MOSEK Optimization Server

Release 11.0.8

MOSEK ApS

12 February 2025

Contents

Chapter 1

Introduction

The **MOSEK** Optimization Suite 11.0.8 is a powerful software package capable of solving large-scale optimization problems of the following kind:

- linear,
- conic:
  - conic quadratic (also known as second-order cone),
  - involving the exponential cone,
  - involving the power cone,
  - semidefinite,
- convex quadratic and quadratically constrained,
- integer.

In order to obtain an overview of features in the **MOSEK** Optimization Suite consult the product introduction guide.

The most widespread class of optimization problems is *linear optimization problems*, where all relations are linear. The tremendous success of both applications and theory of linear optimization can be ascribed to the following factors:

- The required data are simple, i.e. just matrices and vectors.
- Convexity is guaranteed since the problem is convex by construction.
- Linear functions are trivially differentiable.
- There exist very efficient algorithms and software for solving linear problems.
- Duality properties for linear optimization are nice and simple.

Even if the linear optimization model is only an approximation to the true problem at hand, the advantages of linear optimization may outweigh the disadvantages. In some cases, however, the problem formulation is inherently nonlinear and a linear approximation is either intractable or inadequate. *Conic optimization* has proved to be a very expressive and powerful way to introduce nonlinearities, while preserving all the nice properties of linear optimization listed above.

The fundamental expression in linear optimization is a linear expression of the form

$$Ax - b \geq 0.$$

In conic optimization this is replaced with a wider class of constraints

$$Ax - b \in \mathcal{K}$$

where $\mathcal{K}$ is a *convex cone*. For example in 3 dimensions $\mathcal{K}$ may correspond to an ice cream cone. The conic optimizer in **MOSEK** supports a number of different types of cones $\mathcal{K}$, which allows a surprisingly large number of nonlinear relations to be modeled, as described in the **MOSEK** Modeling Cookbook, while preserving the nice algorithmic and theoretical properties of linear optimization.

1.1 Why the Optimization Server?

The **MOSEK** OptServer is a simple solver service. It receives optimization tasks, solves them, and returns solution and log information. A typical application would be offloading heavy computations from client computers, when the problem is set up, to a remote powerful machine, and returning solutions back.

The OptServer can be used in a few ways:

- Users of the Optimizer and Fusion API can use the OptServer directly from the API by providing the server, port number and credentials (if appropriate). This way then can switch between running the same optimization locally and remotely with no change to the rest of their **MOSEK** code except for the `optimize` or `solve` call.
- Similarly to the above, but in asynchronous mode, where the local call does not wait for the remote optimization to terminate. Instead the user should periodically poll the server for a solution.
- Optimization models in standard file formats (MPS, LP, CBF, OPF, **MOSEK** task) can also be sent to the server using a REST API over HTTP or HTTPS and the server returns a file with the solution.

The documentation of the relevant Optimizer API contains examples of calling the remote server using the first two API-based methods.

Chapter 2

Contact Information

Phone	+45 7174 9373	Office
	+45 7174 5700	Sales
Website	mosek.com	
Email		
	sales@mosek.com	Sales, pricing, and licensing
	support@mosek.com	Technical support, questions and bug reports
	info@mosek.com	Everything else.
Mailing Address		
	MOSEK ApS	
	Fruebjergvej 3	
	Symbion Science Park, Box 16	
	2100 Copenhagen O	
	Denmark	

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Youtube	https://www.youtube.com/channel/UCvIyectEVLP31NXeD5mIbEw

In particular **Twitter** is used for news, updates and release announcements.

Chapter 3

License Agreement

3.1 MOSEK end-user license agreement

Before using the **MOSEK** software, please read the license agreement available in the distribution at `<MSKHOME>/mosek/11.0/mosek-eula.pdf` or on the **MOSEK** website https://mosek.com/products/license-agreement. By using **MOSEK** you agree to the terms of that license agreement.

3.2 Third party licenses

MOSEK uses some third-party open-source libraries. Their license details follow.

zlib

MOSEK uses the *zlib* library obtained from the zlib website. The license agreement for *zlib* is shown in Listing 3.1.

Listing 3.1: *zlib* license.

```
zlib.h -- interface of the 'zlib' general purpose compression library
version 1.2.7, May 2nd, 2012

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Jean-loup Gailly        Mark Adler
jloup@gzip.org          madler@alumni.caltech.edu
```

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```
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 *
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 *
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 *
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 *
 ***************************************************************/
```

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Listing 3.5: *OpenSSL* license

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```
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```
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Chapter 4

OptServerLight

This page is about installing and running OptServerLight, the light version (OptServerLight) is a stateless in-memory solver service, which can be started and run from the command line with no configuration.

4.1 Installation

4.1.1 Requirements and files

- The OptServerLight is available for all platforms supported by **MOSEK**.
- Download the **MOSEK** distribution from https://mosek.com/downloads/ first, unpack/install it and locate the `bin` folder with **MOSEK** binaries.
- The OptServerLight consists of binaries and shared libraries present in the `bin` folder of the **MOSEK** distribution, namely: `optserverlight`, `mosekpipe`, `solconv` and `libmosek` (with appropriate extensions as per the operating system and version). The most convenient option is to run `optserverlight` directly from the `bin` folder of **MOSEK**.
- OptServerLight distributed with **MOSEK** version 11.0 is compatible with and optimized for **MOSEK** clients of version 11.0. Supporting clients from other major.minor **MOSEK** versions is not guaranteed. The general *REST API* is always supported.
- The service runs in-memory and does not create any files on disk, except a logfile, if requested.

4.1.2 Starting OptServerLight

To start OptServerLight launch the binary `optserverlight` or `optserverlight.exe` from the `bin` folder of the **MOSEK** installation:

```
optserverlight
```

That will start the OptServerLight with the default options. A typical installation should at least customize the following most important options:

```
optserverlight -port 34567 -solver-timeout 10 -max-task 50 -size-limit 100000000
```

where:

- `-port` is the port number where the application listens for jobs,
- `-solver-timeout` is the time limit for one job (in seconds), after which the solver will be terminated,
- `-max-task` is the maximum number of jobs solved at once, if more jobs arrive they will be kept waiting,
- `-size-limit` is the maximal size (in bytes) of the file that will be accepted.

Full list of configuration options with descriptions can be obtained with:

```
optserverlight -h
```

4.2 Testing the installation

The server started successfully if the log output does not indicate any errors, and contains the host/port at which the server was started.

To further test the setup continue to the section Sec. 6.

Chapter 5

Full OptServer

This page is about installing and running the full version of OptServer, which is a remote solver service additionally equipped with task storage, user management and additional management features.

Important:

- We recommend all users interested with remote optimization to try the light version, OptServerLight, first. It requires no extra setup, is much easier to start, and has all the same capabilities regarding optimization itself.
- This documentation for the full OptServer is intentionally terse and does not cover all possible options in detail. If in doubt please check the config file to see all configuration options, or ideally contact **MOSEK** support for help with the setup.

5.1 Dockerfile

You can set up a fully functional self-contained demo version as a Docker container on Linux using https://github.com/MOSEK/Dockerfiles/tree/master/optserver-demo

The `Dockerfile` and `optserver.conf` from the above project can also serve as examples of installign and configuring the server.

5.2 Installation

Below is an outline of steps required to install, initialize and start the OptServer.

5.2.1 Requirements and files

- OptServer is available for `linux64x86` and `win64x86`.
- Install **MOSEK** following the installation instructions.
- Download the OptServer, which is a separate package available from http://download.mosek.com/optserver/index.html and unpack it.
- The OptServer installation consists of three folders, containing:
  - `bin` - the OptServer binary `optserver`/`optserver.exe`.
  - `etc/mosek` - the configuration file `optserver.conf`.
  - `var` - HTML pages and the default location for database and jobs files created on runtime.

  All paths are fully configurable, so the components of OptServer can be moved around to arbitrary locations.

5.2.2 The config file

Locate and familiarize yourself with the configuration file. It contains default settings, many of which may need to be adjusted later. The file is divided into major sections:

- `[API]` - specifies the API to be used.
- `[Database]` - database configuration.
- `[Http]` - settings for the HTTP/HTTPS service.
- `[Paths]` - paths to **MOSEK**, log and data files.
- `[Tasks]` - settings for managing server load, limits for task sizes and similar.

5.2.3 Initializing database

OptServer supports three database backends: Sqlite, MySql and Postgres. Edit the `Database.Driver` entry in the config file to choose the required backend, and fill in the respective subsection of `[Database]` with the required configuration for that backend.

The simple built-in Sqlite backend is recommend for initial test. In this case only the `Database.Sqlite.Path` entry needs to be configured to point to the location of the database file (or left as default).

Initialize the database by running

```
optserver --config path_to_config_file.conf --log-file - --create-db initialize
```

5.2.4 Connecting MOSEK solver

OptServer needs to know where to find the **MOSEK** solver. This is configured with the option `Paths.Mosek`, which is a list of paths, each leading to the `bin` folder of the **MOSEK** installation you wish to use.

For example, assuming that **MOSEK** version 11.0 on Linux is installed in the folder `/opt/mosek_inst`, you would configure the path as

```
[Paths]
  Mosek = [ "/opt/mosek_inst/11.0/tools/platform/linux64x86/bin" ]
```

The list can contain multiple paths for various **MOSEK** installations coming from different **MOSEK** versions. When remote optimization is invoked from the **MOSEK** client the OptServer will choose the binaries corresponding to the version of the caller. Therefore all the **MOSEK** versions (major/minor `X.Y`) that will be used by clients must be available and configured on the server.

5.2.5 Major options to configure

The following are the major options the user may be interested in editing. This can be done either in the config file or in the command-line invocation (see `optserver --help` for a list of command-line options).

- `Database.Driver` and specific backend settings - as discussed above.
- `Http.Port` - the port to listen on.
- `Http.UseTLS` - whether to run on `https`. In this case the TLS key and certificate paths must be provided in the same section. Recommended `false` for initial testing.
- `Paths` - the paths to the log file, working directory for storing task files, and paths to **MOSEK** solver (see above).
- `Paths.License` - the path to the **MOSEK** license file, if not using a default location (see licenese manual).
- `Tasks.NumWorkers` - maximum number of concurrent jobs to be optimized.
- `Tasks.QueueCapacity` - maximum number of accepted connections before new arriving jobs are rejeccted.

- `Tasks.SolveTimeout` - maximum solver time per job.
- `Tasks.TaskSizeLimit` - maximum size of a task in bytes.

Options can also be provided on command line, for example `Tasks.NumWorkers=6`. Command-line options override configuration file options.

5.2.6 Starting the OptServer

To start the OptServer run

```
optserver --config path_to_config_file.conf [OPTIONS]
```

Additional startup options that may be useful

- `--logfile -` - write the log to stdout.
- `--verbose` - more verbose log.
- `--debug` - very verbose log.

5.2.7 Web GUI

Web GUI is available via

```
https://server:port/index.html
```

when using SSL. The initial password for the admin user can be set using the command-line (see `optserver --help`).

5.3 Testing the installation

The server started successfully if the log output does not indicate any errors, contains the printout of the configuration used and the host/port at which the server was started.

To further test the setup continue to the section Sec. 6.

Chapter 6

Testing the installation

6.1 Test connection

A simple test to check that OptServer is up and running can be performed by opening the URL:

```
http://SERVER:PORT/api/v1/version
```

where `http://SERVER:PORT` (or `https://SERVER:PORT` if using SSL) are the coordinates of the server.

The correct response contains the version number of the OptServer and optionally of the **MOSEK** solver underneath and should be similar to:

```
11.0.1-light/11.0.1                     (for OptServerLight)
3.0.15                                  (for full OptServer)
```

6.2 Test optimization

Assuming the connection works fine a simple *Hello World* test of the optimization capabilities can be performed by running the following python script with the URL of the server as an argument.

```
python3 test_helloworld.py http://SERVER:PORT
```

The expected outcome is to obtain the solver's log output, and a confirmation that the solution is correct. Any errors related to licensing or configuration issues should be detected at this point and can be corrected, possibly with the help of the server's log file.

Listing 6.1: A HelloWorld test of the OptServer.

```python
import requests, sys, json

URL = sys.argv[1]
PROBLEM = r"""
{"Task/data":{"var":{"bk":["lo","ra","lo","lo"],"bl":[0,0,0,0],"bu":[1e+30,10,1e+30,
↪1e+30],"type":["cont","cont","cont","cont"]},
             "con":{"bk":["fx","lo","up"],"bl":[30,15,-1e+30],"bu":[30,1e+30,25]},
             "objective":{"sense":"max","c":{"subj":[0,1,2,3],"val":[3,1,5,1]},"cfix":
↪0},
             "A":{"subi":[1,0,2,1,0,1,0,2,1],"subj":[0,0,1,1,1,2,2,3,3],"val":[2,3,2,
↪1,1,3,2,3,1]}}}
"""
verify = False # Whether to verify SSL certificates

with requests.Session() as s:
    p = s.post(URL + "/api/v1/submit+solve",
               data = PROBLEM,
```

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```
                headers = { "Content-Type" : "application/x-mosek-jtask", "Accept":
↪"application/x-mosek-jtask"},
                verify = verify )
    if p.status_code != 200:
        print(f"Status {p.status_code}")
        print(p.text)
        print(p.headers)
    else:
        token = p.headers['X-Mosek-Job-Token']
        sol = json.loads(p.text)

        l = s.get(URL + "/api/v1/log",
                  headers = { "X-Mosek-Job-Token" : token },
                  verify = verify )
        print(l.text)

        print(f"Status {p.status_code}")
        print(f"MOSEK response {p.headers['X-Mosek-Res-Code']}")

        x = sol['Task/solutions']['interior']['xx']
        print(f"Received solution:", *(f"{xi:.2f}" for xi in x))
        print(f"Expected solution: 0.00 0.00 15.00 8.33")
```

6.3 Further tests and usage

- If using the OptServer from a **MOSEK** API, consult the manual for your API for instructions on how to use remote optimization. They can be found in the section *Solver interaction tutorials/MOSEK OptServer* of your API manual. In most basic cases this amounts to providing the URL of the server when calling the API method which actually optimizes. See also Sec. 8.
- If using **MOSEK** from a third-party or **MOSEK** API remote optimization can also be requested by setting the parameter *MSK_SPAR_REMOTE_OPTSERVER_HOST*.
- If you plan to use the OptServer directly via REST API canns consult the tutorial in Sec. 9 and the API reference in Sec. 10.

Chapter 7

Overview

In this section we present the basic mechanism of the OptServer.

- Sec. 7.1
- Sec. 7.2

7.1 Synchronous Optimization

The easiest way to submit an optimization problem to the OptServer is in *synchronous mode*, where the caller is blocked while waiting for the optimization:

1. A submission request is sent over to the OptServer and the problem is transferred.
2. The submitter is put on hold.
3. The OptServer runs the optimizer and wait for the results.
4. When the optimizer terminates the OptServer collects the result and passes over to the client.
5. The client receives the solution and resumes.

The process can be represented as in Fig. **??**.
This workflow has the following advantages:

- It is effective for problems where the solution is expected reasonably quickly.
- The changes to the code compared to a local optimization are almost nonexistent. They boil down to invoking a different method in place of the usual `optimize` or similar.

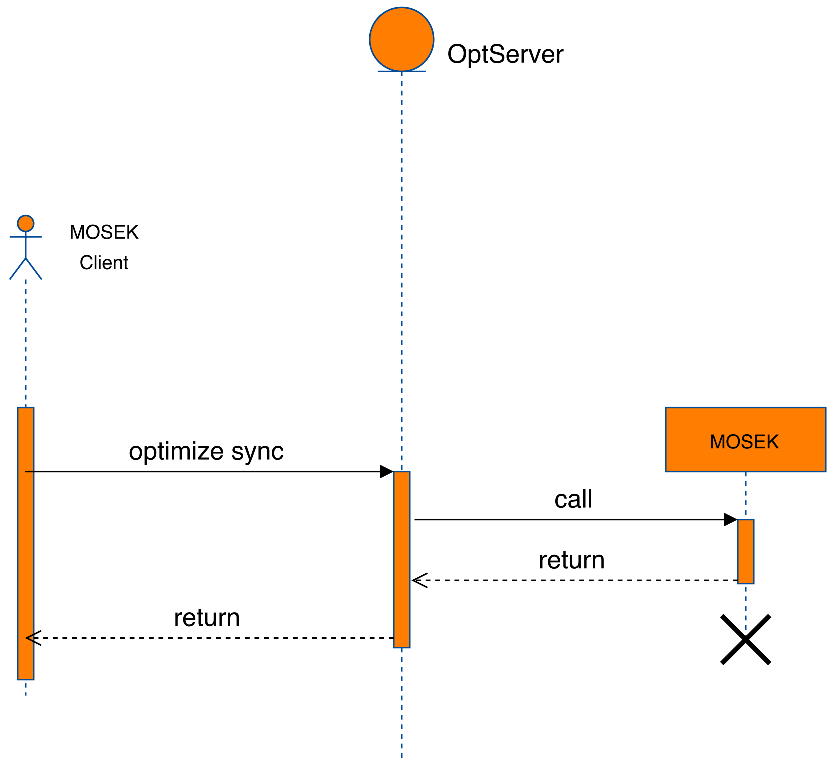
7.2 Asynchronous Optimization

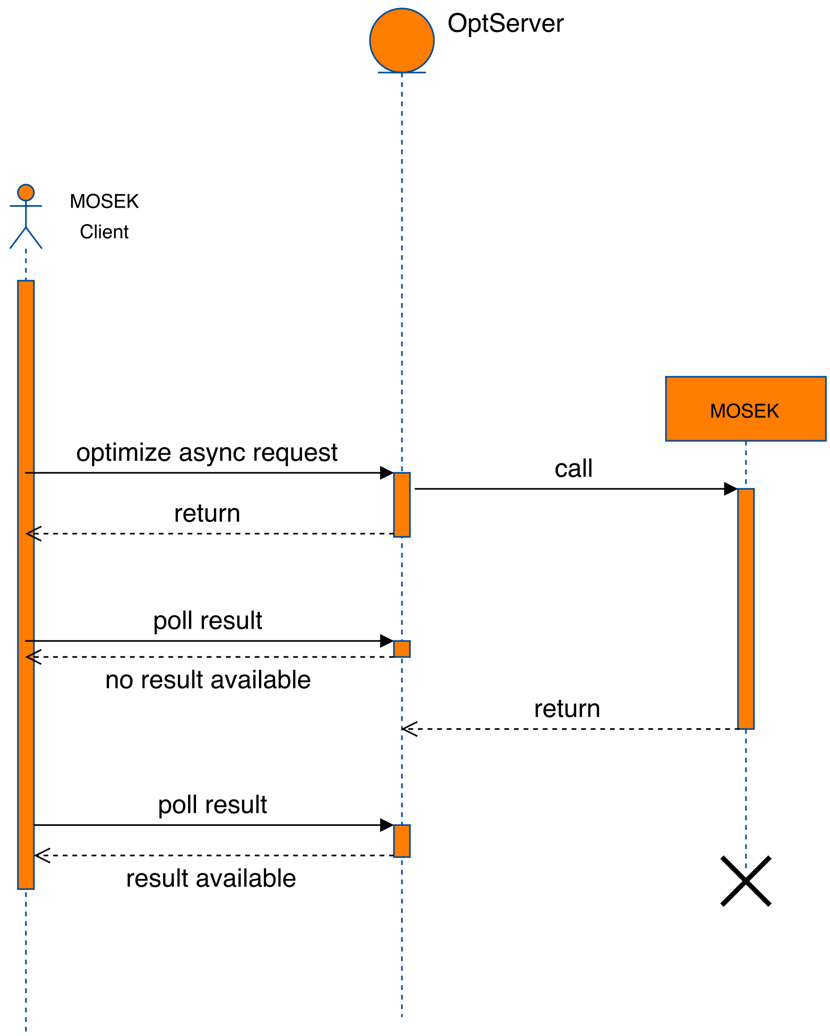
The OptServer accepts jobs also in *asynchronous mode*, where the client is not blocked while waiting for the result:

1. A submission request is sent over to the OptServer and the problem is transferred.
2. The client regains control and continues its own execution flow.
3. The client can poll the OptServer at any time about the job status and solution availability.
4. The OptServer runs the optimizer and wait for the results.
5. When the optimizer terminates the OptServer collects the results, which are available to the client next time it queries.

The process can be represented as in Fig. **??**.
Asynchronous mode is particularly suitable when

- A job is expected to run for long time.
- One wants to submit a set of jobs to run in parallel.
- The submitter is a short-lived process.


OptServer
MOSEK
Client
MOSEK
optimize sync
call
return
return


OptServer
MOSEK
Client
MOSEK
optimize async request
call
return
poll result
no result available
return
poll result
result available

7.3 With or without the MOSEK API

Calling OptServer using the MOSEK API

The **MOSEK** API provides an interface to invoke the OptServer from the client, both in synchronous an asynchronous mode. It is currently available for the Optimizer API (synchronous and asynchronous) and Fusion (synchronous). The API is a set of functions such as `optimizermt`, `asyncoptimize`, `asyncpoll` and similar, which form a replacement for the standard `optimize` call, while the rest of the **MOSEK** code (creating task, loading data, retrieving results) remains the same. The details and examples can be found in the manuals for the Optimizer and Fusion APIs. It is possible to retrieve the log via a log handler and to interrupt a solver from a callback handler also during remote optimization. See Sec. 8 for a simple example.

Calling OptServer directly

Alternatively it is possible to call the OptServer through a REST API, submitting an optimization problem in one of formats supported by **MOSEK**. In this case the caller is responsible for assembling the data, communicating with the solver and interpreting the answer. Details and examples can be found in Sec. 9. Using this approach it is possible to perform optimization from environments that cannot support a **MOSEK** client, for example from a Web application.

Chapter 8

MOSEK API tutorial

In this section we show the simplest usage of OptServer directly from the **MOSEK** API. For the purpose of short demonstration we include the code in the **MOSEK** Optimizer API for Python. Please check the section *Solver interaction tutorials/MOSEK OptServer* in your API manual for an example in your preferred API and a further discussion of both the synchronous and asynchronous case.

To perform synchronous remote optimization the only modification to existing code is pointing the solver to the URL of the remote server; everything else happens transparently for the user. This, depnding on the API, can be done by

- calling a method, like `putoptserverhost` in the example below,
- passing an argument to `solve()` or similar optimization call,
- setting the parameter *MSK_SPAR_REMOTE_OPTSERVER_HOST*,
- other ways, see your API manual.

Below is a Python example that loads a problem from a file and optimizes it on a remote OptServer.

Listing 8.1: Optimizing remotely from Python Optimizer API.

```
# Create task and read example data
task = mosek.Task()
task.readdata(infile)
task.set_Stream(mosek.streamtype.log, sys.stdout.write)

# Specify the OptServer coordinates
task.putoptserverhost(URL)

# Only relevant if using HTTPS, otherwise ignore
task.putstrparam(mosek.sparam.remote_tls_cert_path, cert)

# Solve (remotely)
task.optimize()

# Print some sample results (adjust to your task type)
print(f"Solution status {task.getsolsta(mosek.soltype.itr)}")
print(f"Objective value {task.getprimalobj(mosek.soltype.itr)}")
```

Chapter 9

REST API tutorials

This section contains tutorials for the OptServer REST API. Note that this should not be necessary in typical applications, where invoking the OptServer directly through the **MOSEK** API as discussed in Sec. 8 is easier and more natural.

- Sec. 9.1
  - problem submission and optimization with one REST API call,
  - retrieving the solver log.
- Sec. 9.2
  - problem submission,
  - solving and retrieving the result,
  - retrieving the solver log.
- Sec. 9.3
  - problem submission,
  - solving,
  - checking if the solution is available,
  - retrieving the solver log in chunks,
  - retrieving the solution,
  - stopping the solver.

9.1 Single-call synchronous

This tutorial demonstrates the simplest synchronous OptServer API where the problem is submitted and optimzied in a single call.

Assuming that an HTTP/HTTPS connection to the OptServer was established, we submit a problem using *submit+solve*. The file format is passed in the `Content-Type` header and the requested solution format in the `Accept` header.

Listing 9.1: Submit a problem.

```
# POST problem data
submit = s.post(URL + "/api/v1/submit+solve",
                data = probdata,
                headers = { "Content-Type" : intype, "Accept": outtype },
                verify = verify )
```

The request will return when optimization terminates. If there were no errors, the status codes are available in the headers and the solution in the body of the response.

Listing 9.2: Retrieving results.

```
            if submit.status_code == 200:
                if outtype in ["application/json", "application/x-mosek-jtask"]:
                    solution = json.loads(submit.text)
                else:
                    solution = submit.text
                token = submit.headers['X-Mosek-Job-Token']
                res = submit.headers['X-Mosek-Res-Code']
                trm = submit.headers['X-Mosek-Trm-Code']
```

It is also possible to retrieve the log from the solver (*log*) if we remembered the job token returned by the first call. Otherwise the token is not necessary.

Listing 9.3: Retrieving optimization log.

```
                log = s.get(URL + "/api/v1/log",
                            headers = { "X-Mosek-Job-Token" : token },
                            verify = verify )
                print(log.text)
```

The full example is shown below.

Listing 9.4: How to submit a job and solve the problem synchronously in one request.

```
    # Create a connection
    with requests.Session() as s:
        with open(infile,'rb') as probdata:
            # POST problem data
            submit = s.post(URL + "/api/v1/submit+solve",
                            data = probdata,
                            headers = { "Content-Type" : intype, "Accept": outtype },
                            verify = verify )
            if submit.status_code == 200:
                if outtype in ["application/json", "application/x-mosek-jtask"]:
                    solution = json.loads(submit.text)
                else:
                    solution = submit.text
                token = submit.headers['X-Mosek-Job-Token']
                res = submit.headers['X-Mosek-Res-Code']
                trm = submit.headers['X-Mosek-Trm-Code']

                ## Obtain the solver log output
                log = s.get(URL + "/api/v1/log",
                            headers = { "X-Mosek-Job-Token" : token },
                            verify = verify )
                print(log.text)
                print(f"Solution: {solution}")
                print(f"Response code:    {res}")
                print(f"Termination code: {trm}")
            else:
                # In case of error in the first submission
                print(f"Unexpected status {submit.status_code}")
                print(f"Response: {submit.text}")
                print(f"Headers:  {submit.headers}")
```

9.2 Synchronous

For the purpose of the tutorial we assume that the problem to be solved is read from a file, and the solutions will be saved to a file, i.e. we don't go into the logic which sets up the problem and interprets the solution. See *file formats* for specifications of file formats.

We demonstrate synchronous optimization, see Sec. 7.1. Assuming that an HTTP/HTTPS connection to the OptServer was established, we first submit a problem using *submit*. The file format is passed in the `Content-Type` header.

Listing 9.5: Submit a problem.

```
# POST problem data
submit = s.post(URL + "/api/v1/submit",
                data = probdata,
                headers = { "Content-Type" : intype },
                verify = verify )

if submit.status_code == 200:
    token = submit.headers['X-Mosek-Job-Token']
```

The response contains a token used to identify the job in future requests. If no errors have occurred, we use *solve* to request running the solver for the given job token. When requesting the solution we set the `Accept` header to indicate expected solution format.

Listing 9.6: Starting the solver synchronously.

```
# Request the server to solve the problem
solve = s.get(URL + "/api/v1/solve",
              headers = { "X-Mosek-Job-Token" : token,
                          "Accept": outtype },
              verify = verify )
```

The request will return when optimization terminates. If there were no errors, the status codes are available in the headers and the solution in the body of the response.

Listing 9.7: Retrieving results.

```
if solve.status_code == 200:
    if outtype in ["application/json", "application/x-mosek-jtask"]:
        solution = json.loads(solve.text)
    else:
        solution = solve.text
    res = solve.headers["X-Mosek-Res-Code"]
    trm = solve.headers["X-Mosek-Trm-Code"]
```

It is also possible to retrieve the log from the solver (*log*):

Listing 9.8: Retrieving optimization log.

```
# Obtain the solver log output
log = s.get(URL + "/api/v1/log",
            headers = { "X-Mosek-Job-Token" : token },
            verify = verify )
print(log.text)
```

The full example is shown below.

Listing 9.9: How to submit a job and solve the problem synchronously.

```
# Create a connection
```

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```
    with requests.Session() as s:
        with open(infile,'rb') as probdata:
            # POST problem data
            submit = s.post(URL + "/api/v1/submit",
                            data = probdata,
                            headers = { "Content-Type" : intype },
                            verify = verify )

            if submit.status_code == 200:
                token = submit.headers['X-Mosek-Job-Token']
                print("Submit: success")

                # Request the server to solve the problem
                solve = s.get(URL + "/api/v1/solve",
                              headers = { "X-Mosek-Job-Token" : token,
                                          "Accept": outtype },
                              verify = verify )

                if solve.status_code == 200:
                    if outtype in ["application/json", "application/x-mosek-jtask"]:
                        solution = json.loads(solve.text)
                    else:
                        solution = solve.text
                    res = solve.headers["X-Mosek-Res-Code"]
                    trm = solve.headers["X-Mosek-Trm-Code"]

                    # Obtain the solver log output
                    log = s.get(URL + "/api/v1/log",
                                headers = { "X-Mosek-Job-Token" : token },
                                verify = verify )
                    print(log.text)

                    print(f"Solution: {solution}")
                    print(f"Response code:    {res}")
                    print(f"Termination code: {trm}")
                else:
                    print(f"Error solving the problem, status = {solve.status_code}")
            else:
                print(f"Unexpected status {submit.status_code}")
                print(f"Response: {submit.text}")
                print(f"Headers:  {submit.headers}")
```

9.3 Asynchronous

This tutorial demonstrates most features of the asynchronous OptServer API, that is submitting a problem, polling for solution, retrieving the solution, breaking the solver and retrieving the log output.

Since the stateless OptServerLight forgets a problem shortly after solving it, the full OptServer should be considered for serious asynchronous optimization applications where the solution is to be retrieved, possibly, a long and unspecified time after the job's submission.

For the purpose of the tutorial we assume that the problem to be solved is read from a file, and the solutions will be saved to a file, i.e. we don't go into the logic which sets up the problem and interprets the solution. See *file formats* for specifications of file formats.

Starting the solver

Assuming that an HTTP/HTTPS connection to the OptServer was established, we first submit a problem using *submit*. The file format is passed in the `Content-Type` header.

Listing 9.10: Submit a problem.

```
# POST problem data
submit = s.post(URL + "/api/v1/submit",
                data = probdata,
                headers = { "Content-Type" : intype },
                verify = verify )
```

The response contains a token used to identify the job in future requests. Note that this operation is identical to the *synchronous case*. If no errors have occurred, we use *solve-background* to initiate solving the problem identified by the token:

Listing 9.11: Start solving the submission.

```
# Request the server to solve the problem in the background
solve = s.get(URL + "/api/v1/solve-background",
              headers = { "X-Mosek-Job-Token" : token },
              verify = verify )
```

The calling program regains control immediately.

Waiting for and retrieving the solution

We can now periodically start polling for the solution via *solution*. We set the `Accept` header to indicate expected solution format. If the response is empty then the solution is not yet available:

Listing 9.12: Polling for the solution.

```
pollCount += 1
sol = s.get(URL + "/api/v1/solution",
            headers = { "X-Mosek-Job-Token" : token ,
                        "Accept" : outtype },
            verify = verify )

if sol.status_code == requests.codes.no_content:
    # Solution no yet available
    print(f"Solution not available in poll {pollCount}, continuing")
    time.sleep(1.0)
```

When the response becomes non-empty we can retrieve the solution:

Listing 9.13: Retrieving the solution when available.

```
elif sol.status_code == requests.codes.ok:
    # Solution is available
    solved = True
    if outtype in ["application/json", "application/x-mosek-jtask"]:
        solution = json.loads(sol.text)
    else:
        solution = sol.text
    res = sol.headers["X-Mosek-Res-Code"]
    trm = sol.headers["X-Mosek-Trm-Code"]
```

Stopping the solver

At some point we can decide that the optimization should be stopped. That can be done with *break*.

Listing 9.14: Stopping the solver.

```
# After too many attempts we indicate the solver to stop
if not solved and pollCount >= maxPolls:
    s.get(URL + "/api/v1/break",
          headers = { "X-Mosek-Job-Token" : token },
          verify = verify )
```

Note that the solver need not break immediately, in particular it can enter a few more loops of checking for solution. The **MOSEK** termination code in this case will be *MSK_RES_TRM_USER_CALLBACK*.

Retrieving the log

The log output from the solver can be retrieved gradually in each polling loop. The caller needs to keep track of how much of the log was already read and provide it as an offset in a call to *log*.

Listing 9.15: Retrieving log output.

```
# Get the log from the last call until now
log = s.get(URL + "/api/v1/log" + f"?offset={logOffset}",
        headers = { "X-Mosek-Job-Token" : token },
        verify = verify )
print(log.text)
logOffset += len(log.text)
```

Complete code

The full example is shown below.

Listing 9.16: How to submit a job and solve the problem asynchronously.

```
# Create a connection
token = ""
with requests.Session() as s:
    with open(infile,'rb') as probdata:
        # POST problem data
        submit = s.post(URL + "/api/v1/submit",
                        data = probdata,
                        headers = { "Content-Type" : intype },
                        verify = verify )
        if submit.status_code == requests.codes.ok:
```

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```
                token = submit.headers['X-Mosek-Job-Token']
                print("Submit: success")

                # Request the server to solve the problem in the background
                solve = s.get(URL + "/api/v1/solve-background",
                              headers = { "X-Mosek-Job-Token" : token },
                              verify = verify )
                if solve.status_code not in [requests.codes.ok, requests.codes.no_
↪content]:
                    print(f"Error initiating solve, status = {solve.status_code}")
                    sys.exit(-1)
            else:
                print(f"Error submitting job, status = {submit.status_code}")
                sys.exit(-1)

    # Begin waiting for the solution
    solved = False
    pollCount = 0
    logOffset = 0

    with requests.Session() as s:
        while not solved:
            pollCount += 1
            sol = s.get(URL + "/api/v1/solution",
                        headers = { "X-Mosek-Job-Token" : token ,
                                    "Accept" : outtype },
                        verify = verify )

            if sol.status_code == requests.codes.no_content:
                # Solution no yet available
                print(f"Solution not available in poll {pollCount}, continuing")
                time.sleep(1.0)
            elif sol.status_code == requests.codes.ok:
                # Solution is available
                solved = True
                if outtype in ["application/json", "application/x-mosek-jtask"]:
                    solution = json.loads(sol.text)
                else:
                    solution = sol.text
                res = sol.headers["X-Mosek-Res-Code"]
                trm = sol.headers["X-Mosek-Trm-Code"]
            else:
                print(f"Error querying for solution, status = {sol.status_code}")

            # After too many attempts we indicate the solver to stop
            if not solved and pollCount >= maxPolls:
                s.get(URL + "/api/v1/break",
                      headers = { "X-Mosek-Job-Token" : token },
                      verify = verify )

            # Get the log from the last call until now
            log = s.get(URL + "/api/v1/log" + f"?offset={logOffset}",
                    headers = { "X-Mosek-Job-Token" : token },
                    verify = verify )
            print(log.text)
            logOffset += len(log.text)
```

