: oslqbslv [?] [-keyword=value] [...] [@keyword_file]
keyword_file: Name of file containing "-keyword=value" strings.
(Each "-keyword=value" string in this file must be on a separate line.)

Valid Keywords and Default Values:

maxmin = min|max - default: min
input = input_mps_file - default: standard input
output = listing_file - default: standard output
dspace = value - default: 400000
isolmask = value - default: 0
iprtinfomask = value - default: 31
scale = yes|no - default: yes
imaxiter = value - default: 9999999
osli_n_ = value - default: a function of n
oslr_n_ = value - default: a function of n
oslc_n_ = value - default: a function of n

See the library User's Guide for more information on Control variables.

Explanation of Keywords:

maxmin : Solve as a maximization or minimization problem.
input : Name of file containing input data - MPS format.
output : Name of file to receive messages.
dspace : Size in double words of the work area.
isolmask : Matrix bit mask for EKKPRTS print function.

= 1 : selects the rows
= 2 : selects the columns
= 4 : selects the nonzero elements of the model
= 8 : selects the infeasible elements of the model
= 15 or 0 or 16 : selects the entire matrix

Iprtinfomask : Solution information bit mask for EKKPRTS print function.

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= 4 : selects the names of the columns and rows
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= 256 : selects the input costs
= 512 : selects the matrix elements
= 0 : selects the first six options (i.e., same as 63).

scale : Use EKKSCAL function to scale the coefficient matrix.
imaxiter : The maximum number of iterations that will be performed.
osli_n_ : Integer Control variable n; 0 < n < 62
oslr_n_ : Real Control variable n; 0 < n < 46
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Example 1

oslqbslv ?

This command results in the display of valid keywords, their meanings along with the default values.

Example 2

oslqbslv -imaxiter=20000 < test1.mps > test1.out

The oslqbslv program is started using test1.mps as input data. Output is directed to the file test1.out. The program will stop after 20000 iterations.

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If the file key_file.001 contains the following 4 lines:

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then the command:

```
oslqbslv -dspace=1000000 @key_file.001 < test1.mps > test1.out
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will start oslqbslv with a work area of 1 million double words. The problem is solved as a maximization problem. The program will stop after 20000 iterations. The ekkprts() print function will select only non-zero columns and rows. The maximum number of characters on each line of output is 132.

Example 4

The command:

```
oslqbslv -dspace=1000000 @key_file.001 -input=test1.mps -output=test1.out
```

is equivalent to:

```
oslqbslv -dspace=1000000 @key_file.001 < test1.mps > test1.out
```

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```

Subject to:

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can be written as (1/2) x Qx where Q is:

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    X2       ROW2           1.D0
    X3       OBJ         -1.D0    ROW2          1.D0
    X4       OBJ         1.1 D0   ROW1          -2.D0
    X4       ROW2           4.D0
RHS
    BVEC     ROW1          2.5D0   ROW2           4.D0
BOUNDS
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ENDATA
NAME        QP1
QSECTION
    X1       X1           2.D0     X2           1.D0
    X2       X1           1.D0     X2           4.D0
    X2       X3          -2.D0
    X3       X2          -2.D0     X3           3.D0
    X4       X4           2.D0
ENDATA
```

---

oslqbslv USAGE NOTES

1. If oslqbslv is having difficulty with a problem, then you should increase the size of work area, using the "dspace" keyword, and try solving the problem again.
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