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```
        if solved:
            print(f"Solution: {solution}")
            print(f"Response code:    {res}")
            print(f"Termination code: {trm}")
```

A complete reference for the REST API can be found in Sec. 10.1.

Chapter 10

OptServer Reference

- *REST API Protocol specification*
- **Optimizer parameters:**
  - *Double*, *Integer*, *String*
  - *Full list*
  - *Browse by topic*
- *Optimizer response codes*

10.1 OptServer REST API

10.1.1 Commands

This section describes the REST API of the OptServer. Additional authentication options, common to all commands, are described in Sec. 10.1.2.

`POST /api/v1/submit+solve`

Submit a problem to the server and get the solution.

Performs the actions of `submit` and `solve` in one request. The problem file should be submitted in the content of the request. The `Content-Type` header should specify the file format of the submission (if not present, the solver may guess incorrect format and fail to start the solver). The recognized content types are listed in Table 10.1.

See Sec. 11 for descriptions of supported formats.

The file format of the solution can be specified in the `Accept` header (if not present, a plain text ASCII solution will be returned), as in Table 10.2. The solution is returned as the content of the response and the headers are set as in Table 10.3.

The name of the job can be specified in a query string `jobname=...`.

On response `OK` a token identifying the problem is returned in the header `X-Mosek-Job-Token`. That token is required to identify the job in future request.

`POST /api/v1/submit`

Submit a problem to the server.

The problem file should be submitted in the content of the request. The `Content-Type` header should specify the file format of the submission (if not present, the solver may guess incorrect format and fail to start the solver). The recognized content types are listed in Table 10.1.

Table 10.1: Content types in submit and submit+solve.

Content-Type	File format
application/x-mosek-task	**MOSEK** Task
application/x-mosek-jtask	**MOSEK** JTask (JSON)
application/json	**MOSEK** JTask (JSON)
application/x-mosek-lp	LP format
application/x-mosek-mps	MPS format
application/x-mosek-opf	OPF format
application/x-mosek-cbf	CBF format
application/x-mosek-ptf	PTF format
application/x-mosek-XXX+gzip	`XXX` format compressed with gzip
application/x-mosek-XXX+zstd	`XXX` format compressed with zstd

See Sec. 11 for descriptions of supported formats.

The name of the job can be specified in a query string `jobname=...`.

On response `OK` a token identifying the problem is returned in the response body, in the session cookie and in the header `X-Mosek-Job-Token`. That token is required to identify the job in future request.

`GET /api/v1/solve`

Start solving and wait for the solver to finish.

The job to start is specified in the query string `token=...` or with the header `X-Mosek-Job-Token`.

The file format of the solution can be specified in the `Accept` header (if not present, a plain text ASCII solution will be returned), as in Table 10.2.

The solution is returned as the content of the response and the headers are set as in Table 10.3.

`GET /api/v1/solve-background`

Start solving in the background and return immediately.

The job to start is specified in the query string `token=...` or with the header `X-Mosek-Job-Token`.

It returns `OK` if the solver started successfully.

`GET /api/v1/solution`

Return the solution

The problem whose solution is requested is specified in the query string `token=...` or with the header `X-Mosek-Job-Token`.

The file format of the solution can be specified in the `Accept` header (if not present, a plain text ASCII solution will be returned). The recognized types are:

Table 10.2: Accepted solution formats in solution and solve.

Accept	Solution format
application/x-mosek-task	**MOSEK** Task
application/x-mosek-jtask	**MOSEK** JSol file (JSON)
application/json	**MOSEK** JSol file (JSON)
text/plain	Plain text

See Sec. 11 for descriptions of supported solution formats.

If the solution is not yet available, the call returns an empty response with no content.

If the solution is available it is returned as the content of the response and the following headers are set:

Table 10.3: Headers set in the response to solution and solve.

Header	Value
Content-Type	Solution type as requested in `Accept`
X-Mosek-Process-Time	Time to solve the problem
X-Mosek-Res-Code	Response code from the optimizer
X-Mosek-Trm-Code	Termination code from the optimizer
X-Mosek-Job-Token	Job token
Content-Length	Length of the solution

If an unexpected error occurred then `X-Mosek-Res-Code` will be set to `MSK_RES_UNKNOWN` and the other fields are not defined.

`GET /api/v1/log`

Return the log.

The problem for which the log output is requested is specified in the query string `token=...` or with the header `X-Mosek-Job-Token`.

If the query string contains the parameter `offset=XXXX`, the log file will be returned from offset `XXXX` until the end of what is currently available. Otherwise the whole log is returned.

The response header `X-Mosek-Job-State` is set to `done` or `not-done`, indicating if the optimization was completed.

`GET /api/v1/break`

Attempt to terminate the solver.

The problem to be terminated is specified in the query string `token=...` or with the header `X-Mosek-Job-Token`.

`GET /api/v1/version`

Return the version number.

Returns the string with the version number of the OptServer and of the underlying **MOSEK** solver if using OptServerLight.

10.1.2 Authentication

If the OptServer allows anonymous job submission then no authentication is required. Otherwise all of the commands require authentication in one of the following ways:

- The user's access token is passed as a query string `access-token=...` in the request.
- The user's access token is passed in the header `X-Mosek-Access-Token` of the request.
- Through a session cookie, if the user has logged in and authenticated within an open session.

Access tokens for users can be generated through the Web GUI.

10.2 Parameters grouped by topic

Analysis

- *MSK_DPAR_ANA_SOL_INFEAS_TOL*
- *MSK_IPAR_ANA_SOL_BASIS*
- *MSK_IPAR_ANA_SOL_PRINT_VIOLATED*
- *MSK_IPAR_LOG_ANA_PRO*

Basis identification

- *MSK_DPAR_SIM_LU_TOL_REL_PIV*
- *MSK_IPAR_BI_CLEAN_OPTIMIZER*
- *MSK_IPAR_BI_IGNORE_MAX_ITER*
- *MSK_IPAR_BI_IGNORE_NUM_ERROR*
- *MSK_IPAR_BI_MAX_ITERATIONS*
- *MSK_IPAR_INTPNT_BASIS*
- *MSK_IPAR_LOG_BI*
- *MSK_IPAR_LOG_BI_FREQ*

Conic interior-point method

- *MSK_DPAR_INTPNT_CO_TOL_DFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_INFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_MU_RED*
- *MSK_DPAR_INTPNT_CO_TOL_NEAR_REL*
- *MSK_DPAR_INTPNT_CO_TOL_PFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_REL_GAP*

Data check

- *MSK_DPAR_DATA_SYM_MAT_TOL*
- *MSK_DPAR_DATA_SYM_MAT_TOL_HUGE*
- *MSK_DPAR_DATA_SYM_MAT_TOL_LARGE*
- *MSK_DPAR_DATA_TOL_AIJ_HUGE*
- *MSK_DPAR_DATA_TOL_AIJ_LARGE*
- *MSK_DPAR_DATA_TOL_BOUND_INF*
- *MSK_DPAR_DATA_TOL_BOUND_WRN*
- *MSK_DPAR_DATA_TOL_C_HUGE*
- *MSK_DPAR_DATA_TOL_CJ_LARGE*
- *MSK_DPAR_DATA_TOL_QIJ*
- *MSK_DPAR_DATA_TOL_X*
- *MSK_DPAR_SEMIDEFINITE_TOL_APPROX*

Data input/output

- *MSK_IPAR_INFEAS_REPORT_AUTO*
- *MSK_IPAR_LOG_FILE*
- *MSK_IPAR_OPF_WRITE_HEADER*
- *MSK_IPAR_OPF_WRITE_HINTS*
- *MSK_IPAR_OPF_WRITE_LINE_LENGTH*
- *MSK_IPAR_OPF_WRITE_PARAMETERS*
- *MSK_IPAR_OPF_WRITE_PROBLEM*
- *MSK_IPAR_OPF_WRITE_SOL_BAS*
- *MSK_IPAR_OPF_WRITE_SOL_ITG*
- *MSK_IPAR_OPF_WRITE_SOL_ITR*
- *MSK_IPAR_OPF_WRITE_SOLUTIONS*
- *MSK_IPAR_PARAM_READ_CASE_NAME*
- *MSK_IPAR_PARAM_READ_IGN_ERROR*
- *MSK_IPAR_PTF_WRITE_PARAMETERS*
- *MSK_IPAR_PTF_WRITE_SINGLE_PSD_TERMS*
- *MSK_IPAR_PTF_WRITE_SOLUTIONS*
- *MSK_IPAR_PTF_WRITE_TRANSFORM*
- *MSK_IPAR_READ_ASYNC*
- *MSK_IPAR_READ_DEBUG*
- *MSK_IPAR_READ_KEEP_FREE_CON*
- *MSK_IPAR_READ_MPS_FORMAT*
- *MSK_IPAR_READ_MPS_WIDTH*
- *MSK_IPAR_READ_TASK_IGNORE_PARAM*
- *MSK_IPAR_SOL_READ_NAME_WIDTH*
- *MSK_IPAR_SOL_READ_WIDTH*
- *MSK_IPAR_WRITE_ASYNC*
- *MSK_IPAR_WRITE_BAS_CONSTRAINTS*
- *MSK_IPAR_WRITE_BAS_HEAD*
- *MSK_IPAR_WRITE_BAS_VARIABLES*
- *MSK_IPAR_WRITE_COMPRESSION*
- *MSK_IPAR_WRITE_FREE_CON*
- *MSK_IPAR_WRITE_GENERIC_NAMES*
- *MSK_IPAR_WRITE_IGNORE_INCOMPATIBLE_ITEMS*
- *MSK_IPAR_WRITE_INT_CONSTRAINTS*
- *MSK_IPAR_WRITE_INT_HEAD*

- *MSK_IPAR_WRITE_INT_VARIABLES*
- *MSK_IPAR_WRITE_JSON_INDENTATION*
- *MSK_IPAR_WRITE_LP_FULL_OBJ*
- *MSK_IPAR_WRITE_LP_LINE_WIDTH*
- *MSK_IPAR_WRITE_MPS_FORMAT*
- *MSK_IPAR_WRITE_MPS_INT*
- *MSK_IPAR_WRITE_SOL_BARVARIABLES*
- *MSK_IPAR_WRITE_SOL_CONSTRAINTS*
- *MSK_IPAR_WRITE_SOL_HEAD*
- *MSK_IPAR_WRITE_SOL_IGNORE_INVALID_NAMES*
- *MSK_IPAR_WRITE_SOL_VARIABLES*
- *MSK_SPAR_BAS_SOL_FILE_NAME*
- *MSK_SPAR_DATA_FILE_NAME*
- *MSK_SPAR_DEBUG_FILE_NAME*
- *MSK_SPAR_INT_SOL_FILE_NAME*
- *MSK_SPAR_ITR_SOL_FILE_NAME*
- *MSK_SPAR_MIO_DEBUG_STRING*
- *MSK_SPAR_PARAM_COMMENT_SIGN*
- *MSK_SPAR_PARAM_READ_FILE_NAME*
- *MSK_SPAR_PARAM_WRITE_FILE_NAME*
- *MSK_SPAR_READ_MPS_BOU_NAME*
- *MSK_SPAR_READ_MPS_OBJ_NAME*
- *MSK_SPAR_READ_MPS_RAN_NAME*
- *MSK_SPAR_READ_MPS_RHS_NAME*
- *MSK_SPAR_SENSITIVITY_FILE_NAME*
- *MSK_SPAR_SENSITIVITY_RES_FILE_NAME*
- *MSK_SPAR_SOL_FILTER_XC_LOW*
- *MSK_SPAR_SOL_FILTER_XC_UPR*
- *MSK_SPAR_SOL_FILTER_XX_LOW*
- *MSK_SPAR_SOL_FILTER_XX_UPR*
- *MSK_SPAR_STAT_KEY*
- *MSK_SPAR_STAT_NAME*

Debugging

- *MSK_IPAR_AUTO_SORT_A_BEFORE_OPT*

Dual simplex

- *MSK_IPAR_SIM_DUAL_CRASH*
- *MSK_IPAR_SIM_DUAL_RESTRICT_SELECTION*
- *MSK_IPAR_SIM_DUAL_SELECTION*

Infeasibility report

- *MSK_IPAR_INFEAS_GENERIC_NAMES*
- *MSK_IPAR_INFEAS_REPORT_LEVEL*
- *MSK_IPAR_LOG_INFEAS_ANA*

Interior-point method

- *MSK_DPAR_INTPNT_CO_TOL_DFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_INFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_MU_RED*
- *MSK_DPAR_INTPNT_CO_TOL_NEAR_REL*
- *MSK_DPAR_INTPNT_CO_TOL_PFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_REL_GAP*
- *MSK_DPAR_INTPNT_QO_TOL_DFEAS*
- *MSK_DPAR_INTPNT_QO_TOL_INFEAS*
- *MSK_DPAR_INTPNT_QO_TOL_MU_RED*
- *MSK_DPAR_INTPNT_QO_TOL_NEAR_REL*
- *MSK_DPAR_INTPNT_QO_TOL_PFEAS*
- *MSK_DPAR_INTPNT_QO_TOL_REL_GAP*
- *MSK_DPAR_INTPNT_TOL_DFEAS*
- *MSK_DPAR_INTPNT_TOL_DSAFE*
- *MSK_DPAR_INTPNT_TOL_INFEAS*
- *MSK_DPAR_INTPNT_TOL_MU_RED*
- *MSK_DPAR_INTPNT_TOL_PATH*
- *MSK_DPAR_INTPNT_TOL_PFEAS*
- *MSK_DPAR_INTPNT_TOL_PSAFE*
- *MSK_DPAR_INTPNT_TOL_REL_GAP*
- *MSK_DPAR_INTPNT_TOL_REL_STEP*
- *MSK_DPAR_INTPNT_TOL_STEP_SIZE*
- *MSK_DPAR_QCQO_REFORMULATE_REL_DROP_TOL*

- *MSK_IPAR_BI_IGNORE_MAX_ITER*
- *MSK_IPAR_BI_IGNORE_NUM_ERROR*
- *MSK_IPAR_INTPNT_BASIS*
- *MSK_IPAR_INTPNT_DIFF_STEP*
- *MSK_IPAR_INTPNT_HOTSTART*
- *MSK_IPAR_INTPNT_MAX_ITERATIONS*
- *MSK_IPAR_INTPNT_MAX_NUM_COR*
- *MSK_IPAR_INTPNT_OFF_COL_TRH*
- *MSK_IPAR_INTPNT_ORDER_GP_NUM_SEEDS*
- *MSK_IPAR_INTPNT_ORDER_METHOD*
- *MSK_IPAR_INTPNT_REGULARIZATION_USE*
- *MSK_IPAR_INTPNT_SCALING*
- *MSK_IPAR_INTPNT_SOLVE_FORM*
- *MSK_IPAR_INTPNT_STARTING_POINT*
- *MSK_IPAR_LOG_INTPNT*

License manager

- *MSK_IPAR_CACHE_LICENSE*
- *MSK_IPAR_LICENSE_DEBUG*
- *MSK_IPAR_LICENSE_PAUSE_TIME*
- *MSK_IPAR_LICENSE_SUPPRESS_EXPIRE_WRNS*
- *MSK_IPAR_LICENSE_TRH_EXPIRY_WRN*
- *MSK_IPAR_LICENSE_WAIT*

Logging

- *MSK_IPAR_HEARTBEAT_SIM_FREQ_TICKS*
- *MSK_IPAR_LOG*
- *MSK_IPAR_LOG_ANA_PRO*
- *MSK_IPAR_LOG_BI*
- *MSK_IPAR_LOG_BI_FREQ*
- *MSK_IPAR_LOG_CUT_SECOND_OPT*
- *MSK_IPAR_LOG_EXPAND*
- *MSK_IPAR_LOG_FEAS_REPAIR*
- *MSK_IPAR_LOG_FILE*
- *MSK_IPAR_LOG_INCLUDE_SUMMARY*
- *MSK_IPAR_LOG_INFEAS_ANA*

- MSK_IPAR_LOG_INTPNT
- MSK_IPAR_LOG_LOCAL_INFO
- MSK_IPAR_LOG_MIO
- MSK_IPAR_LOG_MIO_FREQ
- MSK_IPAR_LOG_ORDER
- MSK_IPAR_LOG_PRESOLVE
- MSK_IPAR_LOG_SENSITIVITY
- MSK_IPAR_LOG_SENSITIVITY_OPT
- MSK_IPAR_LOG_SIM
- MSK_IPAR_LOG_SIM_FREQ
- MSK_IPAR_LOG_SIM_FREQ_GIGA_TICKS
- MSK_IPAR_LOG_STORAGE

Mixed-integer optimization

- MSK_DPAR_MIO_CLIQUE_TABLE_SIZE_FACTOR
- MSK_DPAR_MIO_DJC_MAX_BIGM
- MSK_DPAR_MIO_MAX_TIME
- MSK_DPAR_MIO_REL_GAP_CONST
- MSK_DPAR_MIO_TOL_ABS_GAP
- MSK_DPAR_MIO_TOL_ABS_RELAX_INT
- MSK_DPAR_MIO_TOL_FEAS
- MSK_DPAR_MIO_TOL_REL_DUAL_BOUND_IMPROVEMENT
- MSK_DPAR_MIO_TOL_REL_GAP
- MSK_IPAR_LOG_MIO
- MSK_IPAR_LOG_MIO_FREQ
- MSK_IPAR_MIO_BRANCH_DIR
- MSK_IPAR_MIO_CONFLICT_ANALYSIS_LEVEL
- MSK_IPAR_MIO_CONIC_OUTER_APPROXIMATION
- MSK_IPAR_MIO_CONSTRUCT_SOL
- MSK_IPAR_MIO_CROSSOVER_MAX_NODES
- MSK_IPAR_MIO_CUT_CLIQUE
- MSK_IPAR_MIO_CUT_CMIR
- MSK_IPAR_MIO_CUT_GMI
- MSK_IPAR_MIO_CUT_IMPLIED_BOUND
- MSK_IPAR_MIO_CUT_KNAPSACK_COVER
- MSK_IPAR_MIO_CUT_LIPRO

- *MSK_IPAR_MIO_CUT_SELECTION_LEVEL*
- *MSK_IPAR_MIO_DATA_PERMUTATION_METHOD*
- *MSK_IPAR_MIO_DUAL_RAY_ANALYSIS_LEVEL*
- *MSK_IPAR_MIO_FEASPUMP_LEVEL*
- *MSK_IPAR_MIO_HEURISTIC_LEVEL*
- *MSK_IPAR_MIO_INDEPENDENT_BLOCK_LEVEL*
- *MSK_IPAR_MIO_MAX_NUM_BRANCHES*
- *MSK_IPAR_MIO_MAX_NUM_RELAXS*
- *MSK_IPAR_MIO_MAX_NUM_RESTARTS*
- *MSK_IPAR_MIO_MAX_NUM_ROOT_CUT_ROUNDS*
- *MSK_IPAR_MIO_MAX_NUM_SOLUTIONS*
- *MSK_IPAR_MIO_MEMORY_EMPHASIS_LEVEL*
- *MSK_IPAR_MIO_MIN_REL*
- *MSK_IPAR_MIO_NODE_OPTIMIZER*
- *MSK_IPAR_MIO_NODE_SELECTION*
- *MSK_IPAR_MIO_NUMERICAL_EMPHASIS_LEVEL*
- *MSK_IPAR_MIO_OPT_FACE_MAX_NODES*
- *MSK_IPAR_MIO_PERSPECTIVE_REFORMULATE*
- *MSK_IPAR_MIO_PROBING_LEVEL*
- *MSK_IPAR_MIO_PROPAGATE_OBJECTIVE_CONSTRAINT*
- *MSK_IPAR_MIO_QCQO_REFORMULATION_METHOD*
- *MSK_IPAR_MIO_RENS_MAX_NODES*
- *MSK_IPAR_MIO_RINS_MAX_NODES*
- *MSK_IPAR_MIO_ROOT_OPTIMIZER*
- *MSK_IPAR_MIO_SEED*
- *MSK_IPAR_MIO_SYMMETRY_LEVEL*
- *MSK_IPAR_MIO_VAR_SELECTION*
- *MSK_IPAR_MIO_VB_DETECTION_LEVEL*

Output information

- *MSK_IPAR_HEARTBEAT_SIM_FREQ_TICKS*
- *MSK_IPAR_INFEAS_REPORT_LEVEL*
- *MSK_IPAR_LICENSE_SUPPRESS_EXPIRE_WRNS*
- *MSK_IPAR_LICENSE_TRH_EXPIRY_WRN*
- *MSK_IPAR_LOG*
- *MSK_IPAR_LOG_BI*
- *MSK_IPAR_LOG_BI_FREQ*
- *MSK_IPAR_LOG_CUT_SECOND_OPT*
- *MSK_IPAR_LOG_EXPAND*
- *MSK_IPAR_LOG_FEAS_REPAIR*
- *MSK_IPAR_LOG_FILE*
- *MSK_IPAR_LOG_INCLUDE_SUMMARY*
- *MSK_IPAR_LOG_INFEAS_ANA*
- *MSK_IPAR_LOG_INTPNT*
- *MSK_IPAR_LOG_LOCAL_INFO*
- *MSK_IPAR_LOG_MIO*
- *MSK_IPAR_LOG_MIO_FREQ*
- *MSK_IPAR_LOG_ORDER*
- *MSK_IPAR_LOG_SENSITIVITY*
- *MSK_IPAR_LOG_SENSITIVITY_OPT*
- *MSK_IPAR_LOG_SIM*
- *MSK_IPAR_LOG_SIM_FREQ*
- *MSK_IPAR_LOG_SIM_FREQ_GIGA_TICKS*
- *MSK_IPAR_LOG_STORAGE*
- *MSK_IPAR_MAX_NUM_WARNINGS*

Overall solver

- *MSK_IPAR_BI_CLEAN_OPTIMIZER*
- *MSK_IPAR_LICENSE_WAIT*
- *MSK_IPAR_MIO_MODE*
- *MSK_IPAR_OPTIMIZER*
- *MSK_IPAR_PRESOLVE_MAX_NUM_REDUCTIONS*
- *MSK_IPAR_PRESOLVE_USE*
- *MSK_IPAR_PRIMAL_REPAIR_OPTIMIZER*
- *MSK_IPAR_SENSITIVITY_ALL*
- *MSK_IPAR_SENSITIVITY_TYPE*
- *MSK_IPAR_SIM_PRECISION*

Overall system

- *MSK_IPAR_AUTO_UPDATE_SOL_INFO*
- *MSK_IPAR_LICENSE_WAIT*
- *MSK_IPAR_LOG_STORAGE*
- *MSK_IPAR_MT_SPINCOUNT*
- *MSK_IPAR_NUM_THREADS*
- *MSK_IPAR_REMOVE_UNUSED_SOLUTIONS*
- *MSK_IPAR_TIMING_LEVEL*
- *MSK_SPAR_REMOTE_OPTSERVER_HOST*
- *MSK_SPAR_REMOTE_TLS_CERT*
- *MSK_SPAR_REMOTE_TLS_CERT_PATH*

Presolve

- *MSK_DPAR_FOLDING_TOL_EQ*
- *MSK_DPAR_PRESOLVE_TOL_ABS_LINDEP*
- *MSK_DPAR_PRESOLVE_TOL_PRIMAL_INFEAS_PERTURBATION*
- *MSK_DPAR_PRESOLVE_TOL_REL_LINDEP*
- *MSK_DPAR_PRESOLVE_TOL_S*
- *MSK_DPAR_PRESOLVE_TOL_X*
- *MSK_IPAR_FOLDING_USE*
- *MSK_IPAR_MIO_PRESOLVE_AGGREGATOR_USE*
- *MSK_IPAR_PRESOLVE_ELIMINATOR_MAX_FILL*
- *MSK_IPAR_PRESOLVE_ELIMINATOR_MAX_NUM_TRIES*
- *MSK_IPAR_PRESOLVE_LINDEP_ABS_WORK_TRH*
- *MSK_IPAR_PRESOLVE_LINDEP_NEW*
- *MSK_IPAR_PRESOLVE_LINDEP_REL_WORK_TRH*
- *MSK_IPAR_PRESOLVE_LINDEP_USE*
- *MSK_IPAR_PRESOLVE_MAX_NUM_PASS*
- *MSK_IPAR_PRESOLVE_MAX_NUM_REDUCTIONS*
- *MSK_IPAR_PRESOLVE_USE*

Primal simplex

- *MSK_IPAR_SIM_PRIMAL_CRASH*
- *MSK_IPAR_SIM_PRIMAL_RESTRICT_SELECTION*
- *MSK_IPAR_SIM_PRIMAL_SELECTION*

Simplex optimizer

- *MSK_DPAR_BASIS_REL_TOL_S*
- *MSK_DPAR_BASIS_TOL_S*
- *MSK_DPAR_BASIS_TOL_X*
- *MSK_DPAR_SIM_LU_TOL_REL_PIV*
- *MSK_DPAR_SIM_PRECISION_SCALING_EXTENDED*
- *MSK_DPAR_SIM_PRECISION_SCALING_NORMAL*
- *MSK_DPAR_SIMPLEX_ABS_TOL_PIV*
- *MSK_IPAR_BASIS_SOLVE_USE_PLUS_ONE*
- *MSK_IPAR_HEARTBEAT_SIM_FREQ_TICKS*
- *MSK_IPAR_LOG_SIM*
- *MSK_IPAR_LOG_SIM_FREQ*
- *MSK_IPAR_LOG_SIM_FREQ_GIGA_TICKS*
- *MSK_IPAR_SIM_BASIS_FACTOR_USE*
- *MSK_IPAR_SIM_DEGEN*
- *MSK_IPAR_SIM_DETECT_PWL*
- *MSK_IPAR_SIM_DUAL_PHASEONE_METHOD*
- *MSK_IPAR_SIM_EXPLOIT_DUPVEC*
- *MSK_IPAR_SIM_HOTSTART*
- *MSK_IPAR_SIM_HOTSTART_LU*
- *MSK_IPAR_SIM_MAX_ITERATIONS*
- *MSK_IPAR_SIM_MAX_NUM_SETBACKS*
- *MSK_IPAR_SIM_NON_SINGULAR*
- *MSK_IPAR_SIM_PRECISION_BOOST*
- *MSK_IPAR_SIM_PRIMAL_PHASEONE_METHOD*
- *MSK_IPAR_SIM_REFACTOR_FREQ*
- *MSK_IPAR_SIM_REFORMULATION*
- *MSK_IPAR_SIM_SAVE_LU*
- *MSK_IPAR_SIM_SCALING*
- *MSK_IPAR_SIM_SCALING_METHOD*
- *MSK_IPAR_SIM_SEED*
- *MSK_IPAR_SIM_SOLVE_FORM*
- *MSK_IPAR_SIM_SWITCH_OPTIMIZER*

Solution input/output

- *MSK_IPAR_INFEAS_REPORT_AUTO*
- *MSK_IPAR_SOL_FILTER_KEEP_BASIC*
- *MSK_IPAR_SOL_READ_NAME_WIDTH*
- *MSK_IPAR_SOL_READ_WIDTH*
- *MSK_IPAR_WRITE_BAS_CONSTRAINTS*
- *MSK_IPAR_WRITE_BAS_HEAD*
- *MSK_IPAR_WRITE_BAS_VARIABLES*
- *MSK_IPAR_WRITE_INT_CONSTRAINTS*
- *MSK_IPAR_WRITE_INT_HEAD*
- *MSK_IPAR_WRITE_INT_VARIABLES*
- *MSK_IPAR_WRITE_SOL_BARVARIABLES*
- *MSK_IPAR_WRITE_SOL_CONSTRAINTS*
- *MSK_IPAR_WRITE_SOL_HEAD*
- *MSK_IPAR_WRITE_SOL_IGNORE_INVALID_NAMES*
- *MSK_IPAR_WRITE_SOL_VARIABLES*
- *MSK_SPAR_BAS_SOL_FILE_NAME*
- *MSK_SPAR_INT_SOL_FILE_NAME*
- *MSK_SPAR_ITR_SOL_FILE_NAME*
- *MSK_SPAR_SOL_FILTER_XC_LOW*
- *MSK_SPAR_SOL_FILTER_XC_UPR*
- *MSK_SPAR_SOL_FILTER_XX_LOW*
- *MSK_SPAR_SOL_FILTER_XX_UPR*

Termination criteria

- *MSK_DPAR_BASIS_REL_TOL_S*
- *MSK_DPAR_BASIS_TOL_S*
- *MSK_DPAR_BASIS_TOL_X*
- *MSK_DPAR_INTPNT_CO_TOL_DFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_INFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_MU_RED*
- *MSK_DPAR_INTPNT_CO_TOL_NEAR_REL*
- *MSK_DPAR_INTPNT_CO_TOL_PFEAS*
- *MSK_DPAR_INTPNT_CO_TOL_REL_GAP*
- *MSK_DPAR_INTPNT_QO_TOL_DFEAS*
- *MSK_DPAR_INTPNT_QO_TOL_INFEAS*

- *MSK_DPAR_INTPNT_QO_TOL_MU_RED*
- *MSK_DPAR_INTPNT_QO_TOL_NEAR_REL*
- *MSK_DPAR_INTPNT_QO_TOL_PFEAS*
- *MSK_DPAR_INTPNT_QO_TOL_REL_GAP*
- *MSK_DPAR_INTPNT_TOL_DFEAS*
- *MSK_DPAR_INTPNT_TOL_INFEAS*
- *MSK_DPAR_INTPNT_TOL_MU_RED*
- *MSK_DPAR_INTPNT_TOL_PFEAS*
- *MSK_DPAR_INTPNT_TOL_REL_GAP*
- *MSK_DPAR_LOWER_OBJ_CUT*
- *MSK_DPAR_LOWER_OBJ_CUT_FINITE_TRH*
- *MSK_DPAR_MIO_MAX_TIME*
- *MSK_DPAR_MIO_REL_GAP_CONST*
- *MSK_DPAR_MIO_TOL_REL_GAP*
- *MSK_DPAR_OPTIMIZER_MAX_TICKS*
- *MSK_DPAR_OPTIMIZER_MAX_TIME*
- *MSK_DPAR_SIM_PRECISION_SCALING_EXTENDED*
- *MSK_DPAR_SIM_PRECISION_SCALING_NORMAL*
- *MSK_DPAR_UPPER_OBJ_CUT*
- *MSK_DPAR_UPPER_OBJ_CUT_FINITE_TRH*
- *MSK_IPAR_BI_MAX_ITERATIONS*
- *MSK_IPAR_INTPNT_MAX_ITERATIONS*
- *MSK_IPAR_MIO_MAX_NUM_BRANCHES*
- *MSK_IPAR_MIO_MAX_NUM_ROOT_CUT_ROUNDS*
- *MSK_IPAR_MIO_MAX_NUM_SOLUTIONS*
- *MSK_IPAR_SIM_MAX_ITERATIONS*

Other

- *MSK_IPAR_COMPRESS_STATFILE*
- *MSK_IPAR_GETDUAL_CONVERT_LMIS*
- *MSK_IPAR_NG*
- *MSK_IPAR_REMOTE_USE_COMPRESSION*

10.3 Parameters (alphabetical list sorted by type)

- *Double parameters*
- *Integer parameters*
- *String parameters*

10.3.1 Double parameters

`MSK_DPAR_ANA_SOL_INFEAS_TOL`

If a constraint violates its bound with an amount larger than this value, the constraint name, index and violation will be printed by the solution analyzer.

Default
1e-6

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_ANA_SOL_INFEAS_TOL 1e-6 file`

Groups
Analysis

`MSK_DPAR_BASIS_REL_TOL_S`

Maximum relative dual bound violation allowed in an optimal basic solution.

Default
1.0e-12

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_BASIS_REL_TOL_S 1.0e-12 file`

Groups
Simplex optimizer, *Termination criteria*

`MSK_DPAR_BASIS_TOL_S`

Maximum absolute dual bound violation in an optimal basic solution.

Default
1.0e-6

Accepted
[1.0e-9; +inf]

Example
`mosek -d MSK_DPAR_BASIS_TOL_S 1.0e-6 file`

Groups
Simplex optimizer, *Termination criteria*

`MSK_DPAR_BASIS_TOL_X`

Maximum absolute primal bound violation allowed in an optimal basic solution.

Default
1.0e-6

Accepted
[1.0e-9; +inf]

Example
`mosek -d MSK_DPAR_BASIS_TOL_X 1.0e-6 file`

Groups
Simplex optimizer, *Termination criteria*

`MSK_DPAR_DATA_SYM_MAT_TOL`

Absolute zero tolerance for elements in in symmetric matrices. If any value in a symmetric matrix is smaller than this parameter in absolute terms **MOSEK** will treat the values as zero and generate a warning.

Default
1.0e-12

Accepted
[1.0e-16; 1.0e-6]

Example
`mosek -d MSK_DPAR_DATA_SYM_MAT_TOL 1.0e-12 file`

Groups
Data check

`MSK_DPAR_DATA_SYM_MAT_TOL_HUGE`

An element in a symmetric matrix which is larger than this value in absolute size causes an error.

Default
1.0e20

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_DATA_SYM_MAT_TOL_HUGE 1.0e20 file`

Groups
Data check

`MSK_DPAR_DATA_SYM_MAT_TOL_LARGE`

An element in a symmetric matrix which is larger than this value in absolute size causes a warning message to be printed.

Default
1.0e10

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_DATA_SYM_MAT_TOL_LARGE 1.0e10 file`

Groups
Data check

`MSK_DPAR_DATA_TOL_AIJ_HUGE`

An element in A which is larger than this value in absolute size causes an error.

Default
1.0e20

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_DATA_TOL_AIJ_HUGE 1.0e20 file`

Groups
Data check

`MSK_DPAR_DATA_TOL_AIJ_LARGE`

An element in A which is larger than this value in absolute size causes a warning message to be printed.

Default
1.0e10

Accepted
[0.0; +inf]

Example

`mosek -d MSK_DPAR_DATA_TOL_AIJ_LARGE 1.0e10 file`

Groups

Data check

`MSK_DPAR_DATA_TOL_BOUND_INF`

Any bound which in absolute value is greater than this parameter is considered infinite.

Default

1.0e16

Accepted

[0.0; +inf]

Example

`mosek -d MSK_DPAR_DATA_TOL_BOUND_INF 1.0e16 file`

Groups

Data check

`MSK_DPAR_DATA_TOL_BOUND_WRN`

If a bound value is larger than this value in absolute size, then a warning message is issued.

Default

1.0e8

Accepted

[0.0; +inf]

Example

`mosek -d MSK_DPAR_DATA_TOL_BOUND_WRN 1.0e8 file`

Groups

Data check

`MSK_DPAR_DATA_TOL_C_HUGE`

An element in c which is larger than the value of this parameter in absolute terms is considered to be huge and generates an error.

Default

1.0e16

Accepted

[0.0; +inf]

Example

`mosek -d MSK_DPAR_DATA_TOL_C_HUGE 1.0e16 file`

Groups

Data check

`MSK_DPAR_DATA_TOL_CJ_LARGE`

An element in c which is larger than this value in absolute terms causes a warning message to be printed.

Default

1.0e8

Accepted

[0.0; +inf]

Example

`mosek -d MSK_DPAR_DATA_TOL_CJ_LARGE 1.0e8 file`

Groups

Data check

MSK_DPAR_DATA_TOL_QIJ

Absolute zero tolerance for elements in Q matrices.

Default
1.0e-16

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_DATA_TOL_QIJ 1.0e-16 file`

Groups
Data check

MSK_DPAR_DATA_TOL_X

Zero tolerance for constraints and variables i.e. if the distance between the lower and upper bound is less than this value, then the lower and upper bound is considered identical.

Default
1.0e-8

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_DATA_TOL_X 1.0e-8 file`

Groups
Data check

MSK_DPAR_FOLDING_TOL_EQ

Tolerance for coefficient equality during folding.

Default
1e-9

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_FOLDING_TOL_EQ 1e-9 file`

Groups
Presolve

MSK_DPAR_INTPNT_CO_TOL_DFEAS

Dual feasibility tolerance used by the interior-point optimizer for conic problems.

Default
1.0e-8

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_CO_TOL_DFEAS 1.0e-8 file`

See also
MSK_DPAR_INTPNT_CO_TOL_NEAR_REL

Groups
Interior-point method, *Termination criteria*, *Conic interior-point method*

MSK_DPAR_INTPNT_CO_TOL_INFEAS

Infeasibility tolerance used by the interior-point optimizer for conic problems. Controls when the interior-point optimizer declares the model primal or dual infeasible. A small number means the optimizer gets more conservative about declaring the model infeasible.

Default
1.0e-12

Accepted
: [0.0; 1.0]

Example
: `mosek -d MSK_DPAR_INTPNT_CO_TOL_INFEAS 1.0e-12 file`

Groups
: *Interior-point method*, *Termination criteria*, *Conic interior-point method*

`MSK_DPAR_INTPNT_CO_TOL_MU_RED`

Relative complementarity gap tolerance used by the interior-point optimizer for conic problems.

Default
: 1.0e-8

Accepted
: [0.0; 1.0]

Example
: `mosek -d MSK_DPAR_INTPNT_CO_TOL_MU_RED 1.0e-8 file`

Groups
: *Interior-point method*, *Termination criteria*, *Conic interior-point method*

`MSK_DPAR_INTPNT_CO_TOL_NEAR_REL`

Optimality tolerance used by the interior-point optimizer for conic problems. If **MOSEK** cannot compute a solution that has the prescribed accuracy then it will check if the solution found satisfies the termination criteria with all tolerances multiplied by the value of this parameter. If yes, then the solution is also declared optimal.

Default
: 1000

Accepted
: [1.0; +inf]

Example
: `mosek -d MSK_DPAR_INTPNT_CO_TOL_NEAR_REL 1000 file`

Groups
: *Interior-point method*, *Termination criteria*, *Conic interior-point method*

`MSK_DPAR_INTPNT_CO_TOL_PFEAS`

Primal feasibility tolerance used by the interior-point optimizer for conic problems.

Default
: 1.0e-8

Accepted
: [0.0; 1.0]

Example
: `mosek -d MSK_DPAR_INTPNT_CO_TOL_PFEAS 1.0e-8 file`

See also
: *MSK_DPAR_INTPNT_CO_TOL_NEAR_REL*

Groups
: *Interior-point method*, *Termination criteria*, *Conic interior-point method*

`MSK_DPAR_INTPNT_CO_TOL_REL_GAP`

Relative gap termination tolerance used by the interior-point optimizer for conic problems.

Default
: 1.0e-8

Accepted
: [0.0; 1.0]

Example
: `mosek -d MSK_DPAR_INTPNT_CO_TOL_REL_GAP 1.0e-8 file`

See also

MSK_DPAR_INTPNT_CO_TOL_NEAR_REL

Groups

Interior-point method, *Termination criteria*, *Conic interior-point method*

`MSK_DPAR_INTPNT_QO_TOL_DFEAS`

Dual feasibility tolerance used by the interior-point optimizer for quadratic problems.

Default

1.0e-8

Accepted

[0.0; 1.0]

Example

`mosek -d MSK_DPAR_INTPNT_QO_TOL_DFEAS 1.0e-8 file`

See also

MSK_DPAR_INTPNT_QO_TOL_NEAR_REL

Groups

Interior-point method, *Termination criteria*

`MSK_DPAR_INTPNT_QO_TOL_INFEAS`

Infeasibility tolerance used by the interior-point optimizer for quadratic problems. Controls when the interior-point optimizer declares the model primal or dual infeasible. A small number means the optimizer gets more conservative about declaring the model infeasible.

Default

1.0e-12

Accepted

[0.0; 1.0]

Example

`mosek -d MSK_DPAR_INTPNT_QO_TOL_INFEAS 1.0e-12 file`

Groups

Interior-point method, *Termination criteria*

`MSK_DPAR_INTPNT_QO_TOL_MU_RED`

Relative complementarity gap tolerance used by the interior-point optimizer for quadratic problems.

Default

1.0e-8

Accepted

[0.0; 1.0]

Example

`mosek -d MSK_DPAR_INTPNT_QO_TOL_MU_RED 1.0e-8 file`

Groups

Interior-point method, *Termination criteria*

`MSK_DPAR_INTPNT_QO_TOL_NEAR_REL`

Optimality tolerance used by the interior-point optimizer for quadratic problems. If **MOSEK** cannot compute a solution that has the prescribed accuracy then it will check if the solution found satisfies the termination criteria with all tolerances multiplied by the value of this parameter. If yes, then the solution is also declared optimal.

Default

1000

Accepted

[1.0; +inf]

Example

`mosek -d MSK_DPAR_INTPNT_QO_TOL_NEAR_REL 1000 file`

Groups

Interior-point method, *Termination criteria*

MSK_DPAR_INTPNT_QO_TOL_PFEAS

Primal feasibility tolerance used by the interior-point optimizer for quadratic problems.

Default
1.0e-8

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_QO_TOL_PFEAS 1.0e-8 file`

See also
MSK_DPAR_INTPNT_QO_TOL_NEAR_REL

Groups
Interior-point method, *Termination criteria*

MSK_DPAR_INTPNT_QO_TOL_REL_GAP

Relative gap termination tolerance used by the interior-point optimizer for quadratic problems.

Default
1.0e-8

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_QO_TOL_REL_GAP 1.0e-8 file`

See also
MSK_DPAR_INTPNT_QO_TOL_NEAR_REL

Groups
Interior-point method, *Termination criteria*

MSK_DPAR_INTPNT_TOL_DFEAS

Dual feasibility tolerance used by the interior-point optimizer for linear problems.

Default
1.0e-8

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_DFEAS 1.0e-8 file`

Groups
Interior-point method, *Termination criteria*

MSK_DPAR_INTPNT_TOL_DSAFE

Controls the initial dual starting point used by the interior-point optimizer. If the interior-point optimizer converges slowly and/or the constraint or variable bounds are very large, then it might be worthwhile to increase this value.

Default
1.0

Accepted
[1.0e-4; +inf]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_DSAFE 1.0 file`

Groups
Interior-point method

MSK_DPAR_INTPNT_TOL_INFEAS

Infeasibility tolerance used by the interior-point optimizer for linear problems. Controls when the interior-point optimizer declares the model primal or dual infeasible. A small number means the optimizer gets more conservative about declaring the model infeasible.

Default
1.0e-10

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_INFEAS 1.0e-10 file`

Groups
Interior-point method, *Termination criteria*

`MSK_DPAR_INTPNT_TOL_MU_RED`

Relative complementarity gap tolerance used by the interior-point optimizer for linear problems.

Default
1.0e-16

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_MU_RED 1.0e-16 file`

Groups
Interior-point method, *Termination criteria*

`MSK_DPAR_INTPNT_TOL_PATH`

Controls how close the interior-point optimizer follows the central path. A large value of this parameter means the central path is followed very closely. On numerically unstable problems it may be worthwhile to increase this parameter.

Default
1.0e-8

Accepted
[0.0; 0.9999]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_PATH 1.0e-8 file`

Groups
Interior-point method

`MSK_DPAR_INTPNT_TOL_PFEAS`

Primal feasibility tolerance used by the interior-point optimizer for linear problems.

Default
1.0e-8

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_PFEAS 1.0e-8 file`

Groups
Interior-point method, *Termination criteria*

`MSK_DPAR_INTPNT_TOL_PSAFE`

Controls the initial primal starting point used by the interior-point optimizer. If the interior-point optimizer converges slowly and/or the constraint or variable bounds are very large, then it may be worthwhile to increase this value.

Default
1.0

Accepted
[1.0e-4; +inf]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_PSAFE 1.0 file`

Groups
Interior-point method

`MSK_DPAR_INTPNT_TOL_REL_GAP`

Relative gap termination tolerance used by the interior-point optimizer for linear problems.

Default
1.0e-8

Accepted
[1.0e-14; +inf]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_REL_GAP 1.0e-8 file`

Groups
Termination criteria, *Interior-point method*

`MSK_DPAR_INTPNT_TOL_REL_STEP`

Relative step size to the boundary for linear and quadratic optimization problems.

Default
0.9999

Accepted
[1.0e-4; 0.999999]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_REL_STEP 0.9999 file`

Groups
Interior-point method

`MSK_DPAR_INTPNT_TOL_STEP_SIZE`

Minimal step size tolerance. If the step size falls below the value of this parameter, then the interior-point optimizer assumes that it is stalled. In other words the interior-point optimizer does not make any progress and therefore it is better to stop.

Default
1.0e-6

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_INTPNT_TOL_STEP_SIZE 1.0e-6 file`

Groups
Interior-point method

`MSK_DPAR_LOWER_OBJ_CUT`

If either a primal or dual feasible solution is found proving that the optimal objective value is outside the interval [*MSK_DPAR_LOWER_OBJ_CUT*, *MSK_DPAR_UPPER_OBJ_CUT*], then **MOSEK** is terminated.

Default
-INFINITY

Accepted
[-inf; +inf]

Example
`mosek -d MSK_DPAR_LOWER_OBJ_CUT -INFINITY file`

See also
MSK_DPAR_LOWER_OBJ_CUT_FINITE_TRH

Groups
Termination criteria

`MSK_DPAR_LOWER_OBJ_CUT_FINITE_TRH`

If the lower objective cut is less than the value of this parameter value, then the lower objective cut i.e. *MSK_DPAR_LOWER_OBJ_CUT* is treated as $-\infty$.

Default
-0.5e30

Accepted
[-inf; +inf]

Example
`mosek -d MSK_DPAR_LOWER_OBJ_CUT_FINITE_TRH -0.5e30 file`

Groups
Termination criteria

`MSK_DPAR_MIO_CLIQUE_TABLE_SIZE_FACTOR`

Controlls the maximum size of the clique table as a factor of the number of nonzeros in the A matrix. A negative value implies **MOSEK** decides.

Default
-1

Accepted
[-1; +inf]

Example
`mosek -d MSK_DPAR_MIO_CLIQUE_TABLE_SIZE_FACTOR -1 file`

Groups
Mixed-integer optimization

`MSK_DPAR_MIO_DJC_MAX_BIGM`

Maximum allowed big-M value when reformulating disjunctive constraints to linear constraints. Higher values make it more likely that a disjunction is reformulated to linear constraints, but also increase the risk of numerical problems.

Default
1.0e6

Accepted
[0; +inf]

Example
`mosek -d MSK_DPAR_MIO_DJC_MAX_BIGM 1.0e6 file`

Groups
Mixed-integer optimization

`MSK_DPAR_MIO_MAX_TIME`

This parameter limits the maximum time spent by the mixed-integer optimizer (in seconds). A negative number means infinity.

Default
-1.0

Accepted
[-inf; +inf]

Example
`mosek -d MSK_DPAR_MIO_MAX_TIME -1.0 file`

Groups
Mixed-integer optimization, *Termination criteria*

`MSK_DPAR_MIO_REL_GAP_CONST`

This value is used to compute the relative gap for the solution to an integer optimization problem.

Default
1.0e-10

Accepted
[1.0e-15; +inf]

Example
`mosek -d MSK_DPAR_MIO_REL_GAP_CONST 1.0e-10 file`

Groups
Mixed-integer optimization, *Termination criteria*

`MSK_DPAR_MIO_TOL_ABS_GAP`

Absolute optimality tolerance employed by the mixed-integer optimizer.

Default
0.0

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_MIO_TOL_ABS_GAP 0.0 file`

Groups
Mixed-integer optimization

`MSK_DPAR_MIO_TOL_ABS_RELAX_INT`

Absolute integer feasibility tolerance. If the distance to the nearest integer is less than this tolerance then an integer constraint is assumed to be satisfied.

Default
1.0e-5

Accepted
[1e-9; +inf]

Example
`mosek -d MSK_DPAR_MIO_TOL_ABS_RELAX_INT 1.0e-5 file`

Groups
Mixed-integer optimization

`MSK_DPAR_MIO_TOL_FEAS`

Feasibility tolerance for mixed integer solver.

Default
1.0e-6

Accepted
[1e-9; 1e-3]

Example
`mosek -d MSK_DPAR_MIO_TOL_FEAS 1.0e-6 file`

Groups
Mixed-integer optimization

`MSK_DPAR_MIO_TOL_REL_DUAL_BOUND_IMPROVEMENT`

If the relative improvement of the dual bound is smaller than this value, the solver will terminate the root cut generation. A value of 0.0 means that the value is selected automatically.

Default
0.0

Accepted
[0.0; 1.0]

Example
`mosek -d MSK_DPAR_MIO_TOL_REL_DUAL_BOUND_IMPROVEMENT 0.0 file`

Groups
Mixed-integer optimization

MSK_DPAR_MIO_TOL_REL_GAP

Relative optimality tolerance employed by the mixed-integer optimizer.

Default
: 1.0e-4

Accepted
: [0.0; +inf]

Example
: `mosek -d MSK_DPAR_MIO_TOL_REL_GAP 1.0e-4 file`

Groups
: *Mixed-integer optimization*, *Termination criteria*

MSK_DPAR_OPTIMIZER_MAX_TICKS

CURRENTLY NOT IN USE.

Maximum amount of ticks the optimizer is allowed to spent on the optimization. A negative number means infinity.

Default
: -1.0

Accepted
: [-inf; +inf]

Example
: `mosek -d MSK_DPAR_OPTIMIZER_MAX_TICKS -1.0 file`

Groups
: *Termination criteria*

MSK_DPAR_OPTIMIZER_MAX_TIME

Maximum amount of time the optimizer is allowed to spent on the optimization (in seconds). A negative number means infinity.

Default
: -1.0

Accepted
: [-inf; +inf]

Example
: `mosek -d MSK_DPAR_OPTIMIZER_MAX_TIME -1.0 file`

Groups
: *Termination criteria*

MSK_DPAR_PRESOLVE_TOL_ABS_LINDEP

Absolute tolerance employed by the linear dependency checker.

Default
: 1.0e-6

Accepted
: [0.0; +inf]

Example
: `mosek -d MSK_DPAR_PRESOLVE_TOL_ABS_LINDEP 1.0e-6 file`

Groups
: *Presolve*

MSK_DPAR_PRESOLVE_TOL_PRIMAL_INFEAS_PERTURBATION

The presolve is allowed to perturb a bound on a constraint or variable by this amount if it removes an infeasibility.

Default
: 1.0e-6

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_PRESOLVE_TOL_PRIMAL_INFEAS_PERTURBATION 1.0e-6 file`

Groups
Presolve

`MSK_DPAR_PRESOLVE_TOL_REL_LINDEP`

Relative tolerance employed by the linear dependency checker.

Default
1.0e-10

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_PRESOLVE_TOL_REL_LINDEP 1.0e-10 file`

Groups
Presolve

`MSK_DPAR_PRESOLVE_TOL_S`

Absolute zero tolerance employed for s_i in the presolve.

Default
1.0e-8

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_PRESOLVE_TOL_S 1.0e-8 file`

Groups
Presolve

`MSK_DPAR_PRESOLVE_TOL_X`

Absolute zero tolerance employed for x_j in the presolve.

Default
1.0e-8

Accepted
[0.0; +inf]

Example
`mosek -d MSK_DPAR_PRESOLVE_TOL_X 1.0e-8 file`

Groups
Presolve

`MSK_DPAR_QCQO_REFORMULATE_REL_DROP_TOL`

This parameter determines when columns are dropped in incomplete Cholesky factorization during reformulation of quadratic problems.

Default
1e-15

Accepted
[0; +inf]

Example
`mosek -d MSK_DPAR_QCQO_REFORMULATE_REL_DROP_TOL 1e-15 file`

Groups
Interior-point method

MSK_DPAR_SEMIDEFINITE_TOL_APPROX

Tolerance to define a matrix to be positive semidefinite.

Default
1.0e-10

Accepted
[1.0e-15; +inf]

Example
`mosek -d MSK_DPAR_SEMIDEFINITE_TOL_APPROX 1.0e-10 file`

Groups
Data check

MSK_DPAR_SIM_LU_TOL_REL_PIV

Relative pivot tolerance employed when computing the LU factorization of the basis in the simplex optimizers and in the basis identification procedure. A value closer to 1.0 generally improves numerical stability but typically also implies an increase in the computational work.

Default
0.01

Accepted
[1.0e-6; 0.999999]

Example
`mosek -d MSK_DPAR_SIM_LU_TOL_REL_PIV 0.01 file`

Groups
Basis identification, *Simplex optimizer*

MSK_DPAR_SIM_PRECISION_SCALING_EXTENDED

Experimental. Usage not recommended.

Default
2.0

Accepted
[1.0; +inf]

Example
`mosek -d MSK_DPAR_SIM_PRECISION_SCALING_EXTENDED 2.0 file`

Groups
Simplex optimizer, *Termination criteria*

MSK_DPAR_SIM_PRECISION_SCALING_NORMAL

Experimental. Usage not recommended.

Default
1.0

Accepted
[1.0; +inf]

Example
`mosek -d MSK_DPAR_SIM_PRECISION_SCALING_NORMAL 1.0 file`

Groups
Simplex optimizer, *Termination criteria*

MSK_DPAR_SIMPLEX_ABS_TOL_PIV

Absolute pivot tolerance employed by the simplex optimizers.

Default
1.0e-7

Accepted
[1.0e-12; +inf]

Example

mosek -d MSK_DPAR_SIMPLEX_ABS_TOL_PIV 1.0e-7 file

Groups

Simplex optimizer

MSK_DPAR_UPPER_OBJ_CUT

If either a primal or dual feasible solution is found proving that the optimal objective value is outside the interval [*MSK_DPAR_LOWER_OBJ_CUT*, *MSK_DPAR_UPPER_OBJ_CUT*], then **MOSEK** is terminated.

Default

INFINITY

Accepted

[-inf; +inf]

Example

mosek -d MSK_DPAR_UPPER_OBJ_CUT INFINITY file

See also

MSK_DPAR_UPPER_OBJ_CUT_FINITE_TRH

Groups

Termination criteria

MSK_DPAR_UPPER_OBJ_CUT_FINITE_TRH

If the upper objective cut is greater than the value of this parameter, then the upper objective cut *MSK_DPAR_UPPER_OBJ_CUT* is treated as ∞.

Default

0.5e30

Accepted

[-inf; +inf]

Example

mosek -d MSK_DPAR_UPPER_OBJ_CUT_FINITE_TRH 0.5e30 file

Groups

Termination criteria

10.3.2 Integer parameters

MSK_IPAR_ANA_SOL_BASIS

Controls whether the basis matrix is analyzed in solution analyzer.

Default

ON

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_ANA_SOL_BASIS MSK_ON file

Groups

Analysis

MSK_IPAR_ANA_SOL_PRINT_VIOLATED

A parameter of the problem analyzer. Controls whether a list of violated constraints is printed. All constraints violated by more than the value set by the parameter *MSK_DPAR_ANA_SOL_INFEAS_TOL* will be printed.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_ANA_SOL_PRINT_VIOLATED MSK_OFF file

Groups

Analysis

MSK_IPAR_AUTO_SORT_A_BEFORE_OPT

Controls whether the elements in each column of A are sorted before an optimization is performed. This is not required but makes the optimization more deterministic.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_AUTO_SORT_A_BEFORE_OPT MSK_OFF file

Groups

Debugging

MSK_IPAR_AUTO_UPDATE_SOL_INFO

Controls whether the solution information items are automatically updated after an optimization is performed.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_AUTO_UPDATE_SOL_INFO MSK_OFF file

Groups

Overall system

MSK_IPAR_BASIS_SOLVE_USE_PLUS_ONE

If a slack variable is in the basis, then the corresponding column in the basis is a unit vector with -1 in the right position. However, if this parameter is set to *MSK_ON*, -1 is replaced by 1.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_BASIS_SOLVE_USE_PLUS_ONE MSK_OFF file

Groups

Simplex optimizer

MSK_IPAR_BI_CLEAN_OPTIMIZER

Controls which simplex optimizer is used in the clean-up phase. Anything else than *MSK_OPTIMIZER_PRIMAL_SIMPLEX* or *MSK_OPTIMIZER_DUAL_SIMPLEX* is equivalent to *MSK_OPTIMIZER_FREE_SIMPLEX*.

Default

FREE

Accepted

FREE, *INTPNT*, *CONIC*, *PRIMAL_SIMPLEX*, *DUAL_SIMPLEX*, *NEW_PRIMAL_SIMPLEX*, *NEW_DUAL_SIMPLEX*, *FREE_SIMPLEX*, *MIXED_INT*

Example

mosek -d MSK_IPAR_BI_CLEAN_OPTIMIZER MSK_OPTIMIZER_FREE file

Groups

Basis identification, *Overall solver*

`MSK_IPAR_BI_IGNORE_MAX_ITER`

If the parameter *MSK_IPAR_INTPNT_BASIS* has the value *MSK_BI_NO_ERROR* and the interior-point optimizer has terminated due to maximum number of iterations, then basis identification is performed if this parameter has the value *MSK_ON*.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_BI_IGNORE_MAX_ITER MSK_OFF file`

Groups
Interior-point method, *Basis identification*

`MSK_IPAR_BI_IGNORE_NUM_ERROR`

If the parameter *MSK_IPAR_INTPNT_BASIS* has the value *MSK_BI_NO_ERROR* and the interior-point optimizer has terminated due to a numerical problem, then basis identification is performed if this parameter has the value *MSK_ON*.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_BI_IGNORE_NUM_ERROR MSK_OFF file`

Groups
Interior-point method, *Basis identification*

`MSK_IPAR_BI_MAX_ITERATIONS`

Controls the maximum number of simplex iterations allowed to optimize a basis after the basis identification.

Default
1000000

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_BI_MAX_ITERATIONS 1000000 file`

Groups
Basis identification, *Termination criteria*

`MSK_IPAR_CACHE_LICENSE`

Specifies if the license is kept checked out for the lifetime of the **MOSEK** environment/model/process (*MSK_ON*) or returned to the server immediately after the optimization (*MSK_OFF*).

Check-in and check-out of licenses have an overhead. Frequent communication with the license server should be avoided.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_CACHE_LICENSE MSK_ON file`

Groups
License manager

`MSK_IPAR_COMPRESS_STATFILE`

Control compression of stat files.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_COMPRESS_STATFILE MSK_ON file`

`MSK_IPAR_FOLDING_USE`

Controls whether and how to use problem folding (symmetry detection for continuous problems). Note that for symmetry detection for mixed-integer problems one should instead use the parameter *MSK_IPAR_MIO_SYMMETRY_LEVEL*.

Default
FREE_UNLESS_BASIC

Accepted
OFF, *FREE*, *FREE_UNLESS_BASIC*, *FORCE*

Example
`mosek -d MSK_IPAR_FOLDING_USE MSK_FOLDING_MODE_FREE_UNLESS_BASIC file`

Groups
Presolve

`MSK_IPAR_GETDUAL_CONVERT_LMIS`

Whether to perform LMI detection and optimization in the user-level dualizer.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_GETDUAL_CONVERT_LMIS MSK_ON file`

`MSK_IPAR_HEARTBEAT_SIM_FREQ_TICKS`

Controls how frequent the new simplex optimizer calls the user-defined callback function is called.

- -1. Logging is disabled.
- 0. Logging at highest frequency (every iteration).
- ≥ 1. Logging at given frequency measured in ticks.

Default
1000000

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_HEARTBEAT_SIM_FREQ_TICKS 1000000 file`

Groups
Simplex optimizer, *Output information*, *Logging*

`MSK_IPAR_INFEAS_GENERIC_NAMES`

Controls whether generic names are used when an infeasible subproblem is created.

Default
OFF

Accepted
ON, *OFF*

Example

`mosek -d MSK_IPAR_INFEAS_GENERIC_NAMES MSK_OFF file`

Groups

Infeasibility report

MSK_IPAR_INFEAS_REPORT_AUTO

Controls whether an infeasibility report is automatically produced after the optimization if the problem is primal or dual infeasible.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_INFEAS_REPORT_AUTO MSK_OFF file`

Groups

Data input/output, *Solution input/output*

MSK_IPAR_INFEAS_REPORT_LEVEL

Controls the amount of information presented in an infeasibility report. Higher values imply more information.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_INFEAS_REPORT_LEVEL 1 file`

Groups

Infeasibility report, *Output information*

MSK_IPAR_INTPNT_BASIS

Controls whether the interior-point optimizer also computes an optimal basis.

Default

ALWAYS

Accepted

NEVER, *ALWAYS*, *NO_ERROR*, *IF_FEASIBLE*, *RESERVERED*

Example

`mosek -d MSK_IPAR_INTPNT_BASIS MSK_BI_ALWAYS file`

See also

MSK_IPAR_BI_IGNORE_MAX_ITER, *MSK_IPAR_BI_IGNORE_NUM_ERROR*, *MSK_IPAR_BI_MAX_ITERATIONS*, *MSK_IPAR_BI_CLEAN_OPTIMIZER*

Groups

Interior-point method, *Basis identification*

MSK_IPAR_INTPNT_DIFF_STEP

Controls whether different step sizes are allowed in the primal and dual space.

Default

ON

Accepted

- *ON*: Different step sizes are allowed.
- *OFF*: Different step sizes are not allowed.

Example

`mosek -d MSK_IPAR_INTPNT_DIFF_STEP MSK_ON file`

Groups

Interior-point method

MSK_IPAR_INTPNT_HOTSTART

Currently not in use.

Default
NONE

Accepted
NONE, *PRIMAL*, *DUAL*, *PRIMAL_DUAL*

Example
`mosek -d MSK_IPAR_INTPNT_HOTSTART MSK_INTPNT_HOTSTART_NONE file`

Groups
Interior-point method

MSK_IPAR_INTPNT_MAX_ITERATIONS

Controls the maximum number of iterations allowed in the interior-point optimizer.

Default
400

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_INTPNT_MAX_ITERATIONS 400 file`

Groups
Interior-point method, *Termination criteria*

MSK_IPAR_INTPNT_MAX_NUM_COR

Controls the maximum number of correctors allowed by the multiple corrector procedure. A negative value means that **MOSEK** is making the choice.

Default
-1

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_INTPNT_MAX_NUM_COR -1 file`

Groups
Interior-point method

MSK_IPAR_INTPNT_OFF_COL_TRH

Controls how many offending columns are detected in the Jacobian of the constraint matrix.

0	no detection
1	aggressive detection
> 1	higher values mean less aggressive detection

Default
40

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_INTPNT_OFF_COL_TRH 40 file`

Groups
Interior-point method

MSK_IPAR_INTPNT_ORDER_GP_NUM_SEEDS

The GP ordering is dependent on a random seed. Therefore, trying several random seeds may lead to a better ordering. This parameter controls the number of random seeds tried.

A value of 0 means that MOSEK makes the choice.

Default
0

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_INTPNT_ORDER_GP_NUM_SEEDS 0 file`

Groups
Interior-point method

`MSK_IPAR_INTPNT_ORDER_METHOD`

Controls the ordering strategy used by the interior-point optimizer when factorizing the Newton equation system.

Default
FREE

Accepted
FREE, *APPMINLOC*, *EXPERIMENTAL*, *TRY_GRAPHPAR*, *FORCE_GRAPHPAR*, *NONE*

Example
`mosek -d MSK_IPAR_INTPNT_ORDER_METHOD MSK_ORDER_METHOD_FREE file`

Groups
Interior-point method

`MSK_IPAR_INTPNT_REGULARIZATION_USE`

Controls whether regularization is allowed.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_INTPNT_REGULARIZATION_USE MSK_ON file`

Groups
Interior-point method

`MSK_IPAR_INTPNT_SCALING`

Controls how the problem is scaled before the interior-point optimizer is used.

Default
FREE

Accepted
FREE, *NONE*

Example
`mosek -d MSK_IPAR_INTPNT_SCALING MSK_SCALING_FREE file`

Groups
Interior-point method

`MSK_IPAR_INTPNT_SOLVE_FORM`

Controls whether the primal or the dual problem is solved.

Default
FREE

Accepted
FREE, *PRIMAL*, *DUAL*

Example
`mosek -d MSK_IPAR_INTPNT_SOLVE_FORM MSK_SOLVE_FREE file`

Groups
Interior-point method

MSK_IPAR_INTPNT_STARTING_POINT

Starting point used by the interior-point optimizer.

Default
FREE

Accepted
FREE, *GUESS*, *CONSTANT*

Example
`mosek -d MSK_IPAR_INTPNT_STARTING_POINT MSK_STARTING_POINT_FREE file`

Groups
Interior-point method

MSK_IPAR_LICENSE_DEBUG

This option is used to turn on debugging of the license manager.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_LICENSE_DEBUG MSK_OFF file`

Groups
License manager

MSK_IPAR_LICENSE_PAUSE_TIME

If *MSK_IPAR_LICENSE_WAIT* is *MSK_ON* and no license is available, then **MOSEK** sleeps a number of milliseconds between each check of whether a license has become free.

Default
100

Accepted
[0; 1000000]

Example
`mosek -d MSK_IPAR_LICENSE_PAUSE_TIME 100 file`

Groups
License manager

MSK_IPAR_LICENSE_SUPPRESS_EXPIRE_WRNS

Controls whether license features expire warnings are suppressed.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_LICENSE_SUPPRESS_EXPIRE_WRNS MSK_OFF file`

Groups
License manager, *Output information*

MSK_IPAR_LICENSE_TRH_EXPIRY_WRN

If a license feature expires in a numbers of days less than the value of this parameter then a warning will be issued.

Default
7

Accepted
[0; +inf]

Example

mosek -d MSK_IPAR_LICENSE_TRH_EXPIRY_WRN 7 file

Groups

License manager, *Output information*

MSK_IPAR_LICENSE_WAIT

If all licenses are in use **MOSEK** returns with an error code. However, by turning on this parameter **MOSEK** will wait for an available license.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_LICENSE_WAIT MSK_OFF file

Groups

Overall solver, *Overall system*, *License manager*

MSK_IPAR_LOG

Controls the amount of log information. The value 0 implies that all log information is suppressed. A higher level implies that more information is logged.

Please note that if a task is employed to solve a sequence of optimization problems the value of this parameter is reduced by the value of *MSK_IPAR_LOG_CUT_SECOND_OPT* for the second and any subsequent optimizations.

Default

10

Accepted

[0; +inf]

Example

mosek -d MSK_IPAR_LOG 10 file

See also

MSK_IPAR_LOG_CUT_SECOND_OPT

Groups

Output information, *Logging*

MSK_IPAR_LOG_ANA_PRO

Controls amount of output from the problem analyzer.

Default

1

Accepted

[0; +inf]

Example

mosek -d MSK_IPAR_LOG_ANA_PRO 1 file

Groups

Analysis, *Logging*

MSK_IPAR_LOG_BI

Controls the amount of output printed by the basis identification procedure. A higher level implies that more information is logged.

Default

1

Accepted

[0; +inf]

Example

mosek -d MSK_IPAR_LOG_BI 1 file

Groups

Basis identification, *Output information*, *Logging*

MSK_IPAR_LOG_BI_FREQ

Controls how frequently the optimizer outputs information about the basis identification and how frequent the user-defined callback function is called.

Default

2500

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_BI_FREQ 2500 file`

Groups

Basis identification, *Output information*, *Logging*

MSK_IPAR_LOG_CUT_SECOND_OPT

If a task is employed to solve a sequence of optimization problems, then the value of the log levels is reduced by the value of this parameter. E.g *MSK_IPAR_LOG* and *MSK_IPAR_LOG_SIM* are reduced by the value of this parameter for the second and any subsequent optimizations.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_CUT_SECOND_OPT 1 file`

See also

MSK_IPAR_LOG, *MSK_IPAR_LOG_INTPNT*, *MSK_IPAR_LOG_MIO*, *MSK_IPAR_LOG_SIM*

Groups

Output information, *Logging*

MSK_IPAR_LOG_EXPAND

Controls the amount of logging when a data item such as the maximum number constrains is expanded.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_EXPAND 1 file`

Groups

Output information, *Logging*

MSK_IPAR_LOG_FEAS_REPAIR

Controls the amount of output printed when performing feasibility repair. A value higher than one means extensive logging.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_FEAS_REPAIR 1 file`

Groups

Output information, *Logging*

`MSK_IPAR_LOG_FILE`

If turned on, then some log info is printed when a file is written or read.

Default
: 1

Accepted
: [0; +inf]

Example
: `mosek -d MSK_IPAR_LOG_FILE 1 file`

Groups
: *Data input/output*, *Output information*, *Logging*

`MSK_IPAR_LOG_INCLUDE_SUMMARY`

Not relevant for this API.

Default
: *OFF*

Accepted
: *ON*, *OFF*

Example
: `mosek -d MSK_IPAR_LOG_INCLUDE_SUMMARY MSK_OFF file`

Groups
: *Output information*, *Logging*

`MSK_IPAR_LOG_INFEAS_ANA`

Controls amount of output printed by the infeasibility analyzer procedures. A higher level implies that more information is logged.

Default
: 1

Accepted
: [0; +inf]

Example
: `mosek -d MSK_IPAR_LOG_INFEAS_ANA 1 file`

Groups
: *Infeasibility report*, *Output information*, *Logging*

`MSK_IPAR_LOG_INTPNT`

Controls amount of output printed by the interior-point optimizer. A higher level implies that more information is logged.

Default
: 1

Accepted
: [0; +inf]

Example
: `mosek -d MSK_IPAR_LOG_INTPNT 1 file`

Groups
: *Interior-point method*, *Output information*, *Logging*

`MSK_IPAR_LOG_LOCAL_INFO`

Controls whether local identifying information like environment variables, filenames, IP addresses etc. are printed to the log.

Note that this will only affect some functions. Some functions that specifically emit system information will not be affected.

Default
: *ON*

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_LOG_LOCAL_INFO MSK_ON file`

Groups

Output information, *Logging*

`MSK_IPAR_LOG_MIO`

Controls the log level for the mixed-integer optimizer. A higher level implies that more information is logged.

Default

4

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_MIO 4 file`

Groups

Mixed-integer optimization, *Output information*, *Logging*

`MSK_IPAR_LOG_MIO_FREQ`

Controls how frequent the mixed-integer optimizer prints the log line. It will print line every time *MSK_IPAR_LOG_MIO_FREQ* relaxations have been solved.

Default

10

Accepted

[-inf; +inf]

Example

`mosek -d MSK_IPAR_LOG_MIO_FREQ 10 file`

Groups

Mixed-integer optimization, *Output information*, *Logging*

`MSK_IPAR_LOG_ORDER`

If turned on, then factor lines are added to the log.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_ORDER 1 file`

Groups

Output information, *Logging*

`MSK_IPAR_LOG_PRESOLVE`

Controls amount of output printed by the presolve procedure. A higher level implies that more information is logged.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_LOG_PRESOLVE 1 file`

Groups

Logging

MSK_IPAR_LOG_SENSITIVITY

Controls the amount of logging during the sensitivity analysis.

- 0. Means no logging information is produced.
- 1. Timing information is printed.
- 2. Sensitivity results are printed.

Default
1

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_LOG_SENSITIVITY 1 file`

Groups
Output information, *Logging*

MSK_IPAR_LOG_SENSITIVITY_OPT

Controls the amount of logging from the optimizers employed during the sensitivity analysis. 0 means no logging information is produced.

Default
0

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_LOG_SENSITIVITY_OPT 0 file`

Groups
Output information, *Logging*

MSK_IPAR_LOG_SIM

Controls amount of output printed by the simplex optimizer. A higher level implies that more information is logged.

Default
4

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_LOG_SIM 4 file`

Groups
Simplex optimizer, *Output information*, *Logging*

MSK_IPAR_LOG_SIM_FREQ

Controls how frequent the simplex optimizer outputs information about the optimization and how frequent the user-defined callback function is called.

Default
1000

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_LOG_SIM_FREQ 1000 file`

Groups
Simplex optimizer, *Output information*, *Logging*

MSK_IPAR_LOG_SIM_FREQ_GIGA_TICKS

Controls how frequent the new simplex optimizer outputs information about the optimization and how frequent the user-defined callback function is called.

- -1. Logging is disabled.
- 0. Logging at highest frequency (every iteration).
- ≥ 1. Logging at given frequency measured in giga ticks.

Default
100

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_LOG_SIM_FREQ_GIGA_TICKS 100 file`

Groups
Simplex optimizer, *Output information*, *Logging*

MSK_IPAR_LOG_STORAGE

When turned on, **MOSEK** prints messages regarding the storage usage and allocation.

Default
0

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_LOG_STORAGE 0 file`

Groups
Output information, *Overall system*, *Logging*

MSK_IPAR_MAX_NUM_WARNINGS

Each warning is shown a limited number of times controlled by this parameter. A negative value is identical to infinite number of times.

Default
10

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_MAX_NUM_WARNINGS 10 file`

Groups
Output information

MSK_IPAR_MIO_BRANCH_DIR

Controls whether the mixed-integer optimizer is branching up or down by default.

Default
FREE

Accepted
FREE, *UP*, *DOWN*, *NEAR*, *FAR*, *ROOT_LP*, *GUIDED*, *PSEUDOCOST*

Example
`mosek -d MSK_IPAR_MIO_BRANCH_DIR MSK_BRANCH_DIR_FREE file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_CONFLICT_ANALYSIS_LEVEL

Controls the amount of conflict analysis employed by the mixed-integer optimizer.

- -1. The optimizer chooses the level of conflict analysis employed
- 0. conflict analysis is disabled
- 1. A lower amount of conflict analysis is employed
- 2. A higher amount of conflict analysis is employed

Default
-1

Accepted
[-1; 2]

Example
`mosek -d MSK_IPAR_MIO_CONFLICT_ANALYSIS_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_CONIC_OUTER_APPROXIMATION

If this option is turned on outer approximation is used when solving relaxations of conic problems; otherwise interior point is used.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_MIO_CONIC_OUTER_APPROXIMATION MSK_OFF file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_CONSTRUCT_SOL

If set to *MSK_ON* and all integer variables have been given a value for which a feasible mixed integer solution exists, then **MOSEK** generates an initial solution to the mixed integer problem by fixing all integer values and solving the remaining problem.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_MIO_CONSTRUCT_SOL MSK_OFF file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_CROSSOVER_MAX_NODES

Controls the maximum number of nodes allowed in each call to the Crossover heuristic. The default value of -1 means that the value is determined automatically. A value of zero turns off the heuristic.

Default
-1

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_MIO_CROSSOVER_MAX_NODES -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_CUT_CLIQUE

Controls whether clique cuts should be generated.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_MIO_CUT_CLIQUE MSK_ON file`

Groups

Mixed-integer optimization

MSK_IPAR_MIO_CUT_CMIR

Controls whether mixed integer rounding cuts should be generated.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_MIO_CUT_CMIR MSK_ON file`

Groups

Mixed-integer optimization

MSK_IPAR_MIO_CUT_GMI

Controls whether GMI cuts should be generated.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_MIO_CUT_GMI MSK_ON file`

Groups

Mixed-integer optimization

MSK_IPAR_MIO_CUT_IMPLIED_BOUND

Controls whether implied bound cuts should be generated.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_MIO_CUT_IMPLIED_BOUND MSK_ON file`

Groups

Mixed-integer optimization

MSK_IPAR_MIO_CUT_KNAPSACK_COVER

Controls whether knapsack cover cuts should be generated.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_MIO_CUT_KNAPSACK_COVER MSK_ON file`

Groups

Mixed-integer optimization

MSK_IPAR_MIO_CUT_LIPRO

Controls whether lift-and-project cuts should be generated.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_MIO_CUT_LIPRO MSK_OFF file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_CUT_SELECTION_LEVEL

Controls how aggressively generated cuts are selected to be included in the relaxation.

- -1. The optimizer chooses the level of cut selection
- 0. Generated cuts less likely to be added to the relaxation
- 1. Cuts are more aggressively selected to be included in the relaxation

Default
-1

Accepted
[-1; +1]

Example
`mosek -d MSK_IPAR_MIO_CUT_SELECTION_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_DATA_PERMUTATION_METHOD

Controls what problem data permutation method is appplied to mixed-integer problems.

Default
NONE

Accepted
NONE, *CYCLIC_SHIFT*, *RANDOM*

Example
`mosek -d MSK_IPAR_MIO_DATA_PERMUTATION_METHOD MSK_MIO_DATA_PERMUTATION_METHOD_NONE file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_DUAL_RAY_ANALYSIS_LEVEL

Controls the amount of dual ray analysis employed by the mixed-integer optimizer.

- -1. The optimizer chooses the level of dual ray analysis employed
- 0. Dual ray analysis is disabled
- 1. A lower amount of dual ray analysis is employed
- 2. A higher amount of dual ray analysis is employed

Default
-1

Accepted
[-1; 2]

Example
`mosek -d MSK_IPAR_MIO_DUAL_RAY_ANALYSIS_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_FEASPUMP_LEVEL

Controls the way the Feasibility Pump heuristic is employed by the mixed-integer optimizer.

- -1. The optimizer chooses how the Feasibility Pump is used
- 0. The Feasibility Pump is disabled
- 1. The Feasibility Pump is enabled with an effort to improve solution quality
- 2. The Feasibility Pump is enabled with an effort to reach feasibility early

Default
-1

Accepted
[-1; 2]

Example
`mosek -d MSK_IPAR_MIO_FEASPUMP_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_HEURISTIC_LEVEL

Controls the heuristic employed by the mixed-integer optimizer to locate an initial good integer feasible solution. A value of zero means the heuristic is not used at all. A larger value than 0 means that a gradually more sophisticated heuristic is used which is computationally more expensive. A negative value implies that the optimizer chooses the heuristic. Normally a value around 3 to 5 should be optimal.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_MIO_HEURISTIC_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_INDEPENDENT_BLOCK_LEVEL

Controls the way the mixed-integer optimizer tries to find and exploit a decomposition of the problem into independent blocks.

- -1. The optimizer chooses how independent-block structure is handled
- 0. No independent-block structure is detected
- 1. Independent-block structure may be exploited only in presolve
- 2. Independent-block structure may be exploited through a dedicated algorithm after the root node
- 3. Independent-block structure may be exploited through a dedicated algorithm before the root node

Default
-1

Accepted
[-1; 3]

Example
`mosek -d MSK_IPAR_MIO_INDEPENDENT_BLOCK_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_MAX_NUM_BRANCHES

Maximum number of branches allowed during the branch and bound search. A negative value means infinite.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_MIO_MAX_NUM_BRANCHES -1 file`

Groups
Mixed-integer optimization, *Termination criteria*

MSK_IPAR_MIO_MAX_NUM_RELAXS

Maximum number of relaxations allowed during the branch and bound search. A negative value means infinite.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_MIO_MAX_NUM_RELAXS -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_MAX_NUM_RESTARTS

Maximum number of restarts allowed during the branch and bound search.

Default
10

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_MIO_MAX_NUM_RESTARTS 10 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_MAX_NUM_ROOT_CUT_ROUNDS

Maximum number of cut separation rounds at the root node.

Default
100

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_MIO_MAX_NUM_ROOT_CUT_ROUNDS 100 file`

Groups
Mixed-integer optimization, *Termination criteria*

MSK_IPAR_MIO_MAX_NUM_SOLUTIONS

The mixed-integer optimizer can be terminated after a certain number of different feasible solutions has been located. If this parameter has the value $n > 0$, then the mixed-integer optimizer will be terminated when n feasible solutions have been located.

Default
-1

Accepted
[-inf; +inf]

Example

`mosek -d MSK_IPAR_MIO_MAX_NUM_SOLUTIONS -1 file`

Groups

Mixed-integer optimization, *Termination criteria*

`MSK_IPAR_MIO_MEMORY_EMPHASIS_LEVEL`

Controls how much emphasis is put on reducing memory usage. Being more conservative about memory usage may come at the cost of decreased solution speed.

- 0. The optimizer chooses
- 1. More emphasis is put on reducing memory usage and less on speed

Default

0

Accepted

[0; +1]

Example

`mosek -d MSK_IPAR_MIO_MEMORY_EMPHASIS_LEVEL 0 file`

Groups

Mixed-integer optimization

`MSK_IPAR_MIO_MIN_REL`

Number of times a variable must have been branched on for its pseudocost to be considered reliable.

Default

5

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_MIO_MIN_REL 5 file`

Groups

Mixed-integer optimization

`MSK_IPAR_MIO_MODE`

Controls whether the optimizer includes the integer restrictions and disjunctive constraints when solving a (mixed) integer optimization problem.

Default

SATISFIED

Accepted

IGNORED, *SATISFIED*

Example

`mosek -d MSK_IPAR_MIO_MODE MSK_MIO_MODE_SATISFIED file`

Groups

Overall solver

`MSK_IPAR_MIO_NODE_OPTIMIZER`

Controls which optimizer is employed at the non-root nodes in the mixed-integer optimizer.

Default

FREE

Accepted

FREE, *INTPNT*, *CONIC*, *PRIMAL_SIMPLEX*, *DUAL_SIMPLEX*, *NEW_PRIMAL_SIMPLEX*, *NEW_DUAL_SIMPLEX*, *FREE_SIMPLEX*, *MIXED_INT*

Example

`mosek -d MSK_IPAR_MIO_NODE_OPTIMIZER MSK_OPTIMIZER_FREE file`

Groups

Mixed-integer optimization

MSK_IPAR_MIO_NODE_SELECTION

Controls the node selection strategy employed by the mixed-integer optimizer.

Default
FREE

Accepted
FREE, *FIRST*, *BEST*, *PSEUDO*

Example
`mosek -d MSK_IPAR_MIO_NODE_SELECTION MSK_MIO_NODE_SELECTION_FREE file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_NUMERICAL_EMPHASIS_LEVEL

Controls how much emphasis is put on reducing numerical problems possibly at the expense of solution speed.

- 0. The optimizer chooses
- 1. More emphasis is put on reducing numerical problems
- 2. Even more emphasis

Default
0

Accepted
[0; +2]

Example
`mosek -d MSK_IPAR_MIO_NUMERICAL_EMPHASIS_LEVEL 0 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_OPT_FACE_MAX_NODES

Controls the maximum number of nodes allowed in each call to the optimal face heuristic. The default value of -1 means that the value is determined automatically. A value of zero turns off the heuristic.

Default
-1

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_MIO_OPT_FACE_MAX_NODES -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_PERSPECTIVE_REFORMULATE

Enables or disables perspective reformulation in presolve.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_MIO_PERSPECTIVE_REFORMULATE MSK_ON file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_PRESOLVE_AGGREGATOR_USE

Controls if the aggregator should be used.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_MIO_PRESOLVE_AGGREGATOR_USE MSK_ON file`

Groups
Presolve

MSK_IPAR_MIO_PROBING_LEVEL

Controls the amount of probing employed by the mixed-integer optimizer in presolve.

- -1. The optimizer chooses the level of probing employed
- 0. Probing is disabled
- 1. A low amount of probing is employed
- 2. A medium amount of probing is employed
- 3. A high amount of probing is employed

Default
-1

Accepted
[-1; 3]

Example
`mosek -d MSK_IPAR_MIO_PROBING_LEVEL -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_PROPAGATE_OBJECTIVE_CONSTRAINT

Use objective domain propagation.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_MIO_PROPAGATE_OBJECTIVE_CONSTRAINT MSK_OFF file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_QCQO_REFORMULATION_METHOD

Controls what reformulation method is applied to mixed-integer quadratic problems.

Default
FREE

Accepted
FREE, *NONE*, *LINEARIZATION*, *EIGEN_VAL_METHOD*, *DIAG_SDP*, *RELAX_SDP*

Example
`mosek -d MSK_IPAR_MIO_QCQO_REFORMULATION_METHOD MSK_MIO_QCQO_REFORMULATION_METHOD_FREE file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_RENS_MAX_NODES

Controls the maximum number of nodes allowed in each call to the RENS heuristic. The default value of -1 means that the value is determined automatically. A value of zero turns off the heuristic.

Default
-1

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_MIO_RENS_MAX_NODES -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_RINS_MAX_NODES

Controls the maximum number of nodes allowed in each call to the RINS heuristic. The default value of -1 means that the value is determined automatically. A value of zero turns off the heuristic.

Default
-1

Accepted
[-1; +inf]

Example
`mosek -d MSK_IPAR_MIO_RINS_MAX_NODES -1 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_ROOT_OPTIMIZER

Controls which optimizer is employed at the root node in the mixed-integer optimizer.

Default
FREE

Accepted
FREE, *INTPNT*, *CONIC*, *PRIMAL_SIMPLEX*, *DUAL_SIMPLEX*, *NEW_PRIMAL_SIMPLEX*, *NEW_DUAL_SIMPLEX*, *FREE_SIMPLEX*, *MIXED_INT*

Example
`mosek -d MSK_IPAR_MIO_ROOT_OPTIMIZER MSK_OPTIMIZER_FREE file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_SEED

Sets the random seed used for randomization in the mixed integer optimizer. Selecting a different seed can change the path the optimizer takes to the optimal solution.

Default
42

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_MIO_SEED 42 file`

Groups
Mixed-integer optimization

MSK_IPAR_MIO_SYMMETRY_LEVEL

Controls the amount of symmetry detection and handling employed by the mixed-integer optimizer in presolve.

- -1. The optimizer chooses the level of symmetry detection and handling employed
- 0. Symmetry detection and handling is disabled

- 1. A low amount of symmetry detection and handling is employed
- 2. A medium amount of symmetry detection and handling is employed
- 3. A high amount of symmetry detection and handling is employed
- 4. An extremely high amount of symmetry detection and handling is employed

Default
-1

Accepted
[-1; 4]

Example
`mosek -d MSK_IPAR_MIO_SYMMETRY_LEVEL -1 file`

Groups
Mixed-integer optimization

`MSK_IPAR_MIO_VAR_SELECTION`

Controls the variable selection strategy employed by the mixed-integer optimizer.

Default
FREE

Accepted
FREE, *PSEUDOCOST*, *STRONG*

Example
`mosek -d MSK_IPAR_MIO_VAR_SELECTION MSK_MIO_VAR_SELECTION_FREE file`

Groups
Mixed-integer optimization

`MSK_IPAR_MIO_VB_DETECTION_LEVEL`

Controls how much effort is put into detecting variable bounds.

- -1. The optimizer chooses
- 0. No variable bounds are detected
- 1. Only detect variable bounds that are directly represented in the problem
- 2. Detect variable bounds in probing

Default
-1

Accepted
[-1; +2]

Example
`mosek -d MSK_IPAR_MIO_VB_DETECTION_LEVEL -1 file`

Groups
Mixed-integer optimization

`MSK_IPAR_MT_SPINCOUNT`

Set the number of iterations to spin before sleeping.

Default
0

Accepted
[0; 1000000000]

Example
`mosek -d MSK_IPAR_MT_SPINCOUNT 0 file`

Groups
Overall system

MSK_IPAR_NG

Not in use.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_NG MSK_OFF file`

MSK_IPAR_NUM_THREADS

Controls the number of threads employed by the optimizer. If set to 0 the number of threads used will be equal to the number of cores detected on the machine.

Default

0

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_NUM_THREADS 0 file`

Groups

Overall system

MSK_IPAR_OPF_WRITE_HEADER

Write a text header with date and **MOSEK** version in an OPF file.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_OPF_WRITE_HEADER MSK_ON file`

Groups

Data input/output

MSK_IPAR_OPF_WRITE_HINTS

Write a hint section with problem dimensions in the beginning of an OPF file.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_OPF_WRITE_HINTS MSK_ON file`

Groups

Data input/output

MSK_IPAR_OPF_WRITE_LINE_LENGTH

Aim to keep lines in OPF files not much longer than this.

Default

80

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_OPF_WRITE_LINE_LENGTH 80 file`

Groups

Data input/output

MSK_IPAR_OPF_WRITE_PARAMETERS

Write a parameter section in an OPF file.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_OPF_WRITE_PARAMETERS MSK_OFF file`

Groups
Data input/output

MSK_IPAR_OPF_WRITE_PROBLEM

Write objective, constraints, bounds etc. to an OPF file.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_OPF_WRITE_PROBLEM MSK_ON file`

Groups
Data input/output

MSK_IPAR_OPF_WRITE_SOL_BAS

If *MSK_IPAR_OPF_WRITE_SOLUTIONS* is *MSK_ON* and a basic solution is defined, include the basic solution in OPF files.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_OPF_WRITE_SOL_BAS MSK_ON file`

Groups
Data input/output

MSK_IPAR_OPF_WRITE_SOL_ITG

If *MSK_IPAR_OPF_WRITE_SOLUTIONS* is *MSK_ON* and an integer solution is defined, write the integer solution in OPF files.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_OPF_WRITE_SOL_ITG MSK_ON file`

Groups
Data input/output

MSK_IPAR_OPF_WRITE_SOL_ITR

If *MSK_IPAR_OPF_WRITE_SOLUTIONS* is *MSK_ON* and an interior solution is defined, write the interior solution in OPF files.

Default
ON

Accepted
ON, *OFF*

Example

mosek -d MSK_IPAR_OPF_WRITE_SOL_ITR MSK_ON file

Groups

Data input/output

MSK_IPAR_OPF_WRITE_SOLUTIONS

Enable inclusion of solutions in the OPF files.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_OPF_WRITE_SOLUTIONS MSK_OFF file

Groups

Data input/output

MSK_IPAR_OPTIMIZER

The parameter controls which optimizer is used to optimize the task.

Default

FREE

Accepted

FREE, *INTPNT*, *CONIC*, *PRIMAL_SIMPLEX*, *DUAL_SIMPLEX*, *NEW_PRIMAL_SIMPLEX*, *NEW_DUAL_SIMPLEX*, *FREE_SIMPLEX*, *MIXED_INT*

Example

mosek -d MSK_IPAR_OPTIMIZER MSK_OPTIMIZER_FREE file

Groups

Overall solver

MSK_IPAR_PARAM_READ_CASE_NAME

If turned on, then names in the parameter file are case sensitive.

Default

ON

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_PARAM_READ_CASE_NAME MSK_ON file

Groups

Data input/output

MSK_IPAR_PARAM_READ_IGN_ERROR

If turned on, then errors in parameter settings is ignored.

Default

OFF

Accepted

ON, *OFF*

Example

mosek -d MSK_IPAR_PARAM_READ_IGN_ERROR MSK_OFF file

Groups

Data input/output

MSK_IPAR_PRESOLVE_ELIMINATOR_MAX_FILL

Controls the maximum amount of fill-in that can be created by one pivot in the elimination phase of the presolve. A negative value means the parameter value is selected automatically.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_PRESOLVE_ELIMINATOR_MAX_FILL -1 file`

Groups
Presolve

`MSK_IPAR_PRESOLVE_ELIMINATOR_MAX_NUM_TRIES`

Control the maximum number of times the eliminator is tried. A negative value implies **MOSEK** decides.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_PRESOLVE_ELIMINATOR_MAX_NUM_TRIES -1 file`

Groups
Presolve

`MSK_IPAR_PRESOLVE_LINDEP_ABS_WORK_TRH`

Controls linear dependency check in presolve. The linear dependency check is potentially computationally expensive.

Default
100

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_PRESOLVE_LINDEP_ABS_WORK_TRH 100 file`

Groups
Presolve

`MSK_IPAR_PRESOLVE_LINDEP_NEW`

Controls whether a new experimental linear dependency checker is employed.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_PRESOLVE_LINDEP_NEW MSK_OFF file`

Groups
Presolve

`MSK_IPAR_PRESOLVE_LINDEP_REL_WORK_TRH`

Controls linear dependency check in presolve. The linear dependency check is potentially computationally expensive.

Default
100

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_PRESOLVE_LINDEP_REL_WORK_TRH 100 file`

Groups
Presolve

MSK_IPAR_PRESOLVE_LINDEP_USE

Controls whether the linear constraints are checked for linear dependencies.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_PRESOLVE_LINDEP_USE MSK_ON file`

Groups
Presolve

MSK_IPAR_PRESOLVE_MAX_NUM_PASS

Control the maximum number of times presolve passes over the problem. A negative value implies **MOSEK** decides.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_PRESOLVE_MAX_NUM_PASS -1 file`

Groups
Presolve

MSK_IPAR_PRESOLVE_MAX_NUM_REDUCTIONS

Controls the maximum number of reductions performed by the presolve. The value of the parameter is normally only changed in connection with debugging. A negative value implies that an infinite number of reductions are allowed.

Default
-1

Accepted
[-inf; +inf]

Example
`mosek -d MSK_IPAR_PRESOLVE_MAX_NUM_REDUCTIONS -1 file`

Groups
Overall solver, *Presolve*

MSK_IPAR_PRESOLVE_USE

Controls whether the presolve is applied to a problem before it is optimized.

Default
FREE

Accepted
OFF, *ON*, *FREE*

Example
`mosek -d MSK_IPAR_PRESOLVE_USE MSK_PRESOLVE_MODE_FREE file`

Groups
Overall solver, *Presolve*

MSK_IPAR_PRIMAL_REPAIR_OPTIMIZER

Controls which optimizer that is used to find the optimal repair.

Default
FREE

Accepted
FREE, *INTPNT*, *CONIC*, *PRIMAL_SIMPLEX*, *DUAL_SIMPLEX*, *NEW_PRIMAL_SIMPLEX*, *NEW_DUAL_SIMPLEX*, *FREE_SIMPLEX*, *MIXED_INT*

Example

`mosek -d MSK_IPAR_PRIMAL_REPAIR_OPTIMIZER MSK_OPTIMIZER_FREE file`

Groups

Overall solver

`MSK_IPAR_PTF_WRITE_PARAMETERS`

If *MSK_IPAR_PTF_WRITE_PARAMETERS* is *MSK_ON*, the parameters section is written.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_PTF_WRITE_PARAMETERS MSK_OFF file`

Groups

Data input/output

`MSK_IPAR_PTF_WRITE_SINGLE_PSD_TERMS`

Controls whether PSD terms with a coefficient matrix of just one non-zero are written as a single term instead of as a matrix term.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_PTF_WRITE_SINGLE_PSD_TERMS MSK_OFF file`

Groups

Data input/output

`MSK_IPAR_PTF_WRITE_SOLUTIONS`

If *MSK_IPAR_PTF_WRITE_SOLUTIONS* is *MSK_ON*, the solution section is written if any solutions are available, otherwise solution section is not written even if solutions are available.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_PTF_WRITE_SOLUTIONS MSK_OFF file`

Groups

Data input/output

`MSK_IPAR_PTF_WRITE_TRANSFORM`

If *MSK_IPAR_PTF_WRITE_TRANSFORM* is *MSK_ON*, constraint blocks with identifiable conic slacks are transformed into conic constraints and the slacks are eliminated.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_PTF_WRITE_TRANSFORM MSK_ON file`

Groups

Data input/output

MSK_IPAR_READ_ASYNC

Controls whether files are read using synchronous or asynchronous reader.

Default
OFF

Accepted
- *ON*: Use asynchronous reader
- *OFF*: Use synchronous reader

Example
`mosek -d MSK_IPAR_READ_ASYNC MSK_OFF file`

Groups
Data input/output

MSK_IPAR_READ_DEBUG

Turns on additional debugging information when reading files.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_READ_DEBUG MSK_OFF file`

Groups
Data input/output

MSK_IPAR_READ_KEEP_FREE_CON

Controls whether the free constraints are included in the problem. Applies to MPS files.

Default
OFF

Accepted
- *ON*: The free constraints are kept.
- *OFF*: The free constraints are discarded.

Example
`mosek -d MSK_IPAR_READ_KEEP_FREE_CON MSK_OFF file`

Groups
Data input/output

MSK_IPAR_READ_MPS_FORMAT

Controls how strictly the MPS file reader interprets the MPS format.

Default
FREE

Accepted
STRICT, *RELAXED*, *FREE*, *CPLEX*

Example
`mosek -d MSK_IPAR_READ_MPS_FORMAT MSK_MPS_FORMAT_FREE file`

Groups
Data input/output

MSK_IPAR_READ_MPS_WIDTH

Controls the maximal number of characters allowed in one line of the MPS file.

Default
1024

Accepted
[80; +inf]

Example

`mosek -d MSK_IPAR_READ_MPS_WIDTH 1024 file`

Groups

Data input/output

`MSK_IPAR_READ_TASK_IGNORE_PARAM`

Controls whether **MOSEK** should ignore the parameter setting defined in the task file and use the default parameter setting instead.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_READ_TASK_IGNORE_PARAM MSK_OFF file`

Groups

Data input/output

`MSK_IPAR_REMOTE_USE_COMPRESSION`

Use compression when sending data to an optimization server.

Default

ZSTD

Accepted

NONE, *FREE*, *GZIP*, *ZSTD*

Example

`mosek -d MSK_IPAR_REMOTE_USE_COMPRESSION MSK_COMPRESS_ZSTD file`

`MSK_IPAR_REMOVE_UNUSED_SOLUTIONS`

Removes unused solutions before the optimization is performed.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_REMOVE_UNUSED_SOLUTIONS MSK_OFF file`

Groups

Overall system

`MSK_IPAR_SENSITIVITY_ALL`

Not applicable.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_SENSITIVITY_ALL MSK_OFF file`

Groups

Overall solver

`MSK_IPAR_SENSITIVITY_TYPE`

Controls which type of sensitivity analysis is to be performed.

Default

BASIS

Accepted

BASIS

Example

`mosek -d MSK_IPAR_SENSITIVITY_TYPE MSK_SENSITIVITY_TYPE_BASIS file`

Groups

Overall solver

`MSK_IPAR_SIM_BASIS_FACTOR_USE`

Controls whether an LU factorization of the basis is used in a hot-start. Forcing a refactorization sometimes improves the stability of the simplex optimizers, but in most cases there is a performance penalty.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_SIM_BASIS_FACTOR_USE MSK_ON file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_DEGEN`

Controls how aggressively degeneration is handled.

Default

FREE

Accepted

NONE, *FREE*, *AGGRESSIVE*, *MODERATE*, *MINIMUM*

Example

`mosek -d MSK_IPAR_SIM_DEGEN MSK_SIM_DEGEN_FREE file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_DETECT_PWL`

Not in use.

Default

ON

Accepted

- *ON*: PWL are detected.
- *OFF*: PWL are not detected.

Example

`mosek -d MSK_IPAR_SIM_DETECT_PWL MSK_ON file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_DUAL_CRASH`

Controls whether crashing is performed in the dual simplex optimizer. If this parameter is set to x, then a crash will be performed if a basis consists of more than $(100 - x) \mod f_v$ entries, where f_v is the number of fixed variables.

Default

90

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_SIM_DUAL_CRASH 90 file`

Groups

Dual simplex

MSK_IPAR_SIM_DUAL_PHASEONE_METHOD

An experimental feature.

Default
0

Accepted
[0; 10]

Example
`mosek -d MSK_IPAR_SIM_DUAL_PHASEONE_METHOD 0 file`

Groups
Simplex optimizer

MSK_IPAR_SIM_DUAL_RESTRICT_SELECTION

The dual simplex optimizer can use a so-called restricted selection/pricing strategy to choose the outgoing variable. Hence, if restricted selection is applied, then the dual simplex optimizer first choose a subset of all the potential outgoing variables. Next, for some time it will choose the outgoing variable only among the subset. From time to time the subset is redefined. A larger value of this parameter implies that the optimizer will be more aggressive in its restriction strategy, i.e. a value of 0 implies that the restriction strategy is not applied at all.

Default
50

Accepted
[0; 100]

Example
`mosek -d MSK_IPAR_SIM_DUAL_RESTRICT_SELECTION 50 file`

Groups
Dual simplex

MSK_IPAR_SIM_DUAL_SELECTION

Controls the choice of the incoming variable, known as the selection strategy, in the dual simplex optimizer.

Default
FREE

Accepted
FREE, *FULL*, *ASE*, *DEVEX*, *SE*, *PARTIAL*

Example
`mosek -d MSK_IPAR_SIM_DUAL_SELECTION MSK_SIM_SELECTION_FREE file`

Groups
Dual simplex

MSK_IPAR_SIM_EXPLOIT_DUPVEC

Controls if the simplex optimizers are allowed to exploit duplicated columns.

Default
OFF

Accepted
ON, *OFF*, *FREE*

Example
`mosek -d MSK_IPAR_SIM_EXPLOIT_DUPVEC MSK_SIM_EXPLOIT_DUPVEC_OFF file`

Groups
Simplex optimizer

MSK_IPAR_SIM_HOTSTART

Controls the type of hot-start that the simplex optimizer perform.

Default
FREE

Accepted

NONE, *FREE*, *STATUS_KEYS*

Example

`mosek -d MSK_IPAR_SIM_HOTSTART MSK_SIM_HOTSTART_FREE file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_HOTSTART_LU`

Determines if the simplex optimizer should exploit the initial factorization.

Default

ON

Accepted

- *ON*: Factorization is reused if possible.
- *OFF*: Factorization is recomputed.

Example

`mosek -d MSK_IPAR_SIM_HOTSTART_LU MSK_ON file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_MAX_ITERATIONS`

Maximum number of iterations that can be used by a simplex optimizer.

Default

10000000

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_SIM_MAX_ITERATIONS 10000000 file`

Groups

Simplex optimizer, *Termination criteria*

`MSK_IPAR_SIM_MAX_NUM_SETBACKS`

Controls how many set-backs are allowed within a simplex optimizer. A set-back is an event where the optimizer moves in the wrong direction. This is impossible in theory but may happen due to numerical problems.

Default

250

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_SIM_MAX_NUM_SETBACKS 250 file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_NON_SINGULAR`

Controls if the simplex optimizer ensures a non-singular basis, if possible.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_SIM_NON_SINGULAR MSK_ON file`

Groups

Simplex optimizer

MSK_IPAR_SIM_PRECISION

Experimental. Usage not recommended.

Default
NORMAL

Accepted
NORMAL, *EXTENDED*

Example
`mosek -d MSK_IPAR_SIM_PRECISION MSK_SIM_PRECISION_NORMAL file`

Groups
Overall solver

MSK_IPAR_SIM_PRECISION_BOOST

Controls whether the simplex optimizer is allowed to boost the precision during the computations if possible.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_SIM_PRECISION_BOOST MSK_OFF file`

Groups
Simplex optimizer

MSK_IPAR_SIM_PRIMAL_CRASH

Controls whether crashing is performed in the primal simplex optimizer. In general, if a basis consists of more than (100-this parameter value)% fixed variables, then a crash will be performed.

Default
90

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_SIM_PRIMAL_CRASH 90 file`

Groups
Primal simplex

MSK_IPAR_SIM_PRIMAL_PHASEONE_METHOD

An experimental feature.

Default
0

Accepted
[0; 10]

Example
`mosek -d MSK_IPAR_SIM_PRIMAL_PHASEONE_METHOD 0 file`

Groups
Simplex optimizer

MSK_IPAR_SIM_PRIMAL_RESTRICT_SELECTION

The primal simplex optimizer can use a so-called restricted selection/pricing strategy to choose the outgoing variable. Hence, if restricted selection is applied, then the primal simplex optimizer first choose a subset of all the potential incoming variables. Next, for some time it will choose the incoming variable only among the subset. From time to time the subset is redefined. A larger value of this parameter implies that the optimizer will be more aggressive in its restriction strategy, i.e. a value of 0 implies that the restriction strategy is not applied at all.

Default
50

Accepted
[0; 100]

Example
`mosek -d MSK_IPAR_SIM_PRIMAL_RESTRICT_SELECTION 50 file`

Groups
Primal simplex

`MSK_IPAR_SIM_PRIMAL_SELECTION`

Controls the choice of the incoming variable, known as the selection strategy, in the primal simplex optimizer.

Default
FREE

Accepted
FREE, *FULL*, *ASE*, *DEVEX*, *SE*, *PARTIAL*

Example
`mosek -d MSK_IPAR_SIM_PRIMAL_SELECTION MSK_SIM_SELECTION_FREE file`

Groups
Primal simplex

`MSK_IPAR_SIM_REFACTOR_FREQ`

Controls how frequent the basis is refactorized. The value 0 means that the optimizer determines the best point of refactorization. It is strongly recommended NOT to change this parameter.

Default
0

Accepted
[0; +inf]

Example
`mosek -d MSK_IPAR_SIM_REFACTOR_FREQ 0 file`

Groups
Simplex optimizer

`MSK_IPAR_SIM_REFORMULATION`

Controls if the simplex optimizers are allowed to reformulate the problem.

Default
OFF

Accepted
ON, *OFF*, *FREE*, *AGGRESSIVE*

Example
`mosek -d MSK_IPAR_SIM_REFORMULATION MSK_SIM_REFORMULATION_OFF file`

Groups
Simplex optimizer

`MSK_IPAR_SIM_SAVE_LU`

Controls if the LU factorization stored should be replaced with the LU factorization corresponding to the initial basis.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_SIM_SAVE_LU MSK_OFF file`

Groups
Simplex optimizer

`MSK_IPAR_SIM_SCALING`

Controls how much effort is used in scaling the problem before a simplex optimizer is used.

Default

FREE

Accepted

FREE, *NONE*

Example

`mosek -d MSK_IPAR_SIM_SCALING MSK_SCALING_FREE file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_SCALING_METHOD`

Controls how the problem is scaled before a simplex optimizer is used.

Default

POW2

Accepted

POW2, *FREE*

Example

`mosek -d MSK_IPAR_SIM_SCALING_METHOD MSK_SCALING_METHOD_POW2 file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_SEED`

Sets the random seed used for randomization in the simplex optimizers.

Default

23456

Accepted

[0; 32749]

Example

`mosek -d MSK_IPAR_SIM_SEED 23456 file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_SOLVE_FORM`

Controls whether the primal or the dual problem is solved by the primal-/dual-simplex optimizer.

Default

FREE

Accepted

FREE, *PRIMAL*, *DUAL*

Example

`mosek -d MSK_IPAR_SIM_SOLVE_FORM MSK_SOLVE_FREE file`

Groups

Simplex optimizer

`MSK_IPAR_SIM_SWITCH_OPTIMIZER`

The simplex optimizer sometimes chooses to solve the dual problem instead of the primal problem. This implies that if you have chosen to use the dual simplex optimizer and the problem is dualized, then it actually makes sense to use the primal simplex optimizer instead. If this parameter is on and the problem is dualized and furthermore the simplex optimizer is chosen to be the primal (dual) one, then it is switched to the dual (primal).

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_SIM_SWITCH_OPTIMIZER MSK_OFF file`

Groups

Simplex optimizer

`MSK_IPAR_SOL_FILTER_KEEP_BASIC`

If turned on, then basic and super basic constraints and variables are written to the solution file independent of the filter setting.

Default

OFF

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_SOL_FILTER_KEEP_BASIC MSK_OFF file`

Groups

Solution input/output

`MSK_IPAR_SOL_READ_NAME_WIDTH`

When a solution is read by **MOSEK** and some constraint, variable or cone names contain blanks, then a maximum name width much be specified. A negative value implies that no name contain blanks.

Default

-1

Accepted

[-inf; +inf]

Example

`mosek -d MSK_IPAR_SOL_READ_NAME_WIDTH -1 file`

Groups

Data input/output, *Solution input/output*

`MSK_IPAR_SOL_READ_WIDTH`

Controls the maximal acceptable width of line in the solutions when read by **MOSEK**.

Default

1024

Accepted

[80; +inf]

Example

`mosek -d MSK_IPAR_SOL_READ_WIDTH 1024 file`

Groups

Data input/output, *Solution input/output*

`MSK_IPAR_TIMING_LEVEL`

Controls the amount of timing performed inside **MOSEK**.

Default

1

Accepted

[0; +inf]

Example

`mosek -d MSK_IPAR_TIMING_LEVEL 1 file`

Groups

Overall system

MSK_IPAR_WRITE_ASYNC

Controls whether files are read using synchronous or asynchronous writer.

Default
OFF

Accepted
- *ON*: Use asynchronous writer
- *OFF*: Use synchronous writer

Example
`mosek -d MSK_IPAR_WRITE_ASYNC MSK_OFF file`

Groups
Data input/output

MSK_IPAR_WRITE_BAS_CONSTRAINTS

Controls whether the constraint section is written to the basic solution file.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_BAS_CONSTRAINTS MSK_ON file`

Groups
Data input/output, *Solution input/output*

MSK_IPAR_WRITE_BAS_HEAD

Controls whether the header section is written to the basic solution file.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_BAS_HEAD MSK_ON file`

Groups
Data input/output, *Solution input/output*

MSK_IPAR_WRITE_BAS_VARIABLES

Controls whether the variables section is written to the basic solution file.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_BAS_VARIABLES MSK_ON file`

Groups
Data input/output, *Solution input/output*

MSK_IPAR_WRITE_COMPRESSION

Controls whether the data file is compressed while it is written. 0 means no compression while higher values mean more compression.

Default
9

Accepted
[0; +inf]

Example

```
mosek -d MSK_IPAR_WRITE_COMPRESSION 9 file
```

Groups

Data input/output

MSK_IPAR_WRITE_FREE_CON

Controls whether the free constraints are written to the data file. Applies to MPS files.

Default

ON

Accepted

ON, *OFF*

Example

```
mosek -d MSK_IPAR_WRITE_FREE_CON MSK_ON file
```

Groups

Data input/output

MSK_IPAR_WRITE_GENERIC_NAMES

Controls whether generic names should be used instead of user-defined names when writing to the data file.

Default

OFF

Accepted

ON, *OFF*

Example

```
mosek -d MSK_IPAR_WRITE_GENERIC_NAMES MSK_OFF file
```

Groups

Data input/output

MSK_IPAR_WRITE_IGNORE_INCOMPATIBLE_ITEMS

Controls if the writer ignores incompatible problem items when writing files.

Default

OFF

Accepted

- *ON*: Ignore items that cannot be written to the current output file format.
- *OFF*: Produce an error if the problem contains items that cannot the written to the current output file format.

Example

```
mosek -d MSK_IPAR_WRITE_IGNORE_INCOMPATIBLE_ITEMS MSK_OFF file
```

Groups

Data input/output

MSK_IPAR_WRITE_INT_CONSTRAINTS

Controls whether the constraint section is written to the integer solution file.

Default

ON

Accepted

ON, *OFF*

Example

```
mosek -d MSK_IPAR_WRITE_INT_CONSTRAINTS MSK_ON file
```

Groups

Data input/output, *Solution input/output*

`MSK_IPAR_WRITE_INT_HEAD`

Controls whether the header section is written to the integer solution file.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_INT_HEAD MSK_ON file`

Groups
Data input/output, *Solution input/output*

`MSK_IPAR_WRITE_INT_VARIABLES`

Controls whether the variables section is written to the integer solution file.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_INT_VARIABLES MSK_ON file`

Groups
Data input/output, *Solution input/output*

`MSK_IPAR_WRITE_JSON_INDENTATION`

When set, the JSON task and solution files are written with indentation for better readability.

Default
OFF

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_JSON_INDENTATION MSK_OFF file`

Groups
Data input/output

`MSK_IPAR_WRITE_LP_FULL_OBJ`

Write all variables, including the ones with 0-coefficients, in the objective.

Default
ON

Accepted
ON, *OFF*

Example
`mosek -d MSK_IPAR_WRITE_LP_FULL_OBJ MSK_ON file`

Groups
Data input/output

`MSK_IPAR_WRITE_LP_LINE_WIDTH`

Maximum width of line in an LP file written by **MOSEK**.

Default
80

Accepted
[40; +inf]

Example
`mosek -d MSK_IPAR_WRITE_LP_LINE_WIDTH 80 file`

Groups
Data input/output

MSK_IPAR_WRITE_MPS_FORMAT

Controls in which format the MPS file is written.

Default

FREE

Accepted

STRICT, *RELAXED*, *FREE*, *CPLEX*

Example

`mosek -d MSK_IPAR_WRITE_MPS_FORMAT MSK_MPS_FORMAT_FREE file`

Groups

Data input/output

MSK_IPAR_WRITE_MPS_INT

Controls if marker records are written to the MPS file to indicate whether variables are integer restricted.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_WRITE_MPS_INT MSK_ON file`

Groups

Data input/output

MSK_IPAR_WRITE_SOL_BARVARIABLES

Controls whether the symmetric matrix variables section is written to the solution file.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_WRITE_SOL_BARVARIABLES MSK_ON file`

Groups

Data input/output, *Solution input/output*

MSK_IPAR_WRITE_SOL_CONSTRAINTS

Controls whether the constraint section is written to the solution file.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_WRITE_SOL_CONSTRAINTS MSK_ON file`

Groups

Data input/output, *Solution input/output*

MSK_IPAR_WRITE_SOL_HEAD

Controls whether the header section is written to the solution file.

Default

ON

Accepted

ON, *OFF*

Example

`mosek -d MSK_IPAR_WRITE_SOL_HEAD MSK_ON file`

Groups

Data input/output, *Solution input/output*

MSK_IPAR_WRITE_SOL_IGNORE_INVALID_NAMES

Even if the names are invalid MPS names, then they are employed when writing the solution file.

Default

OFF

Accepted

ON, *OFF*

Example

```
mosek -d MSK_IPAR_WRITE_SOL_IGNORE_INVALID_NAMES MSK_OFF file
```

Groups

Data input/output, *Solution input/output*

MSK_IPAR_WRITE_SOL_VARIABLES

Controls whether the variables section is written to the solution file.

Default

ON

Accepted

ON, *OFF*

Example

```
mosek -d MSK_IPAR_WRITE_SOL_VARIABLES MSK_ON file
```

Groups

Data input/output, *Solution input/output*

10.3.3 String parameters

MSK_SPAR_BAS_SOL_FILE_NAME

Name of the bas solution file.

Accepted

Any valid file name.

Example

```
mosek -d MSK_SPAR_BAS_SOL_FILE_NAME somevalue file
```

Groups

Data input/output, *Solution input/output*

MSK_SPAR_DATA_FILE_NAME

Data are read and written to this file.

Accepted

Any valid file name.

Example

```
mosek -d MSK_SPAR_DATA_FILE_NAME somevalue file
```

Groups

Data input/output

MSK_SPAR_DEBUG_FILE_NAME

MOSEK debug file.

Accepted

Any valid file name.

Example

```
mosek -d MSK_SPAR_DEBUG_FILE_NAME somevalue file
```

Groups

Data input/output

MSK_SPAR_INT_SOL_FILE_NAME

Name of the `int` solution file.

Accepted
Any valid file name.

Example
`mosek -d MSK_SPAR_INT_SOL_FILE_NAME somevalue file`

Groups
Data input/output, *Solution input/output*

MSK_SPAR_ITR_SOL_FILE_NAME

Name of the `itr` solution file.

Accepted
Any valid file name.

Example
`mosek -d MSK_SPAR_ITR_SOL_FILE_NAME somevalue file`

Groups
Data input/output, *Solution input/output*

MSK_SPAR_MIO_DEBUG_STRING

For internal debugging purposes.

Accepted
Any valid string.

Example
`mosek -d MSK_SPAR_MIO_DEBUG_STRING somevalue file`

Groups
Data input/output

MSK_SPAR_PARAM_COMMENT_SIGN

Only the first character in this string is used. It is considered as a start of comment sign in the **MOSEK** parameter file. Spaces are ignored in the string.

Default
%%

Accepted
Any valid string.

Example
`mosek -d MSK_SPAR_PARAM_COMMENT_SIGN %% file`

Groups
Data input/output

MSK_SPAR_PARAM_READ_FILE_NAME

Modifications to the parameter database is read from this file.

Accepted
Any valid file name.

Example
`mosek -d MSK_SPAR_PARAM_READ_FILE_NAME somevalue file`

Groups
Data input/output

MSK_SPAR_PARAM_WRITE_FILE_NAME

The parameter database is written to this file.

Accepted
Any valid file name.

Example

`mosek -d MSK_SPAR_PARAM_WRITE_FILE_NAME somevalue file`

Groups

Data input/output

`MSK_SPAR_READ_MPS_BOU_NAME`

Name of the BOUNDS vector used. An empty name means that the first BOUNDS vector is used.

Accepted

Any valid MPS name.

Example

`mosek -d MSK_SPAR_READ_MPS_BOU_NAME somevalue file`

Groups

Data input/output

`MSK_SPAR_READ_MPS_OBJ_NAME`

Name of the free constraint used as objective function. An empty name means that the first constraint is used as objective function.

Accepted

Any valid MPS name.

Example

`mosek -d MSK_SPAR_READ_MPS_OBJ_NAME somevalue file`

Groups

Data input/output

`MSK_SPAR_READ_MPS_RAN_NAME`

Name of the RANGE vector used. An empty name means that the first RANGE vector is used.

Accepted

Any valid MPS name.

Example

`mosek -d MSK_SPAR_READ_MPS_RAN_NAME somevalue file`

Groups

Data input/output

`MSK_SPAR_READ_MPS_RHS_NAME`

Name of the RHS used. An empty name means that the first RHS vector is used.

Accepted

Any valid MPS name.

Example

`mosek -d MSK_SPAR_READ_MPS_RHS_NAME somevalue file`

Groups

Data input/output

`MSK_SPAR_REMOTE_OPTSERVER_HOST`

URL of the remote optimization server in the format `(http|https)://server:port`. If set, all subsequent calls to any **MOSEK** function that involves synchronous optimization will be sent to the specified OptServer instead of being executed locally. Passing empty string deactivates this redirection.

Accepted

Any valid URL.

Example

`mosek -d MSK_SPAR_REMOTE_OPTSERVER_HOST somevalue file`

Groups

Overall system

MSK_SPAR_REMOTE_TLS_CERT

List of known server certificates in PEM format.

Accepted
PEM files separated by new-lines.

Example
`mosek -d MSK_SPAR_REMOTE_TLS_CERT somevalue file`

Groups
Overall system

MSK_SPAR_REMOTE_TLS_CERT_PATH

Path to known server certificates in PEM format.

Accepted
Any valid path.

Example
`mosek -d MSK_SPAR_REMOTE_TLS_CERT_PATH somevalue file`

Groups
Overall system

MSK_SPAR_SENSITIVITY_FILE_NAME

If defined, **MOSEK** reads this file as a sensitivity analysis data file specifying the type of analysis to be done.

Accepted
Any valid string.

Example
`mosek -d MSK_SPAR_SENSITIVITY_FILE_NAME somevalue file`

Groups
Data input/output

MSK_SPAR_SENSITIVITY_RES_FILE_NAME

Accepted
Any valid string.

Example
`mosek -d MSK_SPAR_SENSITIVITY_RES_FILE_NAME somevalue file`

Groups
Data input/output

MSK_SPAR_SOL_FILTER_XC_LOW

A filter used to determine which constraints should be listed in the solution file. A value of 0.5 means that all constraints having `xc[i]>0.5` should be listed, whereas `+0.5` means that all constraints having `xc[i]>=blc[i]+0.5` should be listed. An empty filter means that no filter is applied.

Accepted
Any valid filter.

Example
`mosek -d MSK_SPAR_SOL_FILTER_XC_LOW somevalue file`

Groups
Data input/output, *Solution input/output*

MSK_SPAR_SOL_FILTER_XC_UPR

A filter used to determine which constraints should be listed in the solution file. A value of `0.5` means that all constraints having `xc[i]<0.5` should be listed, whereas `-0.5` means all constraints having `xc[i]<=buc[i]-0.5` should be listed. An empty filter means that no filter is applied.

Accepted
Any valid filter.

Example

```
mosek -d MSK_SPAR_SOL_FILTER_XC_UPR somevalue file
```

Groups

Data input/output, *Solution input/output*

MSK_SPAR_SOL_FILTER_XX_LOW

A filter used to determine which variables should be listed in the solution file. A value of "0.5" means that all constraints having xx[j]>=0.5 should be listed, whereas "+0.5" means that all constraints having xx[j]>=blx[j]+0.5 should be listed. An empty filter means no filter is applied.

Accepted

Any valid filter.

Example

```
mosek -d MSK_SPAR_SOL_FILTER_XX_LOW somevalue file
```

Groups

Data input/output, *Solution input/output*

MSK_SPAR_SOL_FILTER_XX_UPR

A filter used to determine which variables should be listed in the solution file. A value of "0.5" means that all constraints having xx[j]<0.5 should be printed, whereas "-0.5" means all constraints having xx[j]<=bux[j]-0.5 should be listed. An empty filter means no filter is applied.

Accepted

Any valid file name.

Example

```
mosek -d MSK_SPAR_SOL_FILTER_XX_UPR somevalue file
```

Groups

Data input/output, *Solution input/output*

MSK_SPAR_STAT_KEY

Key used when writing the summary file.

Accepted

Any valid string.

Example

```
mosek -d MSK_SPAR_STAT_KEY somevalue file
```

Groups

Data input/output

MSK_SPAR_STAT_NAME

Name used when writing the statistics file.

Accepted

Any valid XML string.

Example

```
mosek -d MSK_SPAR_STAT_NAME somevalue file
```

Groups

Data input/output

10.4 Response codes

Response codes include:

- *Termination codes*
- *Warnings*
- *Errors*

The numerical code (in brackets) identifies the response in error messages and in the log output.

10.4.1 Termination

MSK_RES_OK (0)

No error occurred.

MSK_RES_TRM_MAX_ITERATIONS (100000)

The optimizer terminated at the maximum number of iterations.

MSK_RES_TRM_MAX_TIME (100001)

The optimizer terminated at the maximum amount of time.

MSK_RES_TRM_OBJECTIVE_RANGE (100002)

The optimizer terminated with an objective value outside the objective range.

MSK_RES_TRM_MIO_NUM_RELAXS (100008)

The mixed-integer optimizer terminated as the maximum number of relaxations was reached.

MSK_RES_TRM_MIO_NUM_BRANCHES (100009)

The mixed-integer optimizer terminated as the maximum number of branches was reached.

MSK_RES_TRM_NUM_MAX_NUM_INT_SOLUTIONS (100015)

The mixed-integer optimizer terminated as the maximum number of feasible solutions was reached.

MSK_RES_TRM_STALL (100006)

The optimizer is terminated due to slow progress.

Stalling means that numerical problems prevent the optimizer from making reasonable progress and that it makes no sense to continue. In many cases this happens if the problem is badly scaled or otherwise ill-conditioned. There is no guarantee that the solution will be feasible or optimal. However, often stalling happens near the optimum, and the returned solution may be of good quality. Therefore, it is recommended to check the status of the solution. If the solution status is optimal the solution is most likely good enough for most practical purposes.

Please note that if a linear optimization problem is solved using the interior-point optimizer with basis identification turned on, the returned basic solution likely to have high accuracy, even though the optimizer stalled.

Some common causes of stalling are a) badly scaled models, b) near feasible or near infeasible problems.

MSK_RES_TRM_USER_CALLBACK (100007)

The optimizer terminated due to the return of the user-defined callback function.

MSK_RES_TRM_MAX_NUM_SETBACKS (100020)

The optimizer terminated as the maximum number of set-backs was reached. This indicates serious numerical problems and a possibly badly formulated problem.

MSK_RES_TRM_NUMERICAL_PROBLEM (100025)

The optimizer terminated due to numerical problems.

MSK_RES_TRM_LOST_RACE (100027)

Lost a race.

MSK_RES_TRM_INTERNAL (100030)

The optimizer terminated due to some internal reason. Please contact **MOSEK** support.

MSK_RES_TRM_INTERNAL_STOP (100031)

The optimizer terminated for internal reasons. Please contact **MOSEK** support.

MSK_RES_TRM_SERVER_MAX_TIME (100032)

remote server terminated **MOSEK** on time limit criteria.

MSK_RES_TRM_SERVER_MAX_MEMORY (100033)

remote server terminated **MOSEK** on memory limit criteria.

10.4.2 Warnings

MSK_RES_WRN_OPEN_PARAM_FILE (50)
: The parameter file could not be opened.

MSK_RES_WRN_LARGE_BOUND (51)
: A numerically large bound value is specified.

MSK_RES_WRN_LARGE_LO_BOUND (52)
: A numerically large lower bound value is specified.

MSK_RES_WRN_LARGE_UP_BOUND (53)
: A numerically large upper bound value is specified.

MSK_RES_WRN_LARGE_CON_FX (54)
: An equality constraint is fixed to a numerically large value. This can cause numerical problems.

MSK_RES_WRN_LARGE_CJ (57)
: A numerically large value is specified for one c_j.

MSK_RES_WRN_LARGE_AIJ (62)
: A numerically large value is specified for an $a_{i,j}$ element in A. The parameter *MSK_DPAR_DATA_TOL_AIJ_LARGE* controls when an $a_{i,j}$ is considered large.

MSK_RES_WRN_ZERO_AIJ (63)
: One or more zero elements are specified in A.

MSK_RES_WRN_NAME_MAX_LEN (65)
: A name is longer than the buffer that is supposed to hold it.

MSK_RES_WRN_SPAR_MAX_LEN (66)
: A value for a string parameter is longer than the buffer that is supposed to hold it.

MSK_RES_WRN_MPS_SPLIT_RHS_VECTOR (70)
: An RHS vector is split into several nonadjacent parts in an MPS file.

MSK_RES_WRN_MPS_SPLIT_RAN_VECTOR (71)
: A RANGE vector is split into several nonadjacent parts in an MPS file.

MSK_RES_WRN_MPS_SPLIT_BOU_VECTOR (72)
: A BOUNDS vector is split into several nonadjacent parts in an MPS file.

MSK_RES_WRN_LP_OLD_QUAD_FORMAT (80)
: Missing '/2' after quadratic expressions in bound or objective.

MSK_RES_WRN_LP_DROP_VARIABLE (85)
: Ignored a variable because the variable was not previously defined. Usually this implies that a variable appears in the bound section but not in the objective or the constraints.

MSK_RES_WRN_NZ_IN_UPR_TRI (200)
: Non-zero elements specified in the upper triangle of a matrix were ignored.

MSK_RES_WRN_DROPPED_NZ_QOBJ (201)
: One or more non-zero elements were dropped in the Q matrix in the objective.

MSK_RES_WRN_IGNORE_INTEGER (250)
: Ignored integer constraints.

MSK_RES_WRN_NO_GLOBAL_OPTIMIZER (251)
: No global optimizer is available.

MSK_RES_WRN_MIO_INFEASIBLE_FINAL (270)
: The final mixed-integer problem with all the integer variables fixed at their optimal values is infeasible.

MSK_RES_WRN_SOL_FILTER (300)
: Invalid solution filter is specified.

MSK_RES_WRN_UNDEF_SOL_FILE_NAME (350)
: Undefined name occurred in a solution.

MSK_RES_WRN_SOL_FILE_IGNORED_CON (351)
: One or more lines in the constraint section were ignored when reading a solution file.

MSK_RES_WRN_SOL_FILE_IGNORED_VAR (352)
: One or more lines in the variable section were ignored when reading a solution file.

MSK_RES_WRN_TOO_FEW_BASIS_VARS (400)

An incomplete basis has been specified. Too few basis variables are specified.

MSK_RES_WRN_TOO_MANY_BASIS_VARS (405)

A basis with too many variables has been specified.

MSK_RES_WRN_LICENSE_EXPIRE (500)

The license expires.

MSK_RES_WRN_LICENSE_SERVER (501)

The license server is not responding.

MSK_RES_WRN_EMPTY_NAME (502)

A variable or constraint name is empty. The output file may be invalid.

MSK_RES_WRN_USING_GENERIC_NAMES (503)

Generic names are used because a name invalid. For instance when writing an LP file the names must not contain blanks or start with a digit. Also remeber to give the objective function a name.

MSK_RES_WRN_INVALID_MPS_NAME (504)

A name e.g. a row name is not a valid MPS name.

MSK_RES_WRN_INVALID_MPS_OBJ_NAME (505)

The objective name is not a valid MPS name.

MSK_RES_WRN_LICENSE_FEATURE_EXPIRE (509)

The license expires.

MSK_RES_WRN_PARAM_NAME_DOU (510)

The parameter name is not recognized as a double parameter.

MSK_RES_WRN_PARAM_NAME_INT (511)

The parameter name is not recognized as a integer parameter.

MSK_RES_WRN_PARAM_NAME_STR (512)

The parameter name is not recognized as a string parameter.

MSK_RES_WRN_PARAM_STR_VALUE (515)

The string is not recognized as a symbolic value for the parameter.

MSK_RES_WRN_PARAM_IGNORED_CMIO (516)

A parameter was ignored by the conic mixed integer optimizer.

MSK_RES_WRN_ZEROS_IN_SPARSE_ROW (705)

One or more (near) zero elements are specified in a sparse row of a matrix. Since, it is redundant to specify zero elements then it may indicate an error.

MSK_RES_WRN_ZEROS_IN_SPARSE_COL (710)

One or more (near) zero elements are specified in a sparse column of a matrix. It is redundant to specify zero elements. Hence, it may indicate an error.

MSK_RES_WRN_INCOMPLETE_LINEAR_DEPENDENCY_CHECK (800)

The linear dependency check(s) is incomplete. Normally this is not an important warning unless the optimization problem has been formulated with linear dependencies. Linear dependencies may prevent **MOSEK** from solving the problem.

MSK_RES_WRN_ELIMINATOR_SPACE (801)

The eliminator is skipped at least once due to lack of space.

MSK_RES_WRN_PRESOLVE_OUTOFSPACE (802)

The presolve is incomplete due to lack of space.

MSK_RES_WRN_PRESOLVE_PRIMAL_PERTURBATIONS (803)

The presolve perturbed the bounds of the primal problem. This is an indication that the problem is nearly infeasible.

MSK_RES_WRN_WRITE_CHANGED_NAMES (830)

Some names were changed because they were invalid for the output file format.

MSK_RES_WRN_WRITE_DISCARDED_CFIX (831)

The fixed objective term could not be converted to a variable and was discarded in the output file.

MSK_RES_WRN_DUPLICATE_CONSTRAINT_NAMES (850)

Two constraint names are identical.

MSK_RES_WRN_DUPLICATE_VARIABLE_NAMES (851)

Two variable names are identical.

MSK_RES_WRN_DUPLICATE_BARVARIABLE_NAMES (852)

Two barvariable names are identical.

MSK_RES_WRN_DUPLICATE_CONE_NAMES (853)

Two cone names are identical.

MSK_RES_WRN_ANA_LARGE_BOUNDS (900)

This warning is issued by the problem analyzer, if one or more constraint or variable bounds are very large. One should consider omitting these bounds entirely by setting them to +inf or -inf.

MSK_RES_WRN_ANA_C_ZERO (901)

This warning is issued by the problem analyzer, if the coefficients in the linear part of the objective are all zero.

MSK_RES_WRN_ANA_EMPTY_COLS (902)

This warning is issued by the problem analyzer, if columns, in which all coefficients are zero, are found.

MSK_RES_WRN_ANA_CLOSE_BOUNDS (903)

This warning is issued by problem analyzer, if ranged constraints or variables with very close upper and lower bounds are detected. One should consider treating such constraints as equalities and such variables as constants.

MSK_RES_WRN_ANA_ALMOST_INT_BOUNDS (904)

This warning is issued by the problem analyzer if a constraint is bound nearly integral.

MSK_RES_WRN_NO_INFEASIBILITY_REPORT_WHEN_MATRIX_VARIABLES (930)

An infeasibility report is not available when the problem contains matrix variables.

MSK_RES_WRN_GETDUAL_IGNORES_INTEGRALITY (940)

Dualizer ignores integer variables and disjunctive constraints.

MSK_RES_WRN_NO_DUALIZER (950)

No automatic dualizer is available for the specified problem. The primal problem is solved.

MSK_RES_WRN_SYM_MAT_LARGE (960)

A numerically large value is specified for an $e_{i,j}$ element in E. The parameter *MSK_DPAR_DATA_SYM_MAT_TOL_LARGE* controls when an $e_{i,j}$ is considered large.

MSK_RES_WRN_MODIFIED_DOUBLE_PARAMETER (970)

A double parameter related to solver tolerances has a non-default value.

MSK_RES_WRN_LARGE_FIJ (980)

A numerically large value is specified for an $f_{i,j}$ element in F. The parameter *MSK_DPAR_DATA_TOL_AIJ_LARGE* controls when an $f_{i,j}$ is considered large.

MSK_RES_WRN_PTF_UNKNOWN_SECTION (981)

Unexpected section in PTF file

10.4.3 Errors

MSK_RES_ERR_LICENSE (1000)

Invalid license.

MSK_RES_ERR_LICENSE_EXPIRED (1001)

The license has expired.

MSK_RES_ERR_LICENSE_VERSION (1002)

The license is valid for another version of **MOSEK**.

MSK_RES_ERR_LICENSE_OLD_SERVER_VERSION (1003)

The version of the FlexLM license server is too old. You should upgrade the license server to one matching this version of **MOSEK**. It will support this and all older versions of **MOSEK**.

This error can appear if the client was updated to a new version which includes an upgrade of the licensing module, making it incompatible with a much older license server.

MSK_RES_ERR_SIZE_LICENSE (1005)

The problem is bigger than the license.

MSK_RES_ERR_PROB_LICENSE (1006)

The software is not licensed to solve the problem.

MSK_RES_ERR_FILE_LICENSE (1007)

Invalid license file.

MSK_RES_ERR_MISSING_LICENSE_FILE (1008)

MOSEK cannot find license file or a token server. See the **MOSEK** licensing manual for details.

MSK_RES_ERR_SIZE_LICENSE_CON (1010)

The problem has too many constraints to be solved with the available license.

MSK_RES_ERR_SIZE_LICENSE_VAR (1011)

The problem has too many variables to be solved with the available license.

MSK_RES_ERR_SIZE_LICENSE_INTVAR (1012)

The problem contains too many integer variables to be solved with the available license.

MSK_RES_ERR_OPTIMIZER_LICENSE (1013)

The optimizer required is not licensed.

MSK_RES_ERR_FLEXLM (1014)

The FLEXlm license manager reported an error.

MSK_RES_ERR_LICENSE_SERVER (1015)

The license server is not responding.

MSK_RES_ERR_LICENSE_MAX (1016)

Maximum number of licenses is reached.

MSK_RES_ERR_LICENSE_MOSEKLM_DAEMON (1017)

The MOSEKLM license manager daemon is not up and running.

MSK_RES_ERR_LICENSE_FEATURE (1018)

A requested feature is not available in the license file(s). Most likely due to an incorrect license system setup.

MSK_RES_ERR_PLATFORM_NOT_LICENSED (1019)

A requested license feature is not available for the required platform.

MSK_RES_ERR_LICENSE_CANNOT_ALLOCATE (1020)

The license system cannot allocate the memory required.

MSK_RES_ERR_LICENSE_CANNOT_CONNECT (1021)

MOSEK cannot connect to the license server. Most likely the license server is not up and running.

MSK_RES_ERR_LICENSE_INVALID_HOSTID (1025)

The host ID specified in the license file does not match the host ID of the computer.

MSK_RES_ERR_LICENSE_SERVER_VERSION (1026)

The version specified in the checkout request is greater than the highest version number the daemon supports.

MSK_RES_ERR_LICENSE_NO_SERVER_SUPPORT (1027)

The license server does not support the requested feature. Possible reasons for this error include:

- The feature has expired.
- The feature's start date is later than today's date.
- The version requested is higher than feature's the highest supported version.
- A corrupted license file.

Try restarting the license and inspect the license server debug file, usually called `lmgrd.log`.

MSK_RES_ERR_LICENSE_NO_SERVER_LINE (1028)

There is no `SERVER` line in the license file. All non-zero license count features need at least one `SERVER` line.

MSK_RES_ERR_OLDER_DLL (1035)

The dynamic link library is older than the specified version.

MSK_RES_ERR_NEWER_DLL (1036)

The dynamic link library is newer than the specified version.

MSK_RES_ERR_LINK_FILE_DLL (1040)

A file cannot be linked to a stream in the DLL version.

MSK_RES_ERR_THREAD_MUTEX_INIT (1045)

Could not initialize a mutex.

MSK_RES_ERR_THREAD_MUTEX_LOCK (1046)

Could not lock a mutex.

MSK_RES_ERR_THREAD_MUTEX_UNLOCK (1047)

Could not unlock a mutex.

MSK_RES_ERR_THREAD_CREATE (1048)

Could not create a thread. This error may occur if a large number of environments are created and not deleted again. In any case it is a good practice to minimize the number of environments created.

MSK_RES_ERR_THREAD_COND_INIT (1049)

Could not initialize a condition.

MSK_RES_ERR_UNKNOWN (1050)

Unknown error.

MSK_RES_ERR_SPACE (1051)

Out of space.

MSK_RES_ERR_FILE_OPEN (1052)

Error while opening a file.

MSK_RES_ERR_FILE_READ (1053)

File read error.

MSK_RES_ERR_FILE_WRITE (1054)

File write error.

MSK_RES_ERR_DATA_FILE_EXT (1055)

The data file format cannot be determined from the file name.

MSK_RES_ERR_INVALID_FILE_NAME (1056)

An invalid file name has been specified.

MSK_RES_ERR_INVALID_SOL_FILE_NAME (1057)

An invalid file name has been specified.

MSK_RES_ERR_END_OF_FILE (1059)

End of file has been reached unexpectedly.

MSK_RES_ERR_NULL_ENV (1060)

`env` is a `NULL` pointer.

MSK_RES_ERR_NULL_TASK (1061)

`task` is a `NULL` pointer.

MSK_RES_ERR_INVALID_STREAM (1062)

An invalid stream is referenced.

MSK_RES_ERR_NO_INIT_ENV (1063)

`env` is not initialized.

MSK_RES_ERR_INVALID_TASK (1064)

The `task` is invalid.

MSK_RES_ERR_NULL_POINTER (1065)

An argument to a function is unexpectedly a `NULL` pointer.

MSK_RES_ERR_LIVING_TASKS (1066)

All tasks associated with an enviroment must be deleted before the environment is deleted. There are still some undeleted tasks.

MSK_RES_ERR_READ_GZIP (1067)

Error encountered in GZIP stream.

MSK_RES_ERR_READ_ZSTD (1068)

Error encountered in ZSTD stream.

MSK_RES_ERR_READ_ASYNC (1069)

Error encountered in async stream.

MSK_RES_ERR_BLANK_NAME (1070)

An all blank name has been specified.

MSK_RES_ERR_DUP_NAME (1071)

The same name was used multiple times for the same problem item type.

MSK_RES_ERR_FORMAT_STRING (1072)

The name format string is invalid.

MSK_RES_ERR_SPARSITY_SPECIFICATION (1073)

The sparsity included an index that was out of bounds of the shape.

MSK_RES_ERR_MISMATCHING_DIMENSION (1074)

Mismatching dimensions specified in arguments

MSK_RES_ERR_INVALID_OBJ_NAME (1075)

An invalid objective name is specified.

MSK_RES_ERR_INVALID_CON_NAME (1076)

An invalid constraint name is used.

MSK_RES_ERR_INVALID_VAR_NAME (1077)

An invalid variable name is used.

MSK_RES_ERR_INVALID_CONE_NAME (1078)

An invalid cone name is used.

MSK_RES_ERR_INVALID_BARVAR_NAME (1079)

An invalid symmetric matrix variable name is used.

MSK_RES_ERR_SPACE_LEAKING (1080)

MOSEK is leaking memory. This can be due to either an incorrect use of **MOSEK** or a bug.

MSK_RES_ERR_SPACE_NO_INFO (1081)

No available information about the space usage.

MSK_RES_ERR_DIMENSION_SPECIFICATION (1082)

Invalid dimension specification

MSK_RES_ERR_AXIS_NAME_SPECIFICATION (1083)

Invalid axis names specification

MSK_RES_ERR_READ_PREMATURE_EOF (1089)

Encountered premature end-of-file in input stream.

MSK_RES_ERR_READ_FORMAT (1090)

The specified format cannot be read.

MSK_RES_ERR_WRITE_LP_INVALID_VAR_NAMES (1091)

Invalid variable name. Cannot write valid LP file.

MSK_RES_ERR_WRITE_LP_DUPLICATE_VAR_NAMES (1092)

Duplicate variable names. Cannot write valid LP file.

MSK_RES_ERR_WRITE_LP_INVALID_CON_NAMES (1093)

Invalid constraint name. Cannot write valid LP file.

MSK_RES_ERR_WRITE_LP_DUPLICATE_CON_NAMES (1094)

Duplicate constraint names. Cannot write valid LP file.

MSK_RES_ERR_MPS_FILE (1100)

An error occurred while reading an MPS file.

MSK_RES_ERR_MPS_INV_FIELD (1101)

A field in the MPS file is invalid. Probably it is too wide.

MSK_RES_ERR_MPS_INV_MARKER (1102)

An invalid marker has been specified in the MPS file.

MSK_RES_ERR_MPS_NULL_CON_NAME (1103)

An empty constraint name is used in an MPS file.

MSK_RES_ERR_MPS_NULL_VAR_NAME (1104)

An empty variable name is used in an MPS file.

MSK_RES_ERR_MPS_UNDEF_CON_NAME (1105)

An undefined constraint name occurred in an MPS file.

MSK_RES_ERR_MPS_UNDEF_VAR_NAME (1106)

An undefined variable name occurred in an MPS file.

MSK_RES_ERR_MPS_INVALID_CON_KEY (1107)

An invalid constraint key occurred in an MPS file.

MSK_RES_ERR_MPS_INVALID_BOUND_KEY (1108)

An invalid bound key occurred in an MPS file.

MSK_RES_ERR_MPS_INVALID_SEC_NAME (1109)

An invalid section name occurred in an MPS file.

MSK_RES_ERR_MPS_NO_OBJECTIVE (1110)

No objective is defined in an MPS file.

MSK_RES_ERR_MPS_SPLITTED_VAR (1111)

All elements in a column of the A matrix must be specified consecutively. Hence, it is illegal to specify non-zero elements in A for variable 1, then for variable 2 and then variable 1 again.

MSK_RES_ERR_MPS_MUL_CON_NAME (1112)

A constraint name was specified multiple times in the ROWS section.

MSK_RES_ERR_MPS_MUL_QSEC (1113)

Multiple QSECTIONs are specified for a constraint in the MPS data file.

MSK_RES_ERR_MPS_MUL_QOBJ (1114)

The Q term in the objective is specified multiple times in the MPS data file.

MSK_RES_ERR_MPS_INV_SEC_ORDER (1115)

The sections in the MPS data file are not in the correct order.

MSK_RES_ERR_MPS_MUL_CSEC (1116)

Multiple CSECTIONs are given the same name.

MSK_RES_ERR_MPS_CONE_TYPE (1117)

Invalid cone type specified in a CSECTION.

MSK_RES_ERR_MPS_CONE_OVERLAP (1118)

A variable is specified to be a member of several cones.

MSK_RES_ERR_MPS_CONE_REPEAT (1119)

A variable is repeated within the CSECTION.

MSK_RES_ERR_MPS_NON_SYMMETRIC_Q (1120)

A non symmetric matrix has been speciefied.

MSK_RES_ERR_MPS_DUPLICATE_Q_ELEMENT (1121)

Duplicate elements is specfied in a Q matrix.

MSK_RES_ERR_MPS_INVALID_OBJSENSE (1122)

An invalid objective sense is specified.

MSK_RES_ERR_MPS_TAB_IN_FIELD2 (1125)

A tab char occurred in field 2.

MSK_RES_ERR_MPS_TAB_IN_FIELD3 (1126)

A tab char occurred in field 3.

MSK_RES_ERR_MPS_TAB_IN_FIELD5 (1127)

A tab char occurred in field 5.

MSK_RES_ERR_MPS_INVALID_OBJ_NAME (1128)

An invalid objective name is specified.

MSK_RES_ERR_MPS_INVALID_KEY (1129)

An invalid indicator key occurred in an MPS file.

MSK_RES_ERR_MPS_INVALID_INDICATOR_CONSTRAINT (1130)

An invalid indicator constraint is used. It must not be a ranged constraint.

MSK_RES_ERR_MPS_INVALID_INDICATOR_VARIABLE (1131)

An invalid indicator variable is specfied. It must be a binary variable.

MSK_RES_ERR_MPS_INVALID_INDICATOR_VALUE (1132)

An invalid indicator value is specfied. It must be either 0 or 1.

MSK_RES_ERR_MPS_INVALID_INDICATOR_QUADRATIC_CONSTRAINT (1133)

A quadratic constraint can be be an indicator constraint.

MSK_RES_ERR_OPF_SYNTAX (1134)

Syntax error in an OPF file

MSK_RES_ERR_OPF_PREMATURE_EOF (1136)

Premature end of file in an OPF file.

MSK_RES_ERR_OPF_MISMATCHED_TAG (1137)

Mismatched end-tag in OPF file

MSK_RES_ERR_OPF_DUPLICATE_BOUND (1138)

Either upper or lower bound was specified twice in OPF file

MSK_RES_ERR_OPF_DUPLICATE_CONSTRAINT_NAME (1139)

Duplicate constraint name in OPF File

MSK_RES_ERR_OPF_INVALID_CONE_TYPE (1140)

Invalid cone type in OPF File

MSK_RES_ERR_OPF_INCORRECT_TAG_PARAM (1141)

Invalid number of parameters in start-tag in OPF File

MSK_RES_ERR_OPF_INVALID_TAG (1142)

Invalid start-tag in OPF File

MSK_RES_ERR_OPF_DUPLICATE_CONE_ENTRY (1143)

Same variable appears in multiple cones in OPF File

MSK_RES_ERR_OPF_TOO_LARGE (1144)

The problem is too large to be correctly loaded

MSK_RES_ERR_OPF_DUAL_INTEGER_SOLUTION (1146)

Dual solution values are not allowed in OPF File

MSK_RES_ERR_LP_EMPTY (1151)

The problem cannot be written to an LP formatted file.

MSK_RES_ERR_WRITE_MPS_INVALID_NAME (1153)

An invalid name is created while writing an MPS file. Usually this will make the MPS file unreadable.

MSK_RES_ERR_LP_INVALID_VAR_NAME (1154)

A variable name is invalid when used in an LP formatted file.

MSK_RES_ERR_WRITE_OPF_INVALID_VAR_NAME (1156)

Empty variable names cannot be written to OPF files.

MSK_RES_ERR_LP_FILE_FORMAT (1157)

Syntax error in an LP file.

MSK_RES_ERR_LP_EXPECTED_NUMBER (1158)

Expected a number in LP file

MSK_RES_ERR_READ_LP_MISSING_END_TAG (1159)

Syntax error in LP file. Possibly missing End tag.

MSK_RES_ERR_LP_INDICATOR_VAR (1160)

An indicator variable was not declared binary

MSK_RES_ERR_LP_EXPECTED_OBJECTIVE (1161)

Expected an objective section in LP file

MSK_RES_ERR_LP_EXPECTED_CONSTRAINT_RELATION (1162)

Expected constraint relation

MSK_RES_ERR_LP_AMBIGUOUS_CONSTRAINT_BOUND (1163)

Constraint has ambiguous or invalid bound

MSK_RES_ERR_LP_DUPLICATE_SECTION (1164)

Duplicate section

MSK_RES_ERR_READ_LP_DELAYED_ROWS_NOT_SUPPORTED (1165)
    Duplicate section

MSK_RES_ERR_WRITING_FILE (1166)
    An error occurred while writing file

MSK_RES_ERR_WRITE_ASYNC (1167)
    An error occurred while performing asynchronous writing

MSK_RES_ERR_INVALID_NAME_IN_SOL_FILE (1170)
    An invalid name occurred in a solution file.

MSK_RES_ERR_JSON_SYNTAX (1175)
    Syntax error in an JSON data

MSK_RES_ERR_JSON_STRING (1176)
    Error in JSON string.

MSK_RES_ERR_JSON_NUMBER_OVERFLOW (1177)
    Invalid number entry - wrong type or value overflow.

MSK_RES_ERR_JSON_FORMAT (1178)
    Error in an JSON Task file

MSK_RES_ERR_JSON_DATA (1179)
    Inconsistent data in JSON Task file

MSK_RES_ERR_JSON_MISSING_DATA (1180)
    Missing data section in JSON task file.

MSK_RES_ERR_PTF_INCOMPATIBILITY (1181)
    Incompatible item

MSK_RES_ERR_PTF_UNDEFINED_ITEM (1182)
    Undefined symbol referenced

MSK_RES_ERR_PTF_INCONSISTENCY (1183)
    Inconsistent size of item

MSK_RES_ERR_PTF_FORMAT (1184)
    Syntax error in an PTF file

MSK_RES_ERR_ARGUMENT_LENNEQ (1197)
    Incorrect length of arguments.

MSK_RES_ERR_ARGUMENT_TYPE (1198)
    Incorrect argument type.

MSK_RES_ERR_NUM_ARGUMENTS (1199)
    Incorrect number of function arguments.

MSK_RES_ERR_IN_ARGUMENT (1200)
    A function argument is incorrect.

MSK_RES_ERR_ARGUMENT_DIMENSION (1201)
    A function argument is of incorrect dimension.

MSK_RES_ERR_SHAPE_IS_TOO_LARGE (1202)
    The size of the n-dimensional shape is too large.

MSK_RES_ERR_INDEX_IS_TOO_SMALL (1203)
    An index in an argument is too small.

MSK_RES_ERR_INDEX_IS_TOO_LARGE (1204)
    An index in an argument is too large.

MSK_RES_ERR_INDEX_IS_NOT_UNIQUE (1205)
    An index in an argument is not unique.

MSK_RES_ERR_PARAM_NAME (1206)
    The parameter name is not correct.

MSK_RES_ERR_PARAM_NAME_DOU (1207)
    The parameter name is not correct for a double parameter.

MSK_RES_ERR_PARAM_NAME_INT (1208)
    The parameter name is not correct for an integer parameter.

MSK_RES_ERR_PARAM_NAME_STR (1209)
: The parameter name is not correct for a string parameter.

MSK_RES_ERR_PARAM_INDEX (1210)
: Parameter index is out of range.

MSK_RES_ERR_PARAM_IS_TOO_LARGE (1215)
: The parameter value is too large.

MSK_RES_ERR_PARAM_IS_TOO_SMALL (1216)
: The parameter value is too small.

MSK_RES_ERR_PARAM_VALUE_STR (1217)
: The parameter value string is incorrect.

MSK_RES_ERR_PARAM_TYPE (1218)
: The parameter type is invalid.

MSK_RES_ERR_INF_DOU_INDEX (1219)
: A double information index is out of range for the specified type.

MSK_RES_ERR_INF_INT_INDEX (1220)
: An integer information index is out of range for the specified type.

MSK_RES_ERR_INDEX_ARR_IS_TOO_SMALL (1221)
: An index in an array argument is too small.

MSK_RES_ERR_INDEX_ARR_IS_TOO_LARGE (1222)
: An index in an array argument is too large.

MSK_RES_ERR_INF_LINT_INDEX (1225)
: A long integer information index is out of range for the specified type.

MSK_RES_ERR_ARG_IS_TOO_SMALL (1226)
: The value of a argument is too small.

MSK_RES_ERR_ARG_IS_TOO_LARGE (1227)
: The value of a argument is too large.

MSK_RES_ERR_INVALID_WHICHSOL (1228)
: `whichsol` is invalid.

MSK_RES_ERR_INF_DOU_NAME (1230)
: A double information name is invalid.

MSK_RES_ERR_INF_INT_NAME (1231)
: An integer information name is invalid.

MSK_RES_ERR_INF_TYPE (1232)
: The information type is invalid.

MSK_RES_ERR_INF_LINT_NAME (1234)
: A long integer information name is invalid.

MSK_RES_ERR_INDEX (1235)
: An index is out of range.

MSK_RES_ERR_WHICHSOL (1236)
: The solution defined by `whichsol` does not exists.

MSK_RES_ERR_SOLITEM (1237)
: The solution item number `solitem` is invalid. Please note that *MSK_SOL_ITEM_SNX* is invalid for the basic solution.

MSK_RES_ERR_WHICHITEM_NOT_ALLOWED (1238)
: `whichitem` is unacceptable.

MSK_RES_ERR_MAXNUMCON (1240)
: The maximum number of constraints specified is smaller than the number of constraints in the task.

MSK_RES_ERR_MAXNUMVAR (1241)
: The maximum number of variables specified is smaller than the number of variables in the task.

MSK_RES_ERR_MAXNUMBARVAR (1242)
: The maximum number of semidefinite variables specified is smaller than the number of semidefinite variables in the task.

MSK_RES_ERR_MAXNUMQNZ (1243)

The maximum number of non-zeros specified for the Q matrices is smaller than the number of non-zeros in the current Q matrices.

MSK_RES_ERR_TOO_SMALL_MAX_NUM_NZ (1245)

The maximum number of non-zeros specified is too small.

MSK_RES_ERR_INVALID_IDX (1246)

A specified index is invalid.

MSK_RES_ERR_INVALID_MAX_NUM (1247)

A specified index is invalid.

MSK_RES_ERR_UNALLOWED_WHICHSOL (1248)

The value od `whichsol` is not allowed.

MSK_RES_ERR_NUMCONLIM (1250)

Maximum number of constraints limit is exceeded.

MSK_RES_ERR_NUMVARLIM (1251)

Maximum number of variables limit is exceeded.

MSK_RES_ERR_TOO_SMALL_MAXNUMANZ (1252)

The maximum number of non-zeros specified for A is smaller than the number of non-zeros in the current A.

MSK_RES_ERR_INV_APTRE (1253)

`aptre[j]` is strictly smaller than `aptrb[j]` for some `j`.

MSK_RES_ERR_MUL_A_ELEMENT (1254)

An element in A is defined multiple times.

MSK_RES_ERR_INV_BK (1255)

Invalid bound key.

MSK_RES_ERR_INV_BKC (1256)

Invalid bound key is specified for a constraint.

MSK_RES_ERR_INV_BKX (1257)

An invalid bound key is specified for a variable.

MSK_RES_ERR_INV_VAR_TYPE (1258)

An invalid variable type is specified for a variable.

MSK_RES_ERR_SOLVER_PROBTYPE (1259)

Problem type does not match the chosen optimizer.

MSK_RES_ERR_OBJECTIVE_RANGE (1260)

Empty objective range.

MSK_RES_ERR_INV_RESCODE (1261)

Invalid response code.

MSK_RES_ERR_INV_IINF (1262)

Invalid integer information item.

MSK_RES_ERR_INV_LIINF (1263)

Invalid long integer information item.

MSK_RES_ERR_INV_DINF (1264)

Invalid double information item.

MSK_RES_ERR_BASIS (1266)

An invalid basis is specified. Either too many or too few basis variables are specified.

MSK_RES_ERR_INV_SKC (1267)

Invalid value in `skc`.

MSK_RES_ERR_INV_SKX (1268)

Invalid value in `skx`.

MSK_RES_ERR_INV_SKN (1274)

Invalid value in `skn`.

MSK_RES_ERR_INV_SK_STR (1269)

Invalid status key string encountered.

MSK_RES_ERR_INV_SK (1270)
Invalid status key code.

MSK_RES_ERR_INV_CONE_TYPE_STR (1271)
Invalid cone type string encountered.

MSK_RES_ERR_INV_CONE_TYPE (1272)
Invalid cone type code is encountered.

MSK_RES_ERR_INVALID_SURPLUS (1275)
Invalid surplus.

MSK_RES_ERR_INV_NAME_ITEM (1280)
An invalid name item code is used.

MSK_RES_ERR_PRO_ITEM (1281)
An invalid problem is used.

MSK_RES_ERR_INVALID_FORMAT_TYPE (1283)
Invalid format type.

MSK_RES_ERR_FIRSTI (1285)
Invalid `firsti`.

MSK_RES_ERR_LASTI (1286)
Invalid `lasti`.

MSK_RES_ERR_FIRSTJ (1287)
Invalid `firstj`.

MSK_RES_ERR_LASTJ (1288)
Invalid `lastj`.

MSK_RES_ERR_MAX_LEN_IS_TOO_SMALL (1289)
A maximum length that is too small has been specified.

MSK_RES_ERR_NONLINEAR_EQUALITY (1290)
The model contains a nonlinear equality which defines a nonconvex set.

MSK_RES_ERR_NONCONVEX (1291)
The optimization problem is nonconvex.

MSK_RES_ERR_NONLINEAR_RANGED (1292)
Nonlinear constraints with finite lower and upper bound always define a nonconvex feasible set.

MSK_RES_ERR_CON_Q_NOT_PSD (1293)
The quadratic constraint matrix is not positive semidefinite as expected for a constraint with finite upper bound. This results in a nonconvex problem.

MSK_RES_ERR_CON_Q_NOT_NSD (1294)
The quadratic constraint matrix is not negative semidefinite as expected for a constraint with finite lower bound. This results in a nonconvex problem.

MSK_RES_ERR_OBJ_Q_NOT_PSD (1295)
The quadratic coefficient matrix in the objective is not positive semidefinite as expected for a minimization problem.

MSK_RES_ERR_OBJ_Q_NOT_NSD (1296)
The quadratic coefficient matrix in the objective is not negative semidefinite as expected for a maximization problem.

MSK_RES_ERR_ARGUMENT_PERM_ARRAY (1299)
An invalid permutation array is specified.

MSK_RES_ERR_CONE_INDEX (1300)
An index of a non-existing cone has been specified.

MSK_RES_ERR_CONE_SIZE (1301)
A cone with incorrect number of members is specified.

MSK_RES_ERR_CONE_OVERLAP (1302)
One or more of the variables in the cone to be added is already member of another cone. Now assume the variable is x_j then add a new variable say x_k and the constraint

$$x_j = x_k$$

and then let x_k be member of the cone to be appended.

MSK_RES_ERR_CONE_REP_VAR (1303)

A variable is included multiple times in the cone.

MSK_RES_ERR_MAXNUMCONE (1304)

The value specified for maxnumcone is too small.

MSK_RES_ERR_CONE_TYPE (1305)

Invalid cone type specified.

MSK_RES_ERR_CONE_TYPE_STR (1306)

Invalid cone type specified.

MSK_RES_ERR_CONE_OVERLAP_APPEND (1307)

The cone to be appended has one variable which is already member of another cone.

MSK_RES_ERR_REMOVE_CONE_VARIABLE (1310)

A variable cannot be removed because it will make a cone invalid.

MSK_RES_ERR_APPENDING_TOO_BIG_CONE (1311)

Trying to append a too big cone.

MSK_RES_ERR_CONE_PARAMETER (1320)

An invalid cone parameter.

MSK_RES_ERR_SOL_FILE_INVALID_NUMBER (1350)

An invalid number is specified in a solution file.

MSK_RES_ERR_HUGE_C (1375)

A huge value in absolute size is specified for one c_j.

MSK_RES_ERR_HUGE_AIJ (1380)

A numerically huge value is specified for an $a_{i,j}$ element in A. The parameter *MSK_DPAR_DATA_TOL_AIJ_HUGE* controls when an $a_{i,j}$ is considered huge.

MSK_RES_ERR_DUPLICATE_AIJ (1385)

An element in the A matrix is specified twice.

MSK_RES_ERR_LOWER_BOUND_IS_A_NAN (1390)

The lower bound specified is not a number (nan).

MSK_RES_ERR_UPPER_BOUND_IS_A_NAN (1391)

The upper bound specified is not a number (nan).

MSK_RES_ERR_INFINITE_BOUND (1400)

A numerically huge bound value is specified.

MSK_RES_ERR_INV_QOBJ_SUBI (1401)

Invalid value in qosubi.

MSK_RES_ERR_INV_QOBJ_SUBJ (1402)

Invalid value in qosubj.

MSK_RES_ERR_INV_QOBJ_VAL (1403)

Invalid value in qoval.

MSK_RES_ERR_INV_QCON_SUBK (1404)

Invalid value in qcsubk.

MSK_RES_ERR_INV_QCON_SUBI (1405)

Invalid value in qcsubi.

MSK_RES_ERR_INV_QCON_SUBJ (1406)

Invalid value in qcsubj.

MSK_RES_ERR_INV_QCON_VAL (1407)

Invalid value in qcval.

MSK_RES_ERR_QCON_SUBI_TOO_SMALL (1408)

Invalid value in qcsubi.

MSK_RES_ERR_QCON_SUBI_TOO_LARGE (1409)

Invalid value in qcsubi.

MSK_RES_ERR_QOBJ_UPPER_TRIANGLE (1415)

An element in the upper triangle of Q^o is specified. Only elements in the lower triangle should be specified.

MSK_RES_ERR_QCON_UPPER_TRIANGLE (1417)

An element in the upper triangle of a Q^k is specified. Only elements in the lower triangle should be specified.

MSK_RES_ERR_FIXED_BOUND_VALUES (1420)

A fixed constraint/variable has been specified using the bound keys but the numerical value of the lower and upper bound is different.

MSK_RES_ERR_TOO_SMALL_A_TRUNCATION_VALUE (1421)

A too small value for the A trucation value is specified.

MSK_RES_ERR_INVALID_OBJECTIVE_SENSE (1445)

An invalid objective sense is specified.

MSK_RES_ERR_UNDEFINED_OBJECTIVE_SENSE (1446)

The objective sense has not been specified before the optimization.

MSK_RES_ERR_Y_IS_UNDEFINED (1449)

The solution item y is undefined.

MSK_RES_ERR_NAN_IN_DOUBLE_DATA (1450)

An invalid floating point value was used in some double data.

MSK_RES_ERR_INF_IN_DOUBLE_DATA (1451)

An infinite floating point value was used in some double data.

MSK_RES_ERR_NAN_IN_BLC (1461)

l^c contains an invalid floating point value, i.e. a `NaN` or `Inf`.

MSK_RES_ERR_NAN_IN_BUC (1462)

u^c contains an invalid floating point value, i.e. a `NaN` of `Inf`.

MSK_RES_ERR_INVALID_CFIX (1469)

An invalid fixed term in the objective is speficied.

MSK_RES_ERR_NAN_IN_C (1470)

c contains an invalid floating point value, i.e. a `NaN` or `Inf`.

MSK_RES_ERR_NAN_IN_BLX (1471)

l^x contains an invalid floating point value, i.e. a `NaN` or `Inf`.

MSK_RES_ERR_NAN_IN_BUX (1472)

u^x contains an invalid floating point value, i.e. a `NaN` or `Inf`.

MSK_RES_ERR_INVALID_AIJ (1473)

$a_{i,j}$ contains an invalid floating point value, i.e. a `NaN` or an infinite value.

MSK_RES_ERR_INVALID_CJ (1474)

c_j contains an invalid floating point value, i.e. a `NaN` or an infinite value.

MSK_RES_ERR_SYM_MAT_INVALID (1480)

A symmetric matrix contains an invalid floating point value, i.e. a `NaN` or an infinite value.

MSK_RES_ERR_SYM_MAT_HUGE (1482)

A symmetric matrix contains a huge value in absolute size. The parameter *MSK_DPAR_DATA_SYM_MAT_TOL_HUGE* controls when an $e_{i,j}$ is considered huge.

MSK_RES_ERR_INV_PROBLEM (1500)

Invalid problem type. Probably a nonconvex problem has been specified.

MSK_RES_ERR_MIXED_CONIC_AND_NL (1501)

The problem contains nonlinear terms conic constraints. The requested operation cannot be applied to this type of problem.

MSK_RES_ERR_GLOBAL_INV_CONIC_PROBLEM (1503)

The global optimizer can only be applied to problems without semidefinite variables.

MSK_RES_ERR_INV_OPTIMIZER (1550)

An invalid optimizer has been chosen for the problem.

MSK_RES_ERR_MIO_NO_OPTIMIZER (1551)

No optimizer is available for the current class of integer optimization problems.

MSK_RES_ERR_NO_OPTIMIZER_VAR_TYPE (1552)

No optimizer is available for this class of optimization problems.

MSK_RES_ERR_FINAL_SOLUTION (1560)

An error occurred during the solution finalization.

MSK_RES_ERR_FIRST (1570)

Invalid `first`.

MSK_RES_ERR_LAST (1571)

Invalid index `last`. A given index was out of expected range.

MSK_RES_ERR_SLICE_SIZE (1572)

Invalid slice size specified.

MSK_RES_ERR_NEGATIVE_SURPLUS (1573)

Negative surplus.

MSK_RES_ERR_NEGATIVE_APPEND (1578)

Cannot append a negative number.

MSK_RES_ERR_POSTSOLVE (1580)

An error occurred during the postsolve. Please contact **MOSEK** support.

MSK_RES_ERR_OVERFLOW (1590)

A computation produced an overflow i.e. a very large number.

MSK_RES_ERR_NO_BASIS_SOL (1600)

No basic solution is defined.

MSK_RES_ERR_BASIS_FACTOR (1610)

The factorization of the basis is invalid.

MSK_RES_ERR_BASIS_SINGULAR (1615)

The basis is singular and hence cannot be factored.

MSK_RES_ERR_FACTOR (1650)

An error occurred while factorizing a matrix.

MSK_RES_ERR_FEASREPAIR_CANNOT_RELAX (1700)

An optimization problem cannot be relaxed.

MSK_RES_ERR_FEASREPAIR_SOLVING_RELAXED (1701)

The relaxed problem could not be solved to optimality. Please consult the log file for further details.

MSK_RES_ERR_FEASREPAIR_INCONSISTENT_BOUND (1702)

The upper bound is less than the lower bound for a variable or a constraint. Please correct this before running the feasibility repair.

MSK_RES_ERR_REPAIR_INVALID_PROBLEM (1710)

The feasibility repair does not support the specified problem type.

MSK_RES_ERR_REPAIR_OPTIMIZATION_FAILED (1711)

Computation the optimal relaxation failed. The cause may have been numerical problems.

MSK_RES_ERR_NAME_MAX_LEN (1750)

A name is longer than the buffer that is supposed to hold it.

MSK_RES_ERR_NAME_IS_NULL (1760)

The name buffer is a `NULL` pointer.

MSK_RES_ERR_INVALID_COMPRESSION (1800)

Invalid compression type.

MSK_RES_ERR_INVALID_IOMODE (1801)

Invalid io mode.

MSK_RES_ERR_NO_PRIMAL_INFEAS_CER (2000)

A certificate of primal infeasibility is not available.

MSK_RES_ERR_NO_DUAL_INFEAS_CER (2001)

A certificate of infeasibility is not available.

MSK_RES_ERR_NO_SOLUTION_IN_CALLBACK (2500)

The required solution is not available.

MSK_RES_ERR_INV_MARKI (2501)

Invalid value in marki.

MSK_RES_ERR_INV_MARKJ (2502)

Invalid value in markj.

MSK_RES_ERR_INV_NUMI (2503)

Invalid numi.

MSK_RES_ERR_INV_NUMJ (2504)

Invalid numj.

MSK_RES_ERR_TASK_INCOMPATIBLE (2560)

The Task file is incompatible with this platform. This results from reading a file on a 32 bit platform generated on a 64 bit platform.

MSK_RES_ERR_TASK_INVALID (2561)

The Task file is invalid.

MSK_RES_ERR_TASK_WRITE (2562)

Failed to write the task file.

MSK_RES_ERR_READ_WRITE (2563)

Failed to read or write due to an I/O error.

MSK_RES_ERR_TASK_PREMATURE_EOF (2564)

The Task file ended prematurely.

MSK_RES_ERR_LU_MAX_NUM_TRIES (2800)

Could not compute the LU factors of the matrix within the maximum number of allowed tries.

MSK_RES_ERR_INVALID_UTF8 (2900)

An invalid UTF8 string is encountered.

MSK_RES_ERR_INVALID_WCHAR (2901)

An invalid `wchar` string is encountered.

MSK_RES_ERR_NO_DUAL_FOR_ITG_SOL (2950)

No dual information is available for the integer solution.

MSK_RES_ERR_NO_SNX_FOR_BAS_SOL (2953)

s_n^x is not available for the basis solution.

MSK_RES_ERR_INTERNAL (3000)

An internal error occurred. Please report this problem.

MSK_RES_ERR_API_ARRAY_TOO_SMALL (3001)

An input array was too short.

MSK_RES_ERR_API_CB_CONNECT (3002)

Failed to connect a callback object.

MSK_RES_ERR_API_FATAL_ERROR (3005)

An internal error occurred in the API. Please report this problem.

MSK_RES_ERR_API_INTERNAL (3999)

An internal fatal error occurred in an interface function.

MSK_RES_ERR_SEN_FORMAT (3050)

Syntax error in sensitivity analysis file.

MSK_RES_ERR_SEN_UNDEF_NAME (3051)

An undefined name was encountered in the sensitivity analysis file.

MSK_RES_ERR_SEN_INDEX_RANGE (3052)

Index out of range in the sensitivity analysis file.

MSK_RES_ERR_SEN_BOUND_INVALID_UP (3053)

Analysis of upper bound requested for an index, where no upper bound exists.

MSK_RES_ERR_SEN_BOUND_INVALID_LO (3054)

Analysis of lower bound requested for an index, where no lower bound exists.

MSK_RES_ERR_SEN_INDEX_INVALID (3055)

Invalid range given in the sensitivity file.

MSK_RES_ERR_SEN_INVALID_REGEXP (3056)

Syntax error in regexp or regexp longer than 1024.

MSK_RES_ERR_SEN_SOLUTION_STATUS (3057)

No optimal solution found to the original problem given for sensitivity analysis.

MSK_RES_ERR_SEN_NUMERICAL (3058)

Numerical difficulties encountered performing the sensitivity analysis.

MSK_RES_ERR_SEN_UNHANDLED_PROBLEM_TYPE (3080)

Sensitivity analysis cannot be performed for the specified problem. Sensitivity analysis is only possible for linear problems.

MSK_RES_ERR_UNB_STEP_SIZE (3100)

A step size in an optimizer was unexpectedly unbounded. For instance, if the step-size becomes unbounded in phase 1 of the simplex algorithm then an error occurs. Normally this will happen only if the problem is badly formulated. Please contact **MOSEK** support if this error occurs.

MSK_RES_ERR_IDENTICAL_TASKS (3101)

Some tasks related to this function call were identical. Unique tasks were expected.

MSK_RES_ERR_AD_INVALID_CODELIST (3102)

The code list data was invalid.

MSK_RES_ERR_INTERNAL_TEST_FAILED (3500)

An internal unit test function failed.

MSK_RES_ERR_INT64_TO_INT32_CAST (3800)

A 64 bit integer could not be cast to a 32 bit integer.

MSK_RES_ERR_INFEAS_UNDEFINED (3910)

The requested value is not defined for this solution type.

MSK_RES_ERR_NO_BARX_FOR_SOLUTION (3915)

There is no $\overline{X}$ available for the solution specified. In particular note there are no $\overline{X}$ defined for the basic and integer solutions.

MSK_RES_ERR_NO_BARS_FOR_SOLUTION (3916)

There is no $\bar{s}$ available for the solution specified. In particular note there are no $\bar{s}$ defined for the basic and integer solutions.

MSK_RES_ERR_BAR_VAR_DIM (3920)

The dimension of a symmetric matrix variable has to be greater than 0.

MSK_RES_ERR_SYM_MAT_INVALID_ROW_INDEX (3940)

A row index specified for sparse symmetric matrix is invalid.

MSK_RES_ERR_SYM_MAT_INVALID_COL_INDEX (3941)

A column index specified for sparse symmetric matrix is invalid.

MSK_RES_ERR_SYM_MAT_NOT_LOWER_TRINGULAR (3942)

Only the lower triangular part of sparse symmetric matrix should be specified.

MSK_RES_ERR_SYM_MAT_INVALID_VALUE (3943)

The numerical value specified in a sparse symmetric matrix is not a floating point value.

MSK_RES_ERR_SYM_MAT_DUPLICATE (3944)

A value in a symmetric matric as been specified more than once.

MSK_RES_ERR_INVALID_SYM_MAT_DIM (3950)

A sparse symmetric matrix of invalid dimension is specified.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_SYM_MAT (4000)

The file format does not support a problem with symmetric matrix variables.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_CFIX (4001)

The file format does not support a problem with nonzero fixed term in c.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_RANGED_CONSTRAINTS (4002)

The file format does not support a problem with ranged constraints.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_FREE_CONSTRAINTS (4003)

The file format does not support a problem with free constraints.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_CONES (4005)

The file format does not support a problem with the simple cones (deprecated).

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_QUADRATIC_TERMS (4006)

The file format does not support a problem with quadratic terms.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_NONLINEAR (4010)
: The file format does not support a problem with nonlinear terms.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_DISJUNCTIVE_CONSTRAINTS (4011)
: The file format does not support a problem with disjunctive constraints.

MSK_RES_ERR_INVALID_FILE_FORMAT_FOR_AFFINE_CONIC_CONSTRAINTS (4012)
: The file format does not support a problem with affine conic constraints.

MSK_RES_ERR_DUPLICATE_CONSTRAINT_NAMES (4500)
: Two constraint names are identical.

MSK_RES_ERR_DUPLICATE_VARIABLE_NAMES (4501)
: Two variable names are identical.

MSK_RES_ERR_DUPLICATE_BARVARIABLE_NAMES (4502)
: Two barvariable names are identical.

MSK_RES_ERR_DUPLICATE_CONE_NAMES (4503)
: Two cone names are identical.

MSK_RES_ERR_DUPLICATE_DOMAIN_NAMES (4504)
: Two domain names are identical.

MSK_RES_ERR_DUPLICATE_DJC_NAMES (4505)
: Two disjunctive constraint names are identical.

MSK_RES_ERR_NON_UNIQUE_ARRAY (5000)
: An array does not contain unique elements.

MSK_RES_ERR_ARGUMENT_IS_TOO_SMALL (5004)
: The value of a function argument is too small.

MSK_RES_ERR_ARGUMENT_IS_TOO_LARGE (5005)
: The value of a function argument is too large.

MSK_RES_ERR_MIO_INTERNAL (5010)
: A fatal error occurred in the mixed integer optimizer. Please contact **MOSEK** support.

MSK_RES_ERR_INVALID_PROBLEM_TYPE (6000)
: An invalid problem type.

MSK_RES_ERR_UNHANDLED_SOLUTION_STATUS (6010)
: Unhandled solution status.

MSK_RES_ERR_UPPER_TRIANGLE (6020)
: An element in the upper triangle of a lower triangular matrix is specified.

MSK_RES_ERR_LAU_SINGULAR_MATRIX (7000)
: A matrix is singular.

MSK_RES_ERR_LAU_NOT_POSITIVE_DEFINITE (7001)
: A matrix is not positive definite.

MSK_RES_ERR_LAU_INVALID_LOWER_TRIANGULAR_MATRIX (7002)
: An invalid lower triangular matrix.

MSK_RES_ERR_LAU_UNKNOWN (7005)
: An unknown error.

MSK_RES_ERR_LAU_ARG_M (7010)
: Invalid argument m.

MSK_RES_ERR_LAU_ARG_N (7011)
: Invalid argument n.

MSK_RES_ERR_LAU_ARG_K (7012)
: Invalid argument k.

MSK_RES_ERR_LAU_ARG_TRANSA (7015)
: Invalid argument transa.

MSK_RES_ERR_LAU_ARG_TRANSB (7016)
: Invalid argument transb.

MSK_RES_ERR_LAU_ARG_UPLO (7017)
: Invalid argument uplo.

MSK_RES_ERR_LAU_ARG_TRANS (7018)

Invalid argument trans.

MSK_RES_ERR_LAU_INVALID_SPARSE_SYMMETRIC_MATRIX (7019)

An invalid sparse symmetric matrix is specfified. Note only the lower triangular part with no duplicates is specifed.

MSK_RES_ERR_CBF_PARSE (7100)

An error occurred while parsing an CBF file.

MSK_RES_ERR_CBF_OBJ_SENSE (7101)

An invalid objective sense is specified.

MSK_RES_ERR_CBF_NO_VARIABLES (7102)

No variables are specified.

MSK_RES_ERR_CBF_TOO_MANY_CONSTRAINTS (7103)

Too many constraints specified.

MSK_RES_ERR_CBF_TOO_MANY_VARIABLES (7104)

Too many variables specified.

MSK_RES_ERR_CBF_NO_VERSION_SPECIFIED (7105)

No version specified.

MSK_RES_ERR_CBF_SYNTAX (7106)

Invalid syntax.

MSK_RES_ERR_CBF_DUPLICATE_OBJ (7107)

Duplicate OBJ keyword.

MSK_RES_ERR_CBF_DUPLICATE_CON (7108)

Duplicate CON keyword.

MSK_RES_ERR_CBF_DUPLICATE_VAR (7110)

Duplicate VAR keyword.

MSK_RES_ERR_CBF_DUPLICATE_INT (7111)

Duplicate INT keyword.

MSK_RES_ERR_CBF_INVALID_VAR_TYPE (7112)

Invalid variable type.

MSK_RES_ERR_CBF_INVALID_CON_TYPE (7113)

Invalid constraint type.

MSK_RES_ERR_CBF_INVALID_DOMAIN_DIMENSION (7114)

Invalid domain dimension.

MSK_RES_ERR_CBF_DUPLICATE_OBJACOORD (7115)

Duplicate index in OBJCOORD.

MSK_RES_ERR_CBF_DUPLICATE_BCOORD (7116)

Duplicate index in BCOORD.

MSK_RES_ERR_CBF_DUPLICATE_ACOORD (7117)

Duplicate index in ACOORD.

MSK_RES_ERR_CBF_TOO_FEW_VARIABLES (7118)

Too few variables defined.

MSK_RES_ERR_CBF_TOO_FEW_CONSTRAINTS (7119)

Too few constraints defined.

MSK_RES_ERR_CBF_TOO_FEW_INTS (7120)

Too few ints are specified.

MSK_RES_ERR_CBF_TOO_MANY_INTS (7121)

Too many ints are specified.

MSK_RES_ERR_CBF_INVALID_INT_INDEX (7122)

Invalid INT index.

MSK_RES_ERR_CBF_UNSUPPORTED (7123)

Unsupported feature is present.

MSK_RES_ERR_CBF_DUPLICATE_PSDVAR (7124)
: Duplicate PSDVAR keyword.

MSK_RES_ERR_CBF_INVALID_PSDVAR_DIMENSION (7125)
: Invalid PSDVAR dimension.

MSK_RES_ERR_CBF_TOO_FEW_PSDVAR (7126)
: Too few variables defined.

MSK_RES_ERR_CBF_INVALID_EXP_DIMENSION (7127)
: Invalid dimension of a exponential cone.

MSK_RES_ERR_CBF_DUPLICATE_POW_CONES (7130)
: Multiple POWCONES specified.

MSK_RES_ERR_CBF_DUPLICATE_POW_STAR_CONES (7131)
: Multiple POW*CONES specified.

MSK_RES_ERR_CBF_INVALID_POWER (7132)
: Invalid power specified.

MSK_RES_ERR_CBF_POWER_CONE_IS_TOO_LONG (7133)
: Power cone is too long.

MSK_RES_ERR_CBF_INVALID_POWER_CONE_INDEX (7134)
: Invalid power cone index.

MSK_RES_ERR_CBF_INVALID_POWER_STAR_CONE_INDEX (7135)
: Invalid power star cone index.

MSK_RES_ERR_CBF_UNHANDLED_POWER_CONE_TYPE (7136)
: An unhandled power cone type.

MSK_RES_ERR_CBF_UNHANDLED_POWER_STAR_CONE_TYPE (7137)
: An unhandled power star cone type.

MSK_RES_ERR_CBF_POWER_CONE_MISMATCH (7138)
: The power cone does not match with it definition.

MSK_RES_ERR_CBF_POWER_STAR_CONE_MISMATCH (7139)
: The power star cone does not match with it definition.

MSK_RES_ERR_CBF_INVALID_NUMBER_OF_CONES (7140)
: Invalid number of cones.

MSK_RES_ERR_CBF_INVALID_DIMENSION_OF_CONES (7141)
: Invalid number of cones.

MSK_RES_ERR_CBF_INVALID_NUM_OBJACOORD (7150)
: Invalid number of OBJACOORD.

MSK_RES_ERR_CBF_INVALID_NUM_OBJFCOORD (7151)
: Invalid number of OBJFCOORD.

MSK_RES_ERR_CBF_INVALID_NUM_ACOORD (7152)
: Invalid number of ACOORD.

MSK_RES_ERR_CBF_INVALID_NUM_BCOORD (7153)
: Invalid number of BCOORD.

MSK_RES_ERR_CBF_INVALID_NUM_FCOORD (7155)
: Invalid number of FCOORD.

MSK_RES_ERR_CBF_INVALID_NUM_HCOORD (7156)
: Invalid number of HCOORD.

MSK_RES_ERR_CBF_INVALID_NUM_DCOORD (7157)
: Invalid number of DCOORD.

MSK_RES_ERR_CBF_EXPECTED_A_KEYWORD (7158)
: Expected a key word.

MSK_RES_ERR_CBF_INVALID_NUM_PSDCON (7200)
: Invalid number of PSDCON.

MSK_RES_ERR_CBF_DUPLICATE_PSDCON (7201)
: Duplicate CON keyword.

MSK_RES_ERR_CBF_INVALID_DIMENSION_OF_PSDCON (7202)

Invalid PSDCON dimension.

MSK_RES_ERR_CBF_INVALID_PSDCON_INDEX (7203)

Invalid PSDCON index.

MSK_RES_ERR_CBF_INVALID_PSDCON_VARIABLE_INDEX (7204)

Invalid PSDCON index.

MSK_RES_ERR_CBF_INVALID_PSDCON_BLOCK_INDEX (7205)

Invalid PSDCON index.

MSK_RES_ERR_CBF_UNSUPPORTED_CHANGE (7210)

The CHANGE section is not supported.

MSK_RES_ERR_MIO_INVALID_ROOT_OPTIMIZER (7700)

An invalid root optimizer was selected for the problem type.

MSK_RES_ERR_MIO_INVALID_NODE_OPTIMIZER (7701)

An invalid node optimizer was selected for the problem type.

MSK_RES_ERR_MPS_WRITE_CPLEX_INVALID_CONE_TYPE (7750)

An invalid cone type occurs when writing a CPLEX formatted MPS file.

MSK_RES_ERR_TOCONIC_CONSTR_Q_NOT_PSD (7800)

The matrix defining the quadratric part of constraint is not positive semidefinite.

MSK_RES_ERR_TOCONIC_CONSTRAINT_FX (7801)

The quadratic constraint is an equality, thus not convex.

MSK_RES_ERR_TOCONIC_CONSTRAINT_RA (7802)

The quadratic constraint has finite lower and upper bound, and therefore it is not convex.

MSK_RES_ERR_TOCONIC_CONSTR_NOT_CONIC (7803)

The constraint is not conic representable.

MSK_RES_ERR_TOCONIC_OBJECTIVE_NOT_PSD (7804)

The matrix defining the quadratric part of the objective function is not positive semidefinite.

MSK_RES_ERR_GETDUAL_NOT_AVAILABLE (7820)

The simple dualizer is not available for this problem class.

MSK_RES_ERR_SERVER_CONNECT (8000)

Failed to connect to remote solver server. The server string or the port string were invalid, or the server did not accept connection.

MSK_RES_ERR_SERVER_PROTOCOL (8001)

Unexpected message or data from solver server.

MSK_RES_ERR_SERVER_STATUS (8002)

Server returned non-ok HTTP status code

MSK_RES_ERR_SERVER_TOKEN (8003)

The job ID specified is incorrect or invalid

MSK_RES_ERR_SERVER_ADDRESS (8004)

Invalid address string

MSK_RES_ERR_SERVER_CERTIFICATE (8005)

Invalid TLS certificate format or path

MSK_RES_ERR_SERVER_TLS_CLIENT (8006)

Failed to create TLS cleint

MSK_RES_ERR_SERVER_ACCESS_TOKEN (8007)

Invalid access token

MSK_RES_ERR_SERVER_PROBLEM_SIZE (8008)

The size of the problem exceeds the dimensions permitted by the instance of the OptServer where it was run.

MSK_RES_ERR_SERVER_HARD_TIMEOUT (8009)

The hard timeout limit was reached on solver server, and the solver process was killed

MSK_RES_ERR_DUPLICATE_INDEX_IN_A_SPARSE_MATRIX (20050)

An element in a sparse matrix is specified twice.

MSK_RES_ERR_DUPLICATE_INDEX_IN_AFEIDX_LIST (20060)

An index is specified twice in an affine expression list.

MSK_RES_ERR_DUPLICATE_FIJ (20100)

An element in the F matrix is specified twice.

MSK_RES_ERR_INVALID_FIJ (20101)

$f_{i,j}$ contains an invalid floating point value, i.e. a NaN or an infinite value.

MSK_RES_ERR_HUGE_FIJ (20102)

A numerically huge value is specified for an $f_{i,j}$ element in F. The parameter *MSK_DPAR_DATA_TOL_AIJ_HUGE* controls when an $f_{i,j}$ is considered huge.

MSK_RES_ERR_INVALID_G (20103)

g contains an invalid floating point value, i.e. a NaN or an infinite value.

MSK_RES_ERR_INVALID_B (20150)

b contains an invalid floating point value, i.e. a NaN or an infinite value.

MSK_RES_ERR_DOMAIN_INVALID_INDEX (20400)

A domain index is invalid.

MSK_RES_ERR_DOMAIN_DIMENSION (20401)

A domain dimension is invalid.

MSK_RES_ERR_DOMAIN_DIMENSION_PSD (20402)

A PSD domain dimension is invalid.

MSK_RES_ERR_NOT_POWER_DOMAIN (20403)

The function is only applicable to primal and dual power cone domains.

MSK_RES_ERR_DOMAIN_POWER_INVALID_ALPHA (20404)

Alpha contains an invalid floating point value, i.e. a NaN or an infinite value.

MSK_RES_ERR_DOMAIN_POWER_NEGATIVE_ALPHA (20405)

Alpha contains a negative value or zero.

MSK_RES_ERR_DOMAIN_POWER_NLEFT (20406)

The value of n_{left} is not in $[1, n-1]$ where n is the dimension.

MSK_RES_ERR_AFE_INVALID_INDEX (20500)

An affine expression index is invalid.

MSK_RES_ERR_ACC_INVALID_INDEX (20600)

A affine conic constraint index is invalid.

MSK_RES_ERR_ACC_INVALID_ENTRY_INDEX (20601)

The index of an element in an affine conic constraint is invalid.

MSK_RES_ERR_ACC_AFE_DOMAIN_MISMATCH (20602)

There is a mismatch between between the number of affine expressions and total dimension of the domain(s).

MSK_RES_ERR_DJC_INVALID_INDEX (20700)

A disjunctive constraint index is invalid.

MSK_RES_ERR_DJC_UNSUPPORTED_DOMAIN_TYPE (20701)

An unsupported domain type has been used in a disjunctive constraint.

MSK_RES_ERR_DJC_AFE_DOMAIN_MISMATCH (20702)

There is a mismatch between the number of affine expressions and total dimension of the domain(s).

MSK_RES_ERR_DJC_INVALID_TERM_SIZE (20703)

A termize is invalid.

MSK_RES_ERR_DJC_DOMAIN_TERMSIZE_MISMATCH (20704)

There is a mismatch between the number of domains and the term sizes.

MSK_RES_ERR_DJC_TOTAL_NUM_TERMS_MISMATCH (20705)

There total number of terms in all domains does not match.

MSK_RES_ERR_UNDEF_SOLUTION (22000)

MOSEK has the following solution types:

- an interior-point solution,
- a basic solution,

- and an integer solution.

Each optimizer may set one or more of these solutions; e.g by default a successful optimization with the interior-point optimizer defines the interior-point solution and, for linear problems, also the basic solution. This error occurs when asking for a solution or for information about a solution that is not defined.

MSK_RES_ERR_NO_DOTY (22010)

No doty is available

10.5 Constants

10.5.1 Basis identification

MSK_BI_NEVER

Never do basis identification.

MSK_BI_ALWAYS

Basis identification is always performed even if the interior-point optimizer terminates abnormally.

MSK_BI_NO_ERROR

Basis identification is performed if the interior-point optimizer terminates without an error.

MSK_BI_IF_FEASIBLE

Basis identification is not performed if the interior-point optimizer terminates with a problem status saying that the problem is primal or dual infeasible.

MSK_BI_RESERVERED

Not currently in use.

10.5.2 Bound keys

MSK_BK_LO

The constraint or variable has a finite lower bound and an infinite upper bound.

MSK_BK_UP

The constraint or variable has an infinite lower bound and an finite upper bound.

MSK_BK_FX

The constraint or variable is fixed.

MSK_BK_FR

The constraint or variable is free.

MSK_BK_RA

The constraint or variable is ranged.

10.5.3 Mark

MSK_MARK_LO

The lower bound is selected for sensitivity analysis.

MSK_MARK_UP

The upper bound is selected for sensitivity analysis.

10.5.4 Experimental. Usage not recommended.

MSK_SIM_PRECISION_NORMAL
: Experimental. Usage not recommended.

MSK_SIM_PRECISION_EXTENDED
: Experimental. Usage not recommended.

10.5.5 Degeneracy strategies

MSK_SIM_DEGEN_NONE
: The simplex optimizer should use no degeneration strategy.

MSK_SIM_DEGEN_FREE
: The simplex optimizer chooses the degeneration strategy.

MSK_SIM_DEGEN_AGGRESSIVE
: The simplex optimizer should use an aggressive degeneration strategy.

MSK_SIM_DEGEN_MODERATE
: The simplex optimizer should use a moderate degeneration strategy.

MSK_SIM_DEGEN_MINIMUM
: The simplex optimizer should use a minimum degeneration strategy.

10.5.6 Transposed matrix.

MSK_TRANSPOSE_NO
: No transpose is applied.

MSK_TRANSPOSE_YES
: A transpose is applied.

10.5.7 Triangular part of a symmetric matrix.

MSK_UPLO_LO
: Lower part.

MSK_UPLO_UP
: Upper part.

10.5.8 Problem reformulation.

MSK_SIM_REFORMULATION_ON
: Allow the simplex optimizer to reformulate the problem.

MSK_SIM_REFORMULATION_OFF
: Disallow the simplex optimizer to reformulate the problem.

MSK_SIM_REFORMULATION_FREE
: The simplex optimizer can choose freely.

MSK_SIM_REFORMULATION_AGGRESSIVE
: The simplex optimizer should use an aggressive reformulation strategy.

10.5.9 Exploit duplicate columns.

MSK_SIM_EXPLOIT_DUPVEC_ON

Allow the simplex optimizer to exploit duplicated columns.

MSK_SIM_EXPLOIT_DUPVEC_OFF

Disallow the simplex optimizer to exploit duplicated columns.

MSK_SIM_EXPLOIT_DUPVEC_FREE

The simplex optimizer can choose freely.

10.5.10 Hot-start type employed by the simplex optimizer

MSK_SIM_HOTSTART_NONE

The simplex optimizer performs a coldstart.

MSK_SIM_HOTSTART_FREE

The simplex optimize chooses the hot-start type.

MSK_SIM_HOTSTART_STATUS_KEYS

Only the status keys of the constraints and variables are used to choose the type of hot-start.

10.5.11 Hot-start type employed by the interior-point optimizers.

MSK_INTPNT_HOTSTART_NONE

The interior-point optimizer performs a coldstart.

MSK_INTPNT_HOTSTART_PRIMAL

The interior-point optimizer exploits the primal solution only.

MSK_INTPNT_HOTSTART_DUAL

The interior-point optimizer exploits the dual solution only.

MSK_INTPNT_HOTSTART_PRIMAL_DUAL

The interior-point optimizer exploits both the primal and dual solution.

10.5.12 Progress callback codes

MSK_CALLBACK_BEGIN_BI

The basis identification procedure has been started.

MSK_CALLBACK_BEGIN_CONIC

The callback function is called when the conic optimizer is started.

MSK_CALLBACK_BEGIN_DUAL_BI

The callback function is called from within the basis identification procedure when the dual phase is started.

MSK_CALLBACK_BEGIN_DUAL_SENSITIVITY

Dual sensitivity analysis is started.

MSK_CALLBACK_BEGIN_DUAL_SETUP_BI

The callback function is called when the dual BI phase is started.

MSK_CALLBACK_BEGIN_DUAL_SIMPLEX

The callback function is called when the dual simplex optimizer started.

MSK_CALLBACK_BEGIN_DUAL_SIMPLEX_BI

The callback function is called from within the basis identification procedure when the dual simplex clean-up phase is started.

MSK_CALLBACK_BEGIN_FOLDING

The calback function is called at the beginning of folding.

MSK_CALLBACK_BEGIN_FOLDING_BI

TBD

MSK_CALLBACK_BEGIN_FOLDING_BI_DUAL

TBD

MSK_CALLBACK_BEGIN_FOLDING_BI_INITIALIZE

TBD

MSK_CALLBACK_BEGIN_FOLDING_BI_OPTIMIZER

TBD

MSK_CALLBACK_BEGIN_FOLDING_BI_PRIMAL

TBD

MSK_CALLBACK_BEGIN_INFEAS_ANA

The callback function is called when the infeasibility analyzer is started.

MSK_CALLBACK_BEGIN_INITIALIZE_BI

The callback function is called from within the basis identification procedure when the initialization phase is started.

MSK_CALLBACK_BEGIN_INTPNT

The callback function is called when the interior-point optimizer is started.

MSK_CALLBACK_BEGIN_LICENSE_WAIT

Begin waiting for license.

MSK_CALLBACK_BEGIN_MIO

The callback function is called when the mixed-integer optimizer is started.

MSK_CALLBACK_BEGIN_OPTIMIZE_BI

TBD.

MSK_CALLBACK_BEGIN_OPTIMIZER

The callback function is called when the optimizer is started.

MSK_CALLBACK_BEGIN_PRESOLVE

The callback function is called when the presolve is started.

MSK_CALLBACK_BEGIN_PRIMAL_BI

The callback function is called from within the basis identification procedure when the primal phase is started.

MSK_CALLBACK_BEGIN_PRIMAL_REPAIR

Begin primal feasibility repair.

MSK_CALLBACK_BEGIN_PRIMAL_SENSITIVITY

Primal sensitivity analysis is started.

MSK_CALLBACK_BEGIN_PRIMAL_SETUP_BI

The callback function is called when the primal BI setup is started.

MSK_CALLBACK_BEGIN_PRIMAL_SIMPLEX

The callback function is called when the primal simplex optimizer is started.

MSK_CALLBACK_BEGIN_PRIMAL_SIMPLEX_BI

The callback function is called from within the basis identification procedure when the primal simplex clean-up phase is started.

MSK_CALLBACK_BEGIN_QCQO_REFORMULATE

Begin QCQO reformulation.

MSK_CALLBACK_BEGIN_READ

MOSEK has started reading a problem file.

MSK_CALLBACK_BEGIN_ROOT_CUTGEN

The callback function is called when root cut generation is started.

MSK_CALLBACK_BEGIN_SIMPLEX

The callback function is called when the simplex optimizer is started.

MSK_CALLBACK_BEGIN_SOLVE_ROOT_RELAX

The callback function is called when solution of root relaxation is started.

MSK_CALLBACK_BEGIN_TO_CONIC

Begin conic reformulation.

MSK_CALLBACK_BEGIN_WRITE

MOSEK has started writing a problem file.

MSK_CALLBACK_CONIC

The callback function is called from within the conic optimizer after the information database has been updated.

MSK_CALLBACK_DECOMP_MIO

The callback function is called when the dedicated algorithm for independent blocks inside the mixed-integer solver is started.

MSK_CALLBACK_DUAL_SIMPLEX

The callback function is called from within the dual simplex optimizer.

MSK_CALLBACK_END_BI

The callback function is called when the basis identification procedure is terminated.

MSK_CALLBACK_END_CONIC

The callback function is called when the conic optimizer is terminated.

MSK_CALLBACK_END_DUAL_BI

The callback function is called from within the basis identification procedure when the dual phase is terminated.

MSK_CALLBACK_END_DUAL_SENSITIVITY

Dual sensitivity analysis is terminated.

MSK_CALLBACK_END_DUAL_SETUP_BI

The callback function is called when the dual BI phase is terminated.

MSK_CALLBACK_END_DUAL_SIMPLEX

The callback function is called when the dual simplex optimizer is terminated.

MSK_CALLBACK_END_DUAL_SIMPLEX_BI

The callback function is called from within the basis identification procedure when the dual clean-up phase is terminated.

MSK_CALLBACK_END_FOLDING

The calback function is called at the end of folding.

MSK_CALLBACK_END_FOLDING_BI

TBD

MSK_CALLBACK_END_FOLDING_BI_DUAL

TBD

MSK_CALLBACK_END_FOLDING_BI_INITIALIZE

TBD

MSK_CALLBACK_END_FOLDING_BI_OPTIMIZER

TBD

MSK_CALLBACK_END_FOLDING_BI_PRIMAL

TBD

MSK_CALLBACK_END_INFEAS_ANA

The callback function is called when the infeasibility analyzer is terminated.

MSK_CALLBACK_END_INITIALIZE_BI

The callback function is called from within the basis identification procedure when the initialization phase is terminated.

MSK_CALLBACK_END_INTPNT

The callback function is called when the interior-point optimizer is terminated.

MSK_CALLBACK_END_LICENSE_WAIT

End waiting for license.

MSK_CALLBACK_END_MIO

The callback function is called when the mixed-integer optimizer is terminated.

MSK_CALLBACK_END_OPTIMIZE_BI

TBD.

MSK_CALLBACK_END_OPTIMIZER

The callback function is called when the optimizer is terminated.

MSK_CALLBACK_END_PRESOLVE

The callback function is called when the presolve is completed.

MSK_CALLBACK_END_PRIMAL_BI

The callback function is called from within the basis identification procedure when the primal phase is terminated.

MSK_CALLBACK_END_PRIMAL_REPAIR

End primal feasibility repair.

MSK_CALLBACK_END_PRIMAL_SENSITIVITY

Primal sensitivity analysis is terminated.

MSK_CALLBACK_END_PRIMAL_SETUP_BI

The callback function is called when the primal BI setup is terminated.

MSK_CALLBACK_END_PRIMAL_SIMPLEX

The callback function is called when the primal simplex optimizer is terminated.

MSK_CALLBACK_END_PRIMAL_SIMPLEX_BI

The callback function is called from within the basis identification procedure when the primal clean-up phase is terminated.

MSK_CALLBACK_END_QCQO_REFORMULATE

End QCQO reformulation.

MSK_CALLBACK_END_READ

MOSEK has finished reading a problem file.

MSK_CALLBACK_END_ROOT_CUTGEN

The callback function is called when root cut generation is terminated.

MSK_CALLBACK_END_SIMPLEX

The callback function is called when the simplex optimizer is terminated.

MSK_CALLBACK_END_SIMPLEX_BI

The callback function is called from within the basis identification procedure when the simplex clean-up phase is terminated.

MSK_CALLBACK_END_SOLVE_ROOT_RELAX

The callback function is called when solution of root relaxation is terminated.

MSK_CALLBACK_END_TO_CONIC

End conic reformulation.

MSK_CALLBACK_END_WRITE

MOSEK has finished writing a problem file.

MSK_CALLBACK_FOLDING_BI_DUAL

TBD

MSK_CALLBACK_FOLDING_BI_OPTIMIZER

TBD

MSK_CALLBACK_FOLDING_BI_PRIMAL

TBD

MSK_CALLBACK_HEARTBEAT

A heartbeat callback.

MSK_CALLBACK_IM_DUAL_SENSIVITY

The callback function is called at an intermediate stage of the dual sensitivity analysis.

MSK_CALLBACK_IM_DUAL_SIMPLEX

The callback function is called at an intermediate point in the dual simplex optimizer.

MSK_CALLBACK_IM_LICENSE_WAIT

MOSEK is waiting for a license.

MSK_CALLBACK_IM_LU

The callback function is called from within the LU factorization procedure at an intermediate point.

MSK_CALLBACK_IM_MIO

The callback function is called at an intermediate point in the mixed-integer optimizer.

MSK_CALLBACK_IM_MIO_DUAL_SIMPLEX

The callback function is called at an intermediate point in the mixed-integer optimizer while running the dual simplex optimizer.

MSK_CALLBACK_IM_MIO_INTPNT

The callback function is called at an intermediate point in the mixed-integer optimizer while running the interior-point optimizer.

MSK_CALLBACK_IM_MIO_PRIMAL_SIMPLEX

The callback function is called at an intermediate point in the mixed-integer optimizer while running the primal simplex optimizer.

MSK_CALLBACK_IM_ORDER

The callback function is called from within the matrix ordering procedure at an intermediate point.

MSK_CALLBACK_IM_PRIMAL_SENSIVITY

The callback function is called at an intermediate stage of the primal sensitivity analysis.

MSK_CALLBACK_IM_PRIMAL_SIMPLEX

The callback function is called at an intermediate point in the primal simplex optimizer.

MSK_CALLBACK_IM_READ

Intermediate stage in reading.

MSK_CALLBACK_IM_ROOT_CUTGEN

The callback is called from within root cut generation at an intermediate stage.

MSK_CALLBACK_IM_SIMPLEX

The callback function is called from within the simplex optimizer at an intermediate point.

MSK_CALLBACK_INTPNT

The callback function is called from within the interior-point optimizer after the information database has been updated.

MSK_CALLBACK_NEW_INT_MIO

The callback function is called after a new integer solution has been located by the mixed-integer optimizer.

MSK_CALLBACK_OPTIMIZE_BI

TBD.

MSK_CALLBACK_PRIMAL_SIMPLEX

The callback function is called from within the primal simplex optimizer.

MSK_CALLBACK_QO_REFORMULATE

The callback function is called at an intermediate stage of the conic quadratic reformulation.

MSK_CALLBACK_READ_OPF

The callback function is called from the OPF reader.

MSK_CALLBACK_READ_OPF_SECTION

A chunk of Q non-zeros has been read from a problem file.

MSK_CALLBACK_RESTART_MIO

The callback function is called when the mixed-integer optimizer is restarted.

MSK_CALLBACK_SOLVING_REMOTE

The callback function is called while the task is being solved on a remote server.

MSK_CALLBACK_UPDATE_DUAL_BI

The callback function is called from within the basis identification procedure at an intermediate point in the dual phase.

MSK_CALLBACK_UPDATE_DUAL_SIMPLEX

The callback function is called in the dual simplex optimizer.

MSK_CALLBACK_UPDATE_DUAL_SIMPLEX_BI

The callback function is called from within the basis identification procedure at an intermediate point in the dual simplex clean-up phase. The frequency of the callbacks is controlled by the *MSK_IPAR_LOG_SIM_FREQ* parameter.

MSK_CALLBACK_UPDATE_PRESOLVE

The callback function is called from within the presolve procedure.

MSK_CALLBACK_UPDATE_PRIMAL_BI

The callback function is called from within the basis identification procedure at an intermediate point in the primal phase.

MSK_CALLBACK_UPDATE_PRIMAL_SIMPLEX

The callback function is called in the primal simplex optimizer.

MSK_CALLBACK_UPDATE_PRIMAL_SIMPLEX_BI

The callback function is called from within the basis identification procedure at an intermediate point in the primal simplex clean-up phase. The frequency of the callbacks is controlled by the *MSK_IPAR_LOG_SIM_FREQ* parameter.

MSK_CALLBACK_UPDATE_SIMPLEX

The callback function is called from simplex optimizer.

MSK_CALLBACK_WRITE_OPF

The callback function is called from the OPF writer.

10.5.13 Compression types

MSK_COMPRESS_NONE

No compression is used.

MSK_COMPRESS_FREE

The type of compression used is chosen automatically.

MSK_COMPRESS_GZIP

The type of compression used is gzip compatible.

MSK_COMPRESS_ZSTD

The type of compression used is zstd compatible.

10.5.14 Cone types

MSK_CT_QUAD

The cone is a quadratic cone.

MSK_CT_RQUAD

The cone is a rotated quadratic cone.

MSK_CT_PEXP

A primal exponential cone.

MSK_CT_DEXP

A dual exponential cone.

MSK_CT_PPOW

A primal power cone.

MSK_CT_DPOW

A dual power cone.

MSK_CT_ZERO

The zero cone.

10.5.15 Cone types

MSK_DOMAIN_R

R.

MSK_DOMAIN_RZERO

The zero vector.

MSK_DOMAIN_RPLUS

The positive orthant.

MSK_DOMAIN_RMINUS

The negative orthant.

MSK_DOMAIN_QUADRATIC_CONE

The quadratic cone.

MSK_DOMAIN_RQUADRATIC_CONE

The rotated quadratic cone.

MSK_DOMAIN_PRIMAL_EXP_CONE

The primal exponential cone.

MSK_DOMAIN_DUAL_EXP_CONE

The dual exponential cone.

MSK_DOMAIN_PRIMAL_POWER_CONE

The primal power cone.

MSK_DOMAIN_DUAL_POWER_CONE

The dual power cone.

MSK_DOMAIN_PRIMAL_GEO_MEAN_CONE

The primal geometric mean cone.

MSK_DOMAIN_DUAL_GEO_MEAN_CONE

The dual geometric mean cone.

MSK_DOMAIN_SVEC_PSD_CONE

The vectorized positive semidefinite cone.

10.5.16 Name types

MSK_NAME_TYPE_GEN

General names. However, no duplicate and blank names are allowed.

MSK_NAME_TYPE_MPS

MPS type names.

MSK_NAME_TYPE_LP

LP type names.

10.5.17 Cone types

MSK_SYMMAT_TYPE_SPARSE

Sparse symmetric matrix.

10.5.18 Data format types

MSK_DATA_FORMAT_EXTENSION

The file extension is used to determine the data file format.

MSK_DATA_FORMAT_MPS

The data file is MPS formatted.

MSK_DATA_FORMAT_LP

The data file is LP formatted.

MSK_DATA_FORMAT_OP

The data file is an optimization problem formatted file.

MSK_DATA_FORMAT_FREE_MPS

The data a free MPS formatted file.

MSK_DATA_FORMAT_TASK

Generic task dump file.

MSK_DATA_FORMAT_PTF

(P)retty (T)ext (F)format.

MSK_DATA_FORMAT_CB

Conic benchmark format,

MSK_DATA_FORMAT_JSON_TASK

JSON based task format.

10.5.19 Data format types

MSK_SOL_FORMAT_EXTENSION

The file extension is used to determine the data file format.

MSK_SOL_FORMAT_B

Simple binary format

MSK_SOL_FORMAT_TASK

Tar based format.

MSK_SOL_FORMAT_JSON_TASK

JSON based format.

10.5.20 Double information items

MSK_DINF_ANA_PRO_SCALARIZED_CONSTRAINT_MATRIX_DENSITY

Density percentage of the scalarized constraint matrix.

MSK_DINF_BI_CLEAN_TIME

Time spent within the clean-up phase of the basis identification procedure since its invocation (in seconds).

MSK_DINF_BI_DUAL_TIME

Time spent within the dual phase basis identification procedure since its invocation (in seconds).

MSK_DINF_BI_PRIMAL_TIME

Time spent within the primal phase of the basis identification procedure since its invocation (in seconds).

MSK_DINF_BI_TIME

Time spent within the basis identification procedure since its invocation (in seconds).

MSK_DINF_FOLDING_BI_OPTIMIZE_TIME

TBD

MSK_DINF_FOLDING_BI_UNFOLD_DUAL_TIME

TBD

MSK_DINF_FOLDING_BI_UNFOLD_INITIALIZE_TIME

TBD

MSK_DINF_FOLDING_BI_UNFOLD_PRIMAL_TIME

TBD

MSK_DINF_FOLDING_BI_UNFOLD_TIME

TBD

MSK_DINF_FOLDING_FACTOR

Problem size after folding as a fraction of the original size.

MSK_DINF_FOLDING_TIME

Total time spent in folding for continuous problems (in seconds).

MSK_DINF_INTPNT_DUAL_FEAS

Dual feasibility measure reported by the interior-point optimizer. (For the interior-point optimizer this measure is not directly related to the original problem because a homogeneous model is employed.)

MSK_DINF_INTPNT_DUAL_OBJ

Dual objective value reported by the interior-point optimizer.

MSK_DINF_INTPNT_FACTOR_NUM_FLOPS

An estimate of the number of flops used in the factorization.

MSK_DINF_INTPNT_OPT_STATUS

A measure of optimality of the solution. It should converge to $+1$ if the problem has a primal-dual optimal solution, and converge to -1 if the problem is (strictly) primal or dual infeasible. If the measure converges to another constant, or fails to settle, the problem is usually ill-posed.

MSK_DINF_INTPNT_ORDER_TIME

Order time (in seconds).

MSK_DINF_INTPNT_PRIMAL_FEAS

Primal feasibility measure reported by the interior-point optimizer. (For the interior-point optimizer this measure is not directly related to the original problem because a homogeneous model is employed).

MSK_DINF_INTPNT_PRIMAL_OBJ

Primal objective value reported by the interior-point optimizer.

MSK_DINF_INTPNT_TIME

Time spent within the interior-point optimizer since its invocation (in seconds).

MSK_DINF_MIO_CLIQUE_SELECTION_TIME

Selection time for clique cuts (in seconds).

MSK_DINF_MIO_CLIQUE_SEPARATION_TIME

Separation time for clique cuts (in seconds).

MSK_DINF_MIO_CMIR_SELECTION_TIME

Selection time for CMIR cuts (in seconds).

MSK_DINF_MIO_CMIR_SEPARATION_TIME

Separation time for CMIR cuts (in seconds).

MSK_DINF_MIO_CONSTRUCT_SOLUTION_OBJ

If **MOSEK** has successfully constructed an integer feasible solution, then this item contains the optimal objective value corresponding to the feasible solution.

MSK_DINF_MIO_DUAL_BOUND_AFTER_PRESOLVE

Value of the dual bound after presolve but before cut generation.

MSK_DINF_MIO_GMI_SELECTION_TIME

Selection time for GMI cuts (in seconds).

MSK_DINF_MIO_GMI_SEPARATION_TIME

Separation time for GMI cuts (in seconds).

MSK_DINF_MIO_IMPLIED_BOUND_SELECTION_TIME

Selection time for implied bound cuts (in seconds).

MSK_DINF_MIO_IMPLIED_BOUND_SEPARATION_TIME

Separation time for implied bound cuts (in seconds).

MSK_DINF_MIO_INITIAL_FEASIBLE_SOLUTION_OBJ

If the user provided solution was found to be feasible this information item contains it's objective value.

MSK_DINF_MIO_KNAPSACK_COVER_SELECTION_TIME

Selection time for knapsack cover (in seconds).

MSK_DINF_MIO_KNAPSACK_COVER_SEPARATION_TIME

Separation time for knapsack cover (in seconds).

MSK_DINF_MIO_LIPRO_SELECTION_TIME

Selection time for lift-and-project cuts (in seconds).

MSK_DINF_MIO_LIPRO_SEPARATION_TIME

Separation time for lift-and-project cuts (in seconds).

MSK_DINF_MIO_OBJ_ABS_GAP

Given the mixed-integer optimizer has computed a feasible solution and a bound on the optimal objective value, then this item contains the absolute gap defined by

$$|(\text{objective value of feasible solution}) - (\text{objective bound})|.$$

Otherwise it has the value -1.0.

MSK_DINF_MIO_OBJ_BOUND

The best known bound on the objective function. This value is undefined until at least one relaxation has been solved: To see if this is the case check that *MSK_IINF_MIO_NUM_RELAX* is strictly positive.

MSK_DINF_MIO_OBJ_INT

The primal objective value corresponding to the best integer feasible solution. Please note that at least one integer feasible solution must have been located i.e. check *MSK_IINF_MIO_NUM_INT_SOLUTIONS* .

MSK_DINF_MIO_OBJ_REL_GAP

Given that the mixed-integer optimizer has computed a feasible solution and a bound on the optimal objective value, then this item contains the relative gap defined by

$$\frac{|(\text{objective value of feasible solution}) - (\text{objective bound})|}{\max(\delta, |(\text{objective value of feasible solution})|)}.$$

where δ is given by the parameter *MSK_DPAR_MIO_REL_GAP_CONST*. Otherwise it has the value -1.0.

MSK_DINF_MIO_PROBING_TIME

Total time for probing (in seconds).

MSK_DINF_MIO_ROOT_CUT_SELECTION_TIME

Total time for cut selection (in seconds).

MSK_DINF_MIO_ROOT_CUT_SEPARATION_TIME

Total time for cut separation (in seconds).

MSK_DINF_MIO_ROOT_OPTIMIZER_TIME

Time spent in the contiuous optimizer while processing the root node relaxation (in seconds).

MSK_DINF_MIO_ROOT_PRESOLVE_TIME

Time spent presolving the problem at the root node (in seconds).

MSK_DINF_MIO_ROOT_TIME

Time spent processing the root node (in seconds).

MSK_DINF_MIO_SYMMETRY_DETECTION_TIME

Total time for symmetry detection (in seconds).

MSK_DINF_MIO_SYMMETRY_FACTOR

Degree to which the problem is affected by detected symmetry.

MSK_DINF_MIO_TIME

Time spent in the mixed-integer optimizer (in seconds).

MSK_DINF_MIO_USER_OBJ_CUT

If the objective cut is used, then this information item has the value of the cut.

MSK_DINF_OPTIMIZER_TICKS

Total number of ticks spent in the optimizer since it was invoked. It is strictly negative if it is not available.

MSK_DINF_OPTIMIZER_TIME

Total time spent in the optimizer since it was invoked (in seconds).

MSK_DINF_PRESOLVE_ELI_TIME

Total time spent in the eliminator since the presolve was invoked (in seconds).

MSK_DINF_PRESOLVE_LINDEP_TIME

Total time spent in the linear dependency checker since the presolve was invoked (in seconds).

MSK_DINF_PRESOLVE_TIME

Total time spent in the presolve since it was invoked (in seconds).

MSK_DINF_PRESOLVE_TOTAL_PRIMAL_PERTURBATION

Total perturbation of the bounds of the primal problem.

MSK_DINF_PRIMAL_REPAIR_PENALTY_OBJ

The optimal objective value of the penalty function.

MSK_DINF_QCQO_REFORMULATE_MAX_PERTURBATION

Maximum absolute diagonal perturbation occurring during the QCQO reformulation.

MSK_DINF_QCQO_REFORMULATE_TIME

Time spent with conic quadratic reformulation (in seconds).

MSK_DINF_QCQO_REFORMULATE_WORST_CHOLESKY_COLUMN_SCALING

Worst Cholesky column scaling.

MSK_DINF_QCQO_REFORMULATE_WORST_CHOLESKY_DIAG_SCALING

Worst Cholesky diagonal scaling.

MSK_DINF_READ_DATA_TIME

Time spent reading the data file (in seconds).

MSK_DINF_REMOTE_TIME

The total real time in seconds spent when optimizing on a server by the process performing the optimization on the server (in seconds).

MSK_DINF_SIM_DUAL_TIME

Time spent in the dual simplex optimizer since invoking it (in seconds).

MSK_DINF_SIM_FEAS

Feasibility measure reported by the simplex optimizer.

MSK_DINF_SIM_OBJ

Objective value reported by the simplex optimizer.

MSK_DINF_SIM_PRIMAL_TIME

Time spent in the primal simplex optimizer since invoking it (in seconds).

MSK_DINF_SIM_TIME

Time spent in the simplex optimizer since invoking it (in seconds).

MSK_DINF_SOL_BAS_DUAL_OBJ

Dual objective value of the basic solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_BAS_DVIOLCON

Maximal dual bound violation for x^c in the basic solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_BAS_DVIOLVAR

Maximal dual bound violation for x^x in the basic solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_BAS_NRM_BARX

Infinity norm of $\overline{X}$ in the basic solution.

MSK_DINF_SOL_BAS_NRM_SLC

Infinity norm of s_l^c in the basic solution.

MSK_DINF_SOL_BAS_NRM_SLX

Infinity norm of s_l^x in the basic solution.

MSK_DINF_SOL_BAS_NRM_SUC

Infinity norm of s_u^c in the basic solution.

MSK_DINF_SOL_BAS_NRM_SUX

Infinity norm of s_u^X in the basic solution.

MSK_DINF_SOL_BAS_NRM_XC

Infinity norm of x^c in the basic solution.

MSK_DINF_SOL_BAS_NRM_XX

Infinity norm of x^x in the basic solution.

MSK_DINF_SOL_BAS_NRM_Y

Infinity norm of y in the basic solution.

MSK_DINF_SOL_BAS_PRIMAL_OBJ

Primal objective value of the basic solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_BAS_PVIOLCON

Maximal primal bound violation for x^c in the basic solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_BAS_PVIOLVAR

Maximal primal bound violation for x^x in the basic solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_NRM_BARX

Infinity norm of $\overline{X}$ in the integer solution.

MSK_DINF_SOL_ITG_NRM_XC

Infinity norm of x^c in the integer solution.

MSK_DINF_SOL_ITG_NRM_XX

Infinity norm of x^x in the integer solution.

MSK_DINF_SOL_ITG_PRIMAL_OBJ

Primal objective value of the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLACC

Maximal primal violation for affine conic constraints in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLBARVAR

Maximal primal bound violation for $\overline{X}$ in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLCON

Maximal primal bound violation for x^c in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLCONES

Maximal primal violation for primal conic constraints in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLDJC

Maximal primal violation for disjunctive constraints in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLITG

Maximal violation for the integer constraints in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITG_PVIOLVAR

Maximal primal bound violation for x^x in the integer solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_DUAL_OBJ

Dual objective value of the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_DVIOLACC

Maximal dual violation for the affine conic constraints in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_DVIOLBARVAR

Maximal dual bound violation for $\overline{X}$ in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_DVIOLCON

Maximal dual bound violation for x^c in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_DVIOLCONES

Maximal dual violation for conic constraints in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_DVIOLVAR

Maximal dual bound violation for x^x in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_NRM_BARS

Infinity norm of $\overline{S}$ in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_BARX

Infinity norm of $\overline{X}$ in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_SLC

Infinity norm of s_l^c in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_SLX

Infinity norm of s_l^x in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_SNX

Infinity norm of s_n^x in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_SUC
: Infinity norm of s_u^c in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_SUX
: Infinity norm of s_u^X in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_XC
: Infinity norm of x^c in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_XX
: Infinity norm of x^x in the interior-point solution.

MSK_DINF_SOL_ITR_NRM_Y
: Infinity norm of y in the interior-point solution.

MSK_DINF_SOL_ITR_PRIMAL_OBJ
: Primal objective value of the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_PVIOLACC
: Maximal primal violation for affine conic constraints in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_PVIOLBARVAR
: Maximal primal bound violation for $\overline{X}$ in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_PVIOLCON
: Maximal primal bound violation for x^c in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_PVIOLCONES
: Maximal primal violation for conic constraints in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_SOL_ITR_PVIOLVAR
: Maximal primal bound violation for x^x in the interior-point solution. Updated if *MSK_IPAR_AUTO_UPDATE_SOL_INFO* is set .

MSK_DINF_TO_CONIC_TIME
: Time spent in the last to conic reformulation (in seconds).

MSK_DINF_WRITE_DATA_TIME
: Time spent writing the data file (in seconds).

10.5.21 License feature

MSK_FEATURE_PTS
: Base system.

MSK_FEATURE_PTON
: Conic extension.

10.5.22 Long integer information items.

MSK_LIINF_ANA_PRO_SCALARIZED_CONSTRAINT_MATRIX_NUM_COLUMNS
: Number of columns in the scalarized constraint matrix.

MSK_LIINF_ANA_PRO_SCALARIZED_CONSTRAINT_MATRIX_NUM_NZ
: Number of non-zero entries in the scalarized constraint matrix.

MSK_LIINF_ANA_PRO_SCALARIZED_CONSTRAINT_MATRIX_NUM_ROWS
: Number of rows in the scalarized constraint matrix.

MSK_LIINF_BI_CLEAN_ITER
: Number of clean iterations performed in the basis identification.

MSK_LIINF_BI_DUAL_ITER
: Number of dual pivots performed in the basis identification.

MSK_LIINF_BI_PRIMAL_ITER

Number of primal pivots performed in the basis identification.

MSK_LIINF_FOLDING_BI_DUAL_ITER

TBD

MSK_LIINF_FOLDING_BI_OPTIMIZER_ITER

TBD

MSK_LIINF_FOLDING_BI_PRIMAL_ITER

TBD

MSK_LIINF_INTPNT_FACTOR_NUM_NZ

Number of non-zeros in factorization.

MSK_LIINF_MIO_ANZ

Number of non-zero entries in the constraint matrix of the problem to be solved by the mixed-integer optimizer.

MSK_LIINF_MIO_FINAL_ANZ

Number of non-zero entries in the constraint matrix of the mixed-integer optimizer's final problem.

MSK_LIINF_MIO_INTPNT_ITER

Number of interior-point iterations performed by the mixed-integer optimizer.

MSK_LIINF_MIO_NUM_DUAL_ILLPOSED_CER

Number of dual illposed certificates encountered by the mixed-integer optimizer.

MSK_LIINF_MIO_NUM_PRIM_ILLPOSED_CER

Number of primal illposed certificates encountered by the mixed-integer optimizer.

MSK_LIINF_MIO_PRESOLVED_ANZ

Number of non-zero entries in the constraint matrix of the problem after the mixed-integer optimizer's presolve.

MSK_LIINF_MIO_SIMPLEX_ITER

Number of simplex iterations performed by the mixed-integer optimizer.

MSK_LIINF_RD_NUMACC

Number of affince conic constraints.

MSK_LIINF_RD_NUMANZ

Number of non-zeros in A that is read.

MSK_LIINF_RD_NUMDJC

Number of disjuncive constraints.

MSK_LIINF_RD_NUMQNZ

Number of Q non-zeros.

MSK_LIINF_SIMPLEX_ITER

Number of iterations performed by the simplex optimizer.

10.5.23 Integer information items.

MSK_IINF_ANA_PRO_NUM_CON

Number of constraints in the problem.

MSK_IINF_ANA_PRO_NUM_CON_EQ

Number of equality constraints.

MSK_IINF_ANA_PRO_NUM_CON_FR

Number of unbounded constraints.

MSK_IINF_ANA_PRO_NUM_CON_LO

Number of constraints with a lower bound and an infinite upper bound.

MSK_IINF_ANA_PRO_NUM_CON_RA

Number of constraints with finite lower and upper bounds.

MSK_IINF_ANA_PRO_NUM_CON_UP

Number of constraints with an upper bound and an infinite lower bound.

MSK_IINF_ANA_PRO_NUM_VAR

Number of variables in the problem.

MSK_IINF_ANA_PRO_NUM_VAR_BIN

Number of binary (0-1) variables.

MSK_IINF_ANA_PRO_NUM_VAR_CONT

Number of continuous variables.

MSK_IINF_ANA_PRO_NUM_VAR_EQ

Number of fixed variables.

MSK_IINF_ANA_PRO_NUM_VAR_FR

Number of free variables.

MSK_IINF_ANA_PRO_NUM_VAR_INT

Number of general integer variables.

MSK_IINF_ANA_PRO_NUM_VAR_LO

Number of variables with a lower bound and an infinite upper bound.

MSK_IINF_ANA_PRO_NUM_VAR_RA

Number of variables with finite lower and upper bounds.

MSK_IINF_ANA_PRO_NUM_VAR_UP

Number of variables with an upper bound and an infinite lower bound.

MSK_IINF_FOLDING_APPLIED

Non-zero if folding was exploited.

MSK_IINF_INTPNT_FACTOR_DIM_DENSE

Dimension of the dense sub system in factorization.

MSK_IINF_INTPNT_ITER

Number of interior-point iterations since invoking the interior-point optimizer.

MSK_IINF_INTPNT_NUM_THREADS

Number of threads that the interior-point optimizer is using.

MSK_IINF_INTPNT_SOLVE_DUAL

Non-zero if the interior-point optimizer is solving the dual problem.

MSK_IINF_MIO_ABSGAP_SATISFIED

Non-zero if absolute gap is within tolerances.

MSK_IINF_MIO_CLIQUE_TABLE_SIZE

Size of the clique table.

MSK_IINF_MIO_CONSTRUCT_SOLUTION

This item informs if **MOSEK** constructed an initial integer feasible solution.

- -1: tried, but failed,
- 0: no partial solution supplied by the user,
- 1: constructed feasible solution.

MSK_IINF_MIO_FINAL_NUMBIN

Number of binary variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMBINCONEVAR

Number of binary cone variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMCON

Number of constraints in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMCONE

Number of cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMCONEVAR

Number of cone variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMCONT

Number of continuous variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMCONTCONEVAR

Number of continuous cone variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMDEXPCONES

Number of dual exponential cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMDJC

Number of disjunctive constraints in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMDPOWCONES

Number of dual power cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMINT

Number of integer variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMINTCONEVAR

Number of integer cone variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMPEXPCONES

Number of primal exponential cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMPPOWCONES

Number of primal power cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMQCONES

Number of quadratic cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMRQCONES

Number of rotated quadratic cones in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_FINAL_NUMVAR

Number of variables in the mixed-integer optimizer's final problem.

MSK_IINF_MIO_INITIAL_FEASIBLE_SOLUTION

This item informs if **MOSEK** found the solution provided by the user to be feasible

- 0: solution provided by the user was not found to be feasible for the current problem,
- 1: user provided solution was found to be feasible.

MSK_IINF_MIO_NODE_DEPTH

Depth of the last node solved.

MSK_IINF_MIO_NUM_ACTIVE_NODES

Number of active branch and bound nodes.

MSK_IINF_MIO_NUM_ACTIVE_ROOT_CUTS

Number of active cuts in the final relaxation after the mixed-integer optimizer's root cut generation.

MSK_IINF_MIO_NUM_BLOCKS_SOLVED_IN_BB

Number of independent decomposition blocks solved though a dedicated algorithm.

MSK_IINF_MIO_NUM_BLOCKS_SOLVED_IN_PRESOLVE

Number of independent decomposition blocks solved during presolve.

MSK_IINF_MIO_NUM_BRANCH

Number of branches performed during the optimization.

MSK_IINF_MIO_NUM_INT_SOLUTIONS

Number of integer feasible solutions that have been found.

MSK_IINF_MIO_NUM_RELAX

Number of relaxations solved during the optimization.

MSK_IINF_MIO_NUM_REPEATED_PRESOLVE

Number of times presolve was repeated at root.

MSK_IINF_MIO_NUM_RESTARTS

Number of restarts performed during the optimization.

MSK_IINF_MIO_NUM_ROOT_CUT_ROUNDS

Number of cut separation rounds at the root node of the mixed-integer optimizer.

MSK_IINF_MIO_NUM_SELECTED_CLIQUE_CUTS

Number of clique cuts selected to be included in the relaxation.

MSK_IINF_MIO_NUM_SELECTED_CMIR_CUTS

Number of Complemented Mixed Integer Rounding (CMIR) cuts selected to be included in the relaxation.

MSK_IINF_MIO_NUM_SELECTED_GOMORY_CUTS

Number of Gomory cuts selected to be included in the relaxation.

MSK_IINF_MIO_NUM_SELECTED_IMPLIED_BOUND_CUTS

Number of implied bound cuts selected to be included in the relaxation.

MSK_IINF_MIO_NUM_SELECTED_KNAPSACK_COVER_CUTS

Number of clique cuts selected to be included in the relaxation.

MSK_IINF_MIO_NUM_SELECTED_LIPRO_CUTS

Number of lift-and-project cuts selected to be included in the relaxation.

MSK_IINF_MIO_NUM_SEPARATED_CLIQUE_CUTS

Number of separated clique cuts.

MSK_IINF_MIO_NUM_SEPARATED_CMIR_CUTS

Number of separated Complemented Mixed Integer Rounding (CMIR) cuts.

MSK_IINF_MIO_NUM_SEPARATED_GOMORY_CUTS

Number of separated Gomory cuts.

MSK_IINF_MIO_NUM_SEPARATED_IMPLIED_BOUND_CUTS

Number of separated implied bound cuts.

MSK_IINF_MIO_NUM_SEPARATED_KNAPSACK_COVER_CUTS

Number of separated clique cuts.

MSK_IINF_MIO_NUM_SEPARATED_LIPRO_CUTS

Number of separated lift-and-project cuts.

MSK_IINF_MIO_NUM_SOLVED_NODES

Number of branch and bounds nodes solved in the main branch and bound tree.

MSK_IINF_MIO_NUMBIN

Number of binary variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMBINCONEVAR

Number of binary cone variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMCON

Number of constraints in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMCONE

Number of cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMCONEVAR

Number of cone variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMCONT

Number of continuous variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMCONTCONEVAR

Number of continuous cone variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMDEXPCONES

Number of dual exponential cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMDJC

Number of disjunctive constraints in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMDPOWCONES

Number of dual power cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMINT

Number of integer variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMINTCONEVAR

Number of integer cone variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMPEXPCONES

Number of primal exponential cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMPPOWCONES

Number of primal power cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMQCONES

Number of quadratic cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMRQCONES

Number of rotated quadratic cones in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_NUMVAR

Number of variables in the problem to be solved by the mixed-integer optimizer.

MSK_IINF_MIO_OBJ_BOUND_DEFINED

Non-zero if a valid objective bound has been found, otherwise zero.

MSK_IINF_MIO_PRESOLVED_NUMBIN

Number of binary variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMBINCONEVAR

Number of binary cone variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMCON

Number of constraints in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMCONE

Number of cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMCONEVAR

Number of cone variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMCONT

Number of continuous variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMCONTCONEVAR

Number of continuous cone variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMDEXPCONES

Number of dual exponential cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMDJC

Number of disjunctive constraints in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMDPOWCONES

Number of dual power cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMINT

Number of integer variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMINTCONEVAR

Number of integer cone variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMPEXPCONES

Number of primal exponential cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMPPOWCONES

Number of primal power cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMQCONES

Number of quadratic cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMRQCONES

Number of rotated quadratic cones in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_PRESOLVED_NUMVAR

Number of variables in the problem after the mixed-integer optimizer's presolve.

MSK_IINF_MIO_RELGAP_SATISFIED

Non-zero if relative gap is within tolerances.

MSK_IINF_MIO_TOTAL_NUM_SELECTED_CUTS

Total number of cuts selected to be included in the relaxation by the mixed-integer optimizer.

MSK_IINF_MIO_TOTAL_NUM_SEPARATED_CUTS

Total number of cuts separated by the mixed-integer optimizer.

MSK_IINF_MIO_USER_OBJ_CUT

If it is non-zero, then the objective cut is used.

MSK_IINF_OPT_NUMCON

Number of constraints in the problem solved when the optimizer is called.

MSK_IINF_OPT_NUMVAR

Number of variables in the problem solved when the optimizer is called

MSK_IINF_OPTIMIZE_RESPONSE

The response code returned by optimize.

MSK_IINF_PRESOLVE_NUM_PRIMAL_PERTURBATIONS

Number perturbations to thhe bounds of the primal problem.

MSK_IINF_PURIFY_DUAL_SUCCESS

Is nonzero if the dual solution is purified.

MSK_IINF_PURIFY_PRIMAL_SUCCESS

Is nonzero if the primal solution is purified.

MSK_IINF_RD_NUMBARVAR

Number of symmetric variables read.

MSK_IINF_RD_NUMCON

Number of constraints read.

MSK_IINF_RD_NUMCONE

Number of conic constraints read.

MSK_IINF_RD_NUMINTVAR

Number of integer-constrained variables read.

MSK_IINF_RD_NUMQ

Number of nonempty Q matrices read.

MSK_IINF_RD_NUMVAR

Number of variables read.

MSK_IINF_RD_PROTYPE

Problem type.

MSK_IINF_SIM_DUAL_DEG_ITER

The number of dual degenerate iterations.

MSK_IINF_SIM_DUAL_HOTSTART

If 1 then the dual simplex algorithm is solving from an advanced basis.

MSK_IINF_SIM_DUAL_HOTSTART_LU

If 1 then a valid basis factorization of full rank was located and used by the dual simplex algorithm.

MSK_IINF_SIM_DUAL_INF_ITER

The number of iterations taken with dual infeasibility.

MSK_IINF_SIM_DUAL_ITER

Number of dual simplex iterations during the last optimization.

MSK_IINF_SIM_NUMCON

Number of constraints in the problem solved by the simplex optimizer.

MSK_IINF_SIM_NUMVAR

Number of variables in the problem solved by the simplex optimizer.

MSK_IINF_SIM_PRIMAL_DEG_ITER

The number of primal degenerate iterations.

MSK_IINF_SIM_PRIMAL_HOTSTART

If 1 then the primal simplex algorithm is solving from an advanced basis.

MSK_IINF_SIM_PRIMAL_HOTSTART_LU

If 1 then a valid basis factorization of full rank was located and used by the primal simplex algorithm.

MSK_IINF_SIM_PRIMAL_INF_ITER

The number of iterations taken with primal infeasibility.

MSK_IINF_SIM_PRIMAL_ITER

Number of primal simplex iterations during the last optimization.

MSK_IINF_SIM_SOLVE_DUAL

Is non-zero if dual problem is solved.

MSK_IINF_SOL_BAS_PROSTA

Problem status of the basic solution. Updated after each optimization.

MSK_IINF_SOL_BAS_SOLSTA

Solution status of the basic solution. Updated after each optimization.

MSK_IINF_SOL_ITG_PROSTA

Problem status of the integer solution. Updated after each optimization.

MSK_IINF_SOL_ITG_SOLSTA

Solution status of the integer solution. Updated after each optimization.

MSK_IINF_SOL_ITR_PROSTA

Problem status of the interior-point solution. Updated after each optimization.

MSK_IINF_SOL_ITR_SOLSTA

Solution status of the interior-point solution. Updated after each optimization.

MSK_IINF_STO_NUM_A_REALLOC

Number of times the storage for storing A has been changed. A large value may indicates that memory fragmentation may occur.

10.5.24 Information item types

MSK_INF_DOU_TYPE

Is a double information type.

MSK_INF_INT_TYPE

Is an integer.

MSK_INF_LINT_TYPE

Is a long integer.

10.5.25 Input/output modes

MSK_IOMODE_READ

The file is read-only.

MSK_IOMODE_WRITE

The file is write-only. If the file exists then it is truncated when it is opened. Otherwise it is created when it is opened.

MSK_IOMODE_READWRITE

The file is to read and write.

10.5.26 Specifies the branching direction.

MSK_BRANCH_DIR_FREE

The mixed-integer optimizer decides which branch to choose.

MSK_BRANCH_DIR_UP

The mixed-integer optimizer always chooses the up branch first.

MSK_BRANCH_DIR_DOWN

The mixed-integer optimizer always chooses the down branch first.

MSK_BRANCH_DIR_NEAR

Branch in direction nearest to selected fractional variable.

MSK_BRANCH_DIR_FAR

Branch in direction farthest from selected fractional variable.

MSK_BRANCH_DIR_ROOT_LP

Chose direction based on root lp value of selected variable.

MSK_BRANCH_DIR_GUIDED

Branch in direction of current incumbent.

MSK_BRANCH_DIR_PSEUDOCOST

Branch based on the pseudocost of the variable.

10.5.27 Specifies the reformulation method for mixed-integer quadratic problems.

MSK_MIO_QCQO_REFORMULATION_METHOD_FREE

The mixed-integer optimizer decides which reformulation method to apply.

MSK_MIO_QCQO_REFORMULATION_METHOD_NONE

No reformulation method is applied.

MSK_MIO_QCQO_REFORMULATION_METHOD_LINEARIZATION

A reformulation via linearization is applied.

MSK_MIO_QCQO_REFORMULATION_METHOD_EIGEN_VAL_METHOD

The eigenvalue method is applied.

MSK_MIO_QCQO_REFORMULATION_METHOD_DIAG_SDP

A perturbation of matrix diagonals via the solution of SDPs is applied.

MSK_MIO_QCQO_REFORMULATION_METHOD_RELAX_SDP

A Reformulation based on the solution of an SDP-relaxation of the problem is applied.

10.5.28 Specifies the problem data permutation method for mixed-integer problems.

MSK_MIO_DATA_PERMUTATION_METHOD_NONE

No problem data permutation is applied.

MSK_MIO_DATA_PERMUTATION_METHOD_CYCLIC_SHIFT

A random cyclic shift is applied to permute the problem data.

MSK_MIO_DATA_PERMUTATION_METHOD_RANDOM

A random permutation is applied to the problem data.

10.5.29 Continuous mixed-integer solution type

MSK_MIO_CONT_SOL_NONE

No interior-point or basic solution are reported when the mixed-integer optimizer is used.

MSK_MIO_CONT_SOL_ROOT

The reported interior-point and basic solutions are a solution to the root node problem when mixed-integer optimizer is used.

MSK_MIO_CONT_SOL_ITG

The reported interior-point and basic solutions are a solution to the problem with all integer variables fixed at the value they have in the integer solution. A solution is only reported in case the problem has a primal feasible solution.

MSK_MIO_CONT_SOL_ITG_REL

In case the problem is primal feasible then the reported interior-point and basic solutions are a solution to the problem with all integer variables fixed at the value they have in the integer solution. If the problem is primal infeasible, then the solution to the root node problem is reported.

10.5.30 Integer restrictions

MSK_MIO_MODE_IGNORED

The integer constraints are ignored and the problem is solved as a continuous problem.

MSK_MIO_MODE_SATISFIED

Integer restrictions should be satisfied.

10.5.31 Mixed-integer node selection types

MSK_MIO_NODE_SELECTION_FREE
: The optimizer decides the node selection strategy.

MSK_MIO_NODE_SELECTION_FIRST
: The optimizer employs a depth first node selection strategy.

MSK_MIO_NODE_SELECTION_BEST
: The optimizer employs a best bound node selection strategy.

MSK_MIO_NODE_SELECTION_PSEUDO
: The optimizer employs selects the node based on a pseudo cost estimate.

10.5.32 Mixed-integer variable selection types

MSK_MIO_VAR_SELECTION_FREE
: The optimizer decides the variable selection strategy.

MSK_MIO_VAR_SELECTION_PSEUDOCOST
: The optimizer employs pseudocost variable selection.

MSK_MIO_VAR_SELECTION_STRONG
: The optimizer employs strong branching varfiable selection

10.5.33 MPS file format type

MSK_MPS_FORMAT_STRICT
: It is assumed that the input file satisfies the MPS format strictly.

MSK_MPS_FORMAT_RELAXED
: It is assumed that the input file satisfies a slightly relaxed version of the MPS format.

MSK_MPS_FORMAT_FREE
: It is assumed that the input file satisfies the free MPS format. This implies that spaces are not allowed in names. Otherwise the format is free.

MSK_MPS_FORMAT_CPLEX
: The CPLEX compatible version of the MPS format is employed.

10.5.34 Objective sense types

MSK_OBJECTIVE_SENSE_MINIMIZE
: The problem should be minimized.

MSK_OBJECTIVE_SENSE_MAXIMIZE
: The problem should be maximized.

10.5.35 On/off

MSK_ON
: Switch the option on.

MSK_OFF
: Switch the option off.

10.5.36 Optimizer types

MSK_OPTIMIZER_CONIC
: The optimizer for problems having conic constraints.

MSK_OPTIMIZER_DUAL_SIMPLEX
: The dual simplex optimizer is used.

MSK_OPTIMIZER_FREE
: The optimizer is chosen automatically.

MSK_OPTIMIZER_FREE_SIMPLEX
: One of the simplex optimizers is used.

MSK_OPTIMIZER_INTPNT
: The interior-point optimizer is used.

MSK_OPTIMIZER_MIXED_INT
: The mixed-integer optimizer.

MSK_OPTIMIZER_NEW_DUAL_SIMPLEX
: The new dual simplex optimizer is used.

MSK_OPTIMIZER_NEW_PRIMAL_SIMPLEX
: The new primal simplex optimizer is used. It is not recommended to use this option.

MSK_OPTIMIZER_PRIMAL_SIMPLEX
: The primal simplex optimizer is used.

10.5.37 Ordering strategies

MSK_ORDER_METHOD_FREE
: The ordering method is chosen automatically.

MSK_ORDER_METHOD_APPMINLOC
: Approximate minimum local fill-in ordering is employed.

MSK_ORDER_METHOD_EXPERIMENTAL
: This option should not be used.

MSK_ORDER_METHOD_TRY_GRAPHPAR
: Always try the graph partitioning based ordering.

MSK_ORDER_METHOD_FORCE_GRAPHPAR
: Always use the graph partitioning based ordering even if it is worse than the approximate minimum local fill ordering.

MSK_ORDER_METHOD_NONE
: No ordering is used. Note using this value almost always leads to a significantly slow down.

10.5.38 Presolve method.

MSK_PRESOLVE_MODE_OFF
: The problem is not presolved before it is optimized.

MSK_PRESOLVE_MODE_ON
: The problem is presolved before it is optimized.

MSK_PRESOLVE_MODE_FREE
: It is decided automatically whether to presolve before the problem is optimized.

10.5.39 Method of folding (symmetry detection for continuous problems).

MSK_FOLDING_MODE_OFF

Disabled.

MSK_FOLDING_MODE_FREE

The solver decides on the usage and amount of folding.

MSK_FOLDING_MODE_FREE_UNLESS_BASIC

If only the interior-point solution is requested then the solver decides; if the basic solution is requested then folding is disabled.

MSK_FOLDING_MODE_FORCE

Full folding is always performed regardless of workload.

10.5.40 Parameter type

MSK_PAR_INVALID_TYPE

Not a valid parameter.

MSK_PAR_DOU_TYPE

Is a double parameter.

MSK_PAR_INT_TYPE

Is an integer parameter.

MSK_PAR_STR_TYPE

Is a string parameter.

10.5.41 Problem data items

MSK_PI_VAR

Item is a variable.

MSK_PI_CON

Item is a constraint.

MSK_PI_CONE

Item is a cone.

10.5.42 Problem types

MSK_PROBTYPE_LO

The problem is a linear optimization problem.

MSK_PROBTYPE_QO

The problem is a quadratic optimization problem.

MSK_PROBTYPE_QCQO

The problem is a quadratically constrained optimization problem.

MSK_PROBTYPE_CONIC

A conic optimization.

MSK_PROBTYPE_MIXED

General nonlinear constraints and conic constraints. This combination can not be solved by **MOSEK**.

10.5.43 Problem status keys

MSK_PRO_STA_UNKNOWN
: Unknown problem status.

MSK_PRO_STA_PRIM_AND_DUAL_FEAS
: The problem is primal and dual feasible.

MSK_PRO_STA_PRIM_FEAS
: The problem is primal feasible.

MSK_PRO_STA_DUAL_FEAS
: The problem is dual feasible.

MSK_PRO_STA_PRIM_INFEAS
: The problem is primal infeasible.

MSK_PRO_STA_DUAL_INFEAS
: The problem is dual infeasible.

MSK_PRO_STA_PRIM_AND_DUAL_INFEAS
: The problem is primal and dual infeasible.

MSK_PRO_STA_ILL_POSED
: The problem is ill-posed. For example, it may be primal and dual feasible but have a positive duality gap.

MSK_PRO_STA_PRIM_INFEAS_OR_UNBOUNDED
: The problem is either primal infeasible or unbounded. This may occur for mixed-integer problems.

10.5.44 Response code type

MSK_RESPONSE_OK
: The response code is OK.

MSK_RESPONSE_WRN
: The response code is a warning.

MSK_RESPONSE_TRM
: The response code is an optimizer termination status.

MSK_RESPONSE_ERR
: The response code is an error.

MSK_RESPONSE_UNK
: The response code does not belong to any class.

10.5.45 Scaling type

MSK_SCALING_FREE
: The optimizer chooses the scaling heuristic.

MSK_SCALING_NONE
: No scaling is performed.

10.5.46 Scaling method

MSK_SCALING_METHOD_POW2
: Scales only with power of 2 leaving the mantissa untouched.

MSK_SCALING_METHOD_FREE
: The optimizer chooses the scaling heuristic.

10.5.47 Sensitivity types

MSK_SENSITIVITY_TYPE_BASIS
: Basis sensitivity analysis is performed.

10.5.48 Simplex selection strategy

MSK_SIM_SELECTION_FREE
: The optimizer chooses the pricing strategy.

MSK_SIM_SELECTION_FULL
: The optimizer uses full pricing.

MSK_SIM_SELECTION_ASE
: The optimizer uses approximate steepest-edge pricing.

MSK_SIM_SELECTION_DEVEX
: The optimizer uses devex steepest-edge pricing (or if it is not available an approximate steep-edge selection).

MSK_SIM_SELECTION_SE
: The optimizer uses steepest-edge selection (or if it is not available an approximate steep-edge selection).

MSK_SIM_SELECTION_PARTIAL
: The optimizer uses a partial selection approach. The approach is usually beneficial if the number of variables is much larger than the number of constraints.

10.5.49 Solution items

MSK_SOL_ITEM_XC
: Solution for the constraints.

MSK_SOL_ITEM_XX
: Variable solution.

MSK_SOL_ITEM_Y
: Lagrange multipliers for equations.

MSK_SOL_ITEM_SLC
: Lagrange multipliers for lower bounds on the constraints.

MSK_SOL_ITEM_SUC
: Lagrange multipliers for upper bounds on the constraints.

MSK_SOL_ITEM_SLX
: Lagrange multipliers for lower bounds on the variables.

MSK_SOL_ITEM_SUX
: Lagrange multipliers for upper bounds on the variables.

MSK_SOL_ITEM_SNX
: Lagrange multipliers corresponding to the conic constraints on the variables.

10.5.50 Solution status keys

MSK_SOL_STA_UNKNOWN
: Status of the solution is unknown.

MSK_SOL_STA_OPTIMAL
: The solution is optimal.

MSK_SOL_STA_PRIM_FEAS
: The solution is primal feasible.

MSK_SOL_STA_DUAL_FEAS
: The solution is dual feasible.

MSK_SOL_STA_PRIM_AND_DUAL_FEAS
: The solution is both primal and dual feasible.

MSK_SOL_STA_PRIM_INFEAS_CER

The solution is a certificate of primal infeasibility.

MSK_SOL_STA_DUAL_INFEAS_CER

The solution is a certificate of dual infeasibility.

MSK_SOL_STA_PRIM_ILLPOSED_CER

The solution is a certificate that the primal problem is illposed.

MSK_SOL_STA_DUAL_ILLPOSED_CER

The solution is a certificate that the dual problem is illposed.

MSK_SOL_STA_INTEGER_OPTIMAL

The primal solution is integer optimal.

10.5.51 Solution types

MSK_SOL_BAS

The basic solution.

MSK_SOL_ITR

The interior solution.

MSK_SOL_ITG

The integer solution.

10.5.52 Solve primal or dual form

MSK_SOLVE_FREE

The optimizer is free to solve either the primal or the dual problem.

MSK_SOLVE_PRIMAL

The optimizer should solve the primal problem.

MSK_SOLVE_DUAL

The optimizer should solve the dual problem.

10.5.53 Status keys

MSK_SK_UNK

The status for the constraint or variable is unknown.

MSK_SK_BAS

The constraint or variable is in the basis.

MSK_SK_SUPBAS

The constraint or variable is super basic.

MSK_SK_LOW

The constraint or variable is at its lower bound.

MSK_SK_UPR

The constraint or variable is at its upper bound.

MSK_SK_FIX

The constraint or variable is fixed.

MSK_SK_INF

The constraint or variable is infeasible in the bounds.

10.5.54 Starting point types

MSK_STARTING_POINT_FREE

The starting point is chosen automatically.

MSK_STARTING_POINT_GUESS

The optimizer guesses a starting point.

MSK_STARTING_POINT_CONSTANT

The optimizer constructs a starting point by assigning a constant value to all primal and dual variables. This starting point is normally robust.

10.5.55 Stream types

MSK_STREAM_LOG

Log stream. Contains the aggregated contents of all other streams. This means that a message written to any other stream will also be written to this stream.

MSK_STREAM_MSG

Message stream. Log information relating to performance and progress of the optimization is written to this stream.

MSK_STREAM_ERR

Error stream. Error messages are written to this stream.

MSK_STREAM_WRN

Warning stream. Warning messages are written to this stream.

10.5.56 Integer values

MSK_MAX_STR_LEN

Maximum string length allowed in **MOSEK**.

MSK_LICENSE_BUFFER_LENGTH

The length of a license key buffer.

10.5.57 Variable types

MSK_VAR_TYPE_CONT

Is a continuous variable.

MSK_VAR_TYPE_INT

Is an integer variable.

Chapter 11

Supported File Formats

MOSEK supports a range of problem and solution formats listed in Table 11.1 and Table 11.2.

The most important are:

- the **Task format**, **MOSEK**'s native binary format which supports all features that **MOSEK** supports. It is the closest possible representation of the internal data in a task and it is ideal for submitting problem data support questions.
- the **PTF format**, **MOSEK**'s human-readable format that supports all linear, conic and mixed-integer features. It is ideal for debugging. It is not an exact copy of all the data in the task, but it contains all information required to reconstruct it, presented in a readable fashion.
- **MPS**, **LP**, **CBF** formats are industry standards, each supporting some limited set of features, and potentially requiring some degree of reformulation during read/write.

Problem formats

Table 11.1: List of supported file formats for optimization problems.

Format Type	Ext.	Binary/Text	LP	QCQO	ACC	SDP	DJC	Sol	Param
LP	lp	plain text	X	X					
MPS	mps	plain text	X	X					
PTF	ptf	plain text	X		X	X	X	X	X
CBF	cbf	plain text	X		X	X			
Task format	task	binary	X	X	X	X	X	X	X
Jtask format	jtask	text/JSON	X	X	X	X	X	X	X
OPF (deprecated for conic problems)	opf	plain text	X	X				X	X

The columns of the table indicate if the specified file format supports:

- LP - linear problems, possibly with integer variables,
- QCQO - quadratic objective or constraints,
- ACC - affine conic constraints,
- SDP - semidefinite cone/variables,
- DJC - disjunctive constraints,
- Sol - solutions,
- Param - optimizer parameters.

Solution formats

Table 11.2: List of supported solution formats.

Format Type	Ext.	Binary/Text	Description
SOL	sol	plain text	Interior Solution
	bas	plain text	Basic Solution
	int	plain text	Integer
Jsol format	jsol	text/JSON	All solutions

Compression

MOSEK supports GZIP and Zstandard compression. Problem files with extension `.gz` (for GZIP) and `.zst` (for Zstandard) are assumed to be compressed when read, and are automatically compressed when written. For example, a file called

```
problem.mps.zst
```

will be considered as a Zstandard compressed MPS file.

11.1 The LP File Format

MOSEK supports the LP file format with some extensions. The LP format is not a completely well-defined standard and hence different optimization packages may interpret the same LP file in slightly different ways. **MOSEK** tries to emulate as closely as possible CPLEX's behavior, but tries to stay backward compatible.

The LP file format can specify problems of the form

$$\begin{array}{lccccc} \text{minimize/maximize} & & & c^T x + \frac{1}{2} q^o(x) & & \\ \text{subject to} & l^c & \leq & Ax + \frac{1}{2} q(x) & \leq & u^c, \\ & l^x & \leq & x & \leq & u^x, \\ & & & x_{\mathcal{J}} \text{ integer}, & & \end{array}$$

where

- $x \in \mathbb{R}^n$ is the vector of decision variables.
- $c \in \mathbb{R}^n$ is the linear term in the objective.
- $q^o :\in \mathbb{R}^n \rightarrow \mathbb{R}$ is the quadratic term in the objective where

$$q^o(x) = x^T Q^o x$$

and it is assumed that

$$Q^o = (Q^o)^T.$$

- $A \in \mathbb{R}^{m \times n}$ is the constraint matrix.
- $l^c \in \mathbb{R}^m$ is the lower limit on the activity for the constraints.
- $u^c \in \mathbb{R}^m$ is the upper limit on the activity for the constraints.
- $l^x \in \mathbb{R}^n$ is the lower limit on the activity for the variables.
- $u^x \in \mathbb{R}^n$ is the upper limit on the activity for the variables.
- $q : \mathbb{R}^n \rightarrow \mathbb{R}$ is a vector of quadratic functions. Hence,

$$q_i(x) = x^T Q^i x$$

where it is assumed that

$$Q^i = (Q^i)^T.$$

- $\mathcal{J} \subseteq \{1, 2, \ldots, n\}$ is an index set of the integer constrained variables.

11.1.1 File Sections

An LP formatted file contains a number of sections specifying the objective, constraints, variable bounds, and variable types. The section keywords may be any mix of upper and lower case letters.

Objective Function

The first section beginning with one of the keywords

```
max
maximum
maximize
min
minimum
minimize
```

defines the objective sense and the objective function, i.e.

$$c^T x + \frac{1}{2} x^T Q^o x.$$

The objective may be given a name by writing

```
myname:
```

before the expressions. If no name is given, then the objective is named `obj`.

The objective function contains linear and quadratic terms. The linear terms are written as

```
4 x1 + x2 - 0.1 x3
```

and so forth. The quadratic terms are written in square brackets (`[ ]/2`) and are either squared or multiplied as in the examples

```
x1^2
```

and

```
x1 * x2
```

There may be zero or more pairs of brackets containing quadratic expressions.

An example of an objective section is

```
minimize
myobj: 4 x1 + x2 - 0.1 x3 + [ x1^2 + 2.1 x1 * x2 ]/2
```

Please note that the quadratic expressions are multiplied with $\frac{1}{2}$, so that the above expression means

$$\text{minimize} \quad 4x_1 + x_2 - 0.1 \cdot x_3 + \tfrac{1}{2}(x_1^2 + 2.1 \cdot x_1 \cdot x_2)$$

If the same variable occurs more than once in the linear part, the coefficients are added, so that `4 x1 + 2 x1` is equivalent to `6 x1`. In the quadratic expressions `x1 * x2` is equivalent to `x2 * x1` and, as in the linear part, if the same variables multiplied or squared occur several times their coefficients are added.

Constraints

The second section beginning with one of the keywords

```
subj to
subject to
s.t.
st
```

defines the linear constraint matrix A and the quadratic matrices Q^i.

A constraint contains a name (optional), expressions adhering to the same rules as in the objective and a bound:

```
subject to
con1: x1 + x2 + [ x3^2 ]/2 <= 5.1
```

The bound type (here `<=`) may be any of `<`, `<=`, `=`, `>`, `>=` (`<` and `<=` mean the same), and the bound may be any number.

In the standard LP format it is not possible to define more than one bound per line, but **MOSEK** supports defining ranged constraints by using double-colon (`::`) instead of a single-colon (`:`) after the constraint name, i.e.

$$-5 \leq x_1 + x_2 \leq 5 \tag{11.1}$$

may be written as

```
con:: -5 < x_1 + x_2 < 5
```

By default **MOSEK** writes ranged constraints this way.

If the files must adhere to the LP standard, ranged constraints must either be split into upper bounded and lower bounded constraints or be written as an equality with a slack variable. For example the expression (11.1) may be written as

$$x_1 + x_2 - sl_1 = 0, \ -5 \leq sl_1 \leq 5.$$

Bounds

Bounds on the variables can be specified in the bound section beginning with one of the keywords

```
bound
bounds
```

The bounds section is optional but should, if present, follow the `subject to` section. All variables listed in the bounds section must occur in either the objective or a constraint.

The default lower and upper bounds are 0 and $+\infty$. A variable may be declared free with the keyword `free`, which means that the lower bound is $-\infty$ and the upper bound is $+\infty$. Furthermore it may be assigned a finite lower and upper bound. The bound definitions for a given variable may be written in one or two lines, and bounds can be any number or $\pm\infty$ (written as `+inf`/`-inf`/`+infinity`/`-infinity`) as in the example

```
bounds
x1 free
x2 <= 5
0.1 <= x2
x3 = 42
2 <= x4 < +inf
```

Variable Types

The final two sections are optional and must begin with one of the keywords

```
bin
binaries
binary
```

and

```
gen
general
```

Under `general` all integer variables are listed, and under `binary` all binary (integer variables with bounds 0 and 1) are listed:

```
general
x1 x2
binary
x3 x4
```

Again, all variables listed in the binary or general sections must occur in either the objective or a constraint.

Terminating Section

Finally, an LP formatted file must be terminated with the keyword

```
end
```

11.1.2 LP File Examples

Linear example `lo1.lp`

```
\ File: lo1.lp
maximize
obj: 3 x1 + x2 + 5 x3 + x4
subject to
c1:  3 x1 + x2 + 2 x3 = 30
c2:  2 x1 + x2 + 3 x3 + x4 >= 15
c3:  2 x2 + 3 x4 <= 25
bounds
 0 <= x1 <= +infinity
 0 <= x2 <= 10
 0 <= x3 <= +infinity
 0 <= x4 <= +infinity
end
```

Mixed integer example `milo1.lp`

```
maximize
obj: x1 + 6.4e-01 x2
subject to
c1:  5e+01 x1 + 3.1e+01 x2 <= 2.5e+02
c2:  3e+00 x1 - 2e+00 x2 >= -4e+00
bounds
 0 <= x1 <= +infinity
 0 <= x2 <= +infinity
```

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```
general
 x1 x2
end
```

11.1.3 LP Format peculiarities

Comments

Anything on a line after a \ is ignored and is treated as a comment.

Names

A name for an objective, a constraint or a variable may contain the letters `a-z`, `A-Z`, the digits `0-9` and the characters

```
!"#$%&()/,.;?@_'`|~
```

The first character in a name must not be a number, a period or the letter `e` or `E`. Keywords must not be used as names.

MOSEK accepts any character as valid for names, except `\0`. A name that is not allowed in LP file will be changed and a warning will be issued.

The algorithm for making names LP valid works as follows: The name is interpreted as an `utf-8` string. For a Unicode character `c`:

- If `c==_` (underscore), the output is `__` (two underscores).
- If `c` is a valid LP name character, the output is just `c`.
- If `c` is another character in the ASCII range, the output is `_XX`, where `XX` is the hexadecimal code for the character.
- If `c` is a character in the range *127-65535*, the output is `_uXXXX`, where `XXXX` is the hexadecimal code for the character.
- If `c` is a character above 65535, the output is `_UXXXXXXXX`, where `XXXXXXXX` is the hexadecimal code for the character.

Invalid `utf-8` substrings are escaped as `_XX'`, and if a name starts with a period, `e` or `E`, that character is escaped as `_XX`.

Variable Bounds

Specifying several upper or lower bounds on one variable is possible but **MOSEK** uses only the tightest bounds. If a variable is fixed (with `=`), then it is considered the tightest bound.

11.2 The MPS File Format

MOSEK supports the standard MPS format with some extensions. For a detailed description of the MPS format see the book by Nazareth [Naz87].

11.2.1 MPS File Structure

The version of the MPS format supported by **MOSEK** allows specification of an optimization problem of the form

$$\begin{array}{lccccl} \text{maximize/minimize} & & c^T x + q_0(x) & & & \\ l^c & \leq & Ax + q(x) & \leq & u^c, & \\ l^x & \leq & x & \leq & u^x, & \\ & & x \in \mathcal{K}, & & & \\ & & x_{\mathcal{J}} \ \ \text{integer}, & & & \end{array} \tag{11.2}$$

where

- $x \in \mathbb{R}^n$ is the vector of decision variables.
- $A \in \mathbb{R}^{m \times n}$ is the constraint matrix.
- $l^c \in \mathbb{R}^m$ is the lower limit on the activity for the constraints.
- $u^c \in \mathbb{R}^m$ is the upper limit on the activity for the constraints.
- $l^x \in \mathbb{R}^n$ is the lower limit on the activity for the variables.
- $u^x \in \mathbb{R}^n$ is the upper limit on the activity for the variables.
- $q : \mathbb{R}^n \rightarrow \mathbb{R}$ is a vector of quadratic functions. Hence,

  $$q_i(x) = \frac{1}{2} x^T Q^i x$$

  where it is assumed that $Q^i = (Q^i)^T$. Please note the explicit $\frac{1}{2}$ in the quadratic term and that Q^i is required to be symmetric. The same applies to q_0.
- $\mathcal{K}$ is a convex cone.
- $\mathcal{J} \subseteq \{1, 2, \ldots, n\}$ is an index set of the integer-constrained variables.
- c is the vector of objective coefficients.

An MPS file with one row and one column can be illustrated like this:

```
*         1         2         3         4         5         6
*23456789012345678901234567890123456789012345678901234567890
NAME          [name]
OBJSENSE
    [objsense]
OBJNAME       [objname]
ROWS
 ?  [cname1]
COLUMNS
    [vname1]  [cname1]  [value1]       [cname2]  [value2]
RHS
    [name]    [cname1]  [value1]       [cname2]  [value2]
RANGES
    [name]    [cname1]  [value1]       [cname2]  [value2]
QSECTION      [cname1]
    [vname1]  [vname2]  [value1]       [vname3]  [value2]
QMATRIX
    [vname1]  [vname2]  [value1]
QUADOBJ
    [vname1]  [vname2]  [value1]
QCMATRIX      [cname1]
    [vname1]  [vname2]  [value1]
```

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```
BOUNDS
 ?? [name]     [vname1]   [value1]
CSECTION       [kname1]   [value1]       [ktype]
    [vname1]
ENDATA
```

Here the names in capitals are keywords of the MPS format and names in brackets are custom defined names or values. A couple of notes on the structure:

- Fields: All items surrounded by brackets appear in *fields*. The fields named "`valueN`" are numerical values. Hence, they must have the format

  ```
  [+|-]XXXXXXX.XXXXXX[[e|E][+|-]XXX]
  ```

  where

  ```
  X = [0|1|2|3|4|5|6|7|8|9].
  ```

- Sections: The MPS file consists of several sections where the names in capitals indicate the beginning of a new section. For example, `COLUMNS` denotes the beginning of the columns section.
- Comments: Lines starting with an `*` are comment lines and are ignored by **MOSEK**.
- Keys: The question marks represent keys to be specified later.
- Extensions: The sections `QSECTION` and `CSECTION` are specific **MOSEK** extensions of the MPS format. The sections `QMATRIX`, `QUADOBJ` and `QCMATRIX` are included for sake of compatibility with other vendors extensions to the MPS format.
- The standard MPS format is a fixed format, i.e. everything in the MPS file must be within certain fixed positions. **MOSEK** also supports a *free format*. See Sec. 11.2.5 for details.

Linear example `lo1.mps`

A concrete example of a MPS file is presented below:

```
* File: lo1.mps
NAME          lo1
OBJSENSE
    MAX
ROWS
 N  obj
 E  c1
 G  c2
 L  c3
COLUMNS
    x1        obj       3
    x1        c1        3
    x1        c2        2
    x2        obj       1
    x2        c1        1
    x2        c2        1
    x2        c3        2
    x3        obj       5
    x3        c1        2
    x3        c2        3
    x4        obj       1
    x4        c2        1
    x4        c3        3
```

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```
RHS
    rhs       c1        30
    rhs       c2        15
    rhs       c3        25
RANGES
BOUNDS
 UP bound     x2        10
ENDATA
```

Subsequently each individual section in the MPS format is discussed.

NAME (optional)

In this section a name ([name]) is assigned to the problem.

OBJSENSE (optional)

This is an optional section that can be used to specify the sense of the objective function. The OBJSENSE section contains one line at most which can be one of the following:

```
MIN
MINIMIZE
MAX
MAXIMIZE
```

It should be obvious what the implication is of each of these four lines.

OBJNAME (optional)

This is an optional section that can be used to specify the name of the row that is used as objective function. objname should be a valid row name.

ROWS

A record in the ROWS section has the form

```
?  [cname1]
```

where the requirements for the fields are as follows:

Field	Starting Position	Max Width	required	Description
?	2	1	Yes	Constraint key
[cname1]	5	8	Yes	Constraint name

Hence, in this section each constraint is assigned a unique name denoted by [cname1]. Please note that [cname1] starts in position 5 and the field can be at most 8 characters wide. An initial key ? must be present to specify the type of the constraint. The key can have values E, G, L, or N with the following interpretation:

Constraint type	l_i^c	u_i^c
E (equal)	finite	$= l_i^c$
G (greater)	finite	∞
L (lower)	$-\infty$	finite
N (none)	$-\infty$	∞

In the MPS format the objective vector is not specified explicitly, but one of the constraints having the key N will be used as the objective vector c . In general, if multiple N type constraints are specified, then the first will be used as the objective vector c, unless something else was specified in the section OBJNAME.

COLUMNS

In this section the elements of A are specified using one or more records having the form:

```
[vname1]   [cname1]     [value1]      [cname2]   [value2]
```

where the requirements for each field are as follows:

Field	Starting Position	Max Width	required	Description
[vname1]	5	8	Yes	Variable name
[cname1]	15	8	Yes	Constraint name
[value1]	25	12	Yes	Numerical value
[cname2]	40	8	No	Constraint name
[value2]	50	12	No	Numerical value

Hence, a record specifies one or two elements a_{ij} of A using the principle that `[vname1]` and `[cname1]` determines j and i respectively. Please note that `[cname1]` must be a constraint name specified in the `ROWS` section. Finally, `[value1]` denotes the numerical value of a_{ij} . Another optional element is specified by `[cname2]`, and `[value2]` for the variable specified by `[vname1]`. Some important comments are:

- All elements belonging to one variable must be grouped together.
- Zero elements of A should not be specified.
- At least one element for each variable should be specified.

RHS (optional)

A record in this section has the format

```
[name]     [cname1]     [value1]      [cname2]   [value2]
```

where the requirements for each field are as follows:

Field	Starting Position	Max Width	required	Description
[name]	5	8	Yes	Name of the RHS vector
[cname1]	15	8	Yes	Constraint name
[value1]	25	12	Yes	Numerical value
[cname2]	40	8	No	Constraint name
[value2]	50	12	No	Numerical value

The interpretation of a record is that `[name]` is the name of the `RHS` vector to be specified. In general, several vectors can be specified. `[cname1]` denotes a constraint name previously specified in the `ROWS` section. Now, assume that this name has been assigned to the i -h constraint and v_1 denotes the value specified by `[value1]`, then the interpretation of v_1 is:

Constraint	l_i^c	u_i^c
E	v_1	v_1
G	v_1	
L		v_1
N		

An optional second element is specified by `[cname2]` and `[value2]` and is interpreted in the same way. Please note that it is not necessary to specify zero elements, because elements are assumed to be zero.

`RANGES` (optional)

A record in this section has the form

```
[name]     [cname1]     [value1]      [cname2]   [value2]
```

where the requirements for each fields are as follows:

Field	Starting Position	Max Width	required	Description
`[name]`	5	8	Yes	Name of the `RANGE` vector
`[cname1]`	15	8	Yes	Constraint name
`[value1]`	25	12	Yes	Numerical value
`[cname2]`	40	8	No	Constraint name
`[value2]`	50	12	No	Numerical value

The records in this section are used to modify the bound vectors for the constraints, i.e. the values in l^c and u^c . A record has the following interpretation: `[name]` is the name of the `RANGE` vector and `[cname1]` is a valid constraint name. Assume that `[cname1]` is assigned to the i-th constraint and let v_1 be the value specified by `[value1]`, then a record has the interpretation:

Constraint type	Sign of v_1	l_i^c	u_i^c
`E`	$-$	$u_i^c + v_1$	
`E`	$+$		$l_i^c + v_1$
`G`	$-$ or $+$		$l_i^c + \|v_1\|$
`L`	$-$ or $+$	$u_i^c - \|v_1\|$	
`N`			

Another constraint bound can optionally be modified using `[cname2]` and `[value2]` the same way.

`QSECTION` (optional)

Within the `QSECTION` the label `[cname1]` must be a constraint name previously specified in the `ROWS` section. The label `[cname1]` denotes the constraint to which the quadratic terms belong. A record in the `QSECTION` has the form

```
[vname1]  [vname2]     [value1]      [vname3]   [value2]
```

where the requirements for each field are:

Field	Starting Position	Max Width	required	Description
`[vname1]`	5	8	Yes	Variable name
`[vname2]`	15	8	Yes	Variable name
`[value1]`	25	12	Yes	Numerical value
`[vname3]`	40	8	No	Variable name
`[value2]`	50	12	No	Numerical value

A record specifies one or two elements in the lower triangular part of the Q^i matrix where `[cname1]` specifies the i . Hence, if the names `[vname1]` and `[vname2]` have been assigned to the k-th and j-th variable, then Q_{kj}^i is assigned the value given by `[value1]` An optional second element is specified in the same way by the fields `[vname1]`, `[vname3]`, and `[value2]`.

The example

$$
\begin{array}{lccc}
\text{minimize} & -x_2 + \frac{1}{2}(2x_1^2 - 2x_1x_3 + 0.2x_2^2 + 2x_3^2) & & \\
\text{subject to} & x_1 + x_2 + x_3 & \geq & 1, \\
 & x \geq 0 & &
\end{array}
$$

has the following MPS file representation

```
* File: qo1.mps
NAME          qo1
ROWS
 N  obj
 G  c1
COLUMNS
    x1        c1        1.0
    x2        obj       -1.0
    x2        c1        1.0
    x3        c1        1.0
RHS
    rhs       c1        1.0
QSECTION      obj
    x1        x1        2.0
    x1        x3        -1.0
    x2        x2        0.2
    x3        x3        2.0
ENDATA
```

Regarding the QSECTIONs please note that:

- Only one QSECTION is allowed for each constraint.
- The QSECTIONs can appear in an arbitrary order after the COLUMNS section.
- All variable names occurring in the QSECTION must already be specified in the COLUMNS section.
- All entries specified in a QSECTION are assumed to belong to the lower triangular part of the quadratic term of Q .

QMATRIX/QUADOBJ (optional)

The QMATRIX and QUADOBJ sections allow to define the quadratic term of the objective function. They differ in how the quadratic term of the objective function is stored:

- QMATRIX stores all the nonzeros coefficients, without taking advantage of the symmetry of the Q matrix.
- QUADOBJ stores the upper diagonal nonzero elements of the Q matrix.

A record in both sections has the form:

```
[vname1]  [vname2]   [value1]
```

where the requirements for each field are:

Field	Starting Position	Max Width	required	Description
[vname1]	5	8	Yes	Variable name
[vname2]	15	8	Yes	Variable name
[value1]	25	12	Yes	Numerical value

A record specifies one elements of the Q matrix in the objective function . Hence, if the names [vname1] and [vname2] have been assigned to the k-th and j-th variable, then Q_{kj} is assigned the value given by [value1]. Note that a line must appear for each off-diagonal coefficient if using a QMATRIX section, while only one entry is required in a QUADOBJ section. The quadratic part of the objective function will be evaluated as $1/2x^TQx$.

The example

$$
\begin{array}{lccc}
\text{minimize} & -x_2 + \frac{1}{2}(2x_1^2 - 2x_1x_3 + 0.2x_2^2 + 2x_3^2) & & \\
\text{subject to} & x_1 + x_2 + x_3 & \geq & 1, \\
 & x \geq 0 & &
\end{array}
$$

has the following MPS file representation using QMATRIX

```
* File: qo1_matrix.mps
NAME          qo1_qmatrix
ROWS
 N  obj
 G  c1
COLUMNS
    x1        c1        1.0
    x2        obj       -1.0
    x2        c1        1.0
    x3        c1        1.0
RHS
    rhs       c1        1.0
QMATRIX
    x1        x1        2.0
    x1        x3        -1.0
    x3        x1        -1.0
    x2        x2        0.2
    x3        x3        2.0
ENDATA
```

or the following using `QUADOBJ`

```
* File: qo1_quadobj.mps
NAME          qo1_quadobj
ROWS
 N  obj
 G  c1
COLUMNS
    x1        c1        1.0
    x2        obj       -1.0
    x2        c1        1.0
    x3        c1        1.0
RHS
    rhs       c1        1.0
QUADOBJ
    x1        x1        2.0
    x1        x3        -1.0
    x2        x2        0.2
    x3        x3        2.0
ENDATA
```

Please also note that:

- A `QMATRIX`/`QUADOBJ` section can appear in an arbitrary order after the `COLUMNS` section.
- All variable names occurring in the `QMATRIX`/`QUADOBJ` section must already be specified in the `COLUMNS` section.

`QCMATRIX` (optional)

A `QCMATRIX` section allows to specify the quadratic part of a given constraint. Within the `QCMATRIX` the label `[cname1]` must be a constraint name previously specified in the `ROWS` section. The label `[cname1]` denotes the constraint to which the quadratic term belongs. A record in the `QSECTION` has the form

```
[vname1]  [vname2]   [value1]
```

where the requirements for each field are:

Field	Starting Position	Max Width	required	Description
[vname1]	5	8	Yes	Variable name
[vname2]	15	8	Yes	Variable name
[value1]	25	12	Yes	Numerical value

A record specifies an entry of the Q^i matrix where `[cname1]` specifies the i. Hence, if the names `[vname1]` and `[vname2]` have been assigned to the k-th and j-th variable, then Q^i_{kj} is assigned the value given by `[value1]`. Moreover, the quadratic term is represented as $1/2x^TQx$.

The example

$$\begin{array}{lccl} \text{minimize} & x_2 & & \\ \text{subject to} & x_1 + x_2 + x_3 & \geq & 1, \\ & \frac{1}{2}(-2x_1x_3 + 0.2x_2^2 + 2x_3^2) & \leq & 10, \\ & x \geq 0 & & \end{array}$$

has the following MPS file representation

```
* File: qo1.mps
NAME          qo1
ROWS
 N  obj
 G  c1
 L  q1
COLUMNS
    x1        c1        1.0
    x2        obj       -1.0
    x2        c1        1.0
    x3        c1        1.0
RHS
    rhs       c1        1.0
    rhs       q1        10.0
QCMATRIX      q1
    x1        x1        2.0
    x1        x3        -1.0
    x3        x1        -1.0
    x2        x2        0.2
    x3        x3        2.0
ENDATA
```

Regarding the `QCMATRIX`s please note that:

- Only one `QCMATRIX` is allowed for each constraint.
- The `QCMATRIX`s can appear in an arbitrary order after the `COLUMNS` section.
- All variable names occurring in the `QSECTION` must already be specified in the `COLUMNS` section.
- `QCMATRIX` does not exploit the symmetry of Q: an off-diagonal entry (i, j) should appear twice.

BOUNDS (optional)

In the `BOUNDS` section changes to the default bounds vectors l^x and u^x are specified. The default bounds vectors are $l^x = 0$ and $u^x = \infty$. Moreover, it is possible to specify several sets of bound vectors. A record in this section has the form

```
?? [name]    [vname1]    [value1]
```

where the requirements for each field are:

Field	Starting Position	Max Width	Required	Description
`??`	2	2	Yes	Bound key
`[name]`	5	8	Yes	Name of the `BOUNDS` vector
`[vname1]`	15	8	Yes	Variable name
`[value1]`	25	12	No	Numerical value

Hence, a record in the `BOUNDS` section has the following interpretation: `[name]` is the name of the bound vector and `[vname1]` is the name of the variable for which the bounds are modified by the record. `??` and `[value1]` are used to modify the bound vectors according to the following table:

`??`	l_j^x	u_j^x	Made integer (added to $\mathcal{J}$)
`FR`	$-\infty$	∞	No
`FX`	v_1	v_1	No
`LO`	v_1	unchanged	No
`MI`	$-\infty$	unchanged	No
`PL`	unchanged	∞	No
`UP`	unchanged	v_1	No
`BV`	0	1	Yes
`LI`	$\lceil v_1 \rceil$	unchanged	Yes
`UI`	unchanged	$\lfloor v_1 \rfloor$	Yes

Here v_1 is the value specified by `[value1]`.

`CSECTION` (optional)

The purpose of the `CSECTION` is to specify the conic constraint

$$x \in \mathcal{K}$$

in (11.2). It is assumed that $\mathcal{K}$ satisfies the following requirements. Let

$$x^t \in \mathbb{R}^{n^t}, \quad t = 1, \ldots, k$$

be vectors comprised of parts of the decision variables x so that each decision variable is a member of exactly **one** vector x^t, for example

$$x^1 = \begin{bmatrix} x_1 \\ x_4 \\ x_7 \end{bmatrix} \quad \text{and} \quad x^2 = \begin{bmatrix} x_6 \\ x_5 \\ x_3 \\ x_2 \end{bmatrix}.$$

Next define

$$\mathcal{K} := \left\{ x \in \mathbb{R}^n : \quad x^t \in \mathcal{K}_t, \quad t = 1, \ldots, k \right\}$$

where $\mathcal{K}_t$ must have one of the following forms:

- $\mathbb{R}$ set:

$$\mathcal{K}_t = \mathbb{R}^{n^t}.$$

- Zero cone:

$$\mathcal{K}_t = \{0\} \subseteq \mathbb{R}^{n^t}. \tag{11.3}$$

- Quadratic cone:

$$\mathcal{K}_t = \left\{ x \in \mathbb{R}^{n^t} : x_1 \geq \sqrt{\sum_{j=2}^{n^t} x_j^2} \right\}. \tag{11.4}$$

- Rotated quadratic cone:

$$\mathcal{K}_t = \left\{ x \in \mathbb{R}^{n^t} : 2x_1x_2 \geq \sum_{j=3}^{n^t} x_j^2, \quad x_1, x_2 \geq 0 \right\}. \tag{11.5}$$

- Primal exponential cone:

$$\mathcal{K}_t = \left\{ x \in \mathbb{R}^3 : x_1 \geq x_2 \exp(x_3/x_2), \quad x_1, x_2 \geq 0 \right\}. \tag{11.6}$$

- Primal power cone (with parameter $0 < \alpha < 1$):

$$\mathcal{K}_t = \left\{ x \in \mathbb{R}^{n^t} : x_1^{\alpha} x_2^{1-\alpha} \geq \sqrt{\sum_{j=3}^{n^t} x_j^2}, \quad x_1, x_2 \geq 0 \right\}. \tag{11.7}$$

- Dual exponential cone:

$$\mathcal{K}_t = \left\{ x \in \mathbb{R}^3 : x_1 \geq -x_3 e^{-1} \exp(x_2/x_3), \quad x_3 \leq 0, x_1 \geq 0 \right\}. \tag{11.8}$$

- Dual power cone (with parameter $0 < \alpha < 1$):

$$\mathcal{K}_t = \left\{ x \in \mathbb{R}^{n^t} : \left(\frac{x_1}{\alpha}\right)^{\alpha} \left(\frac{x_2}{1-\alpha}\right)^{1-\alpha} \geq \sqrt{\sum_{j=3}^{n^t} x_j^2}, \quad x_1, x_2 \geq 0 \right\}. \tag{11.9}$$

In general, membership in the $\mathbb{R}$ set is not specified. If a variable is not a member of any other cone then it is assumed to be a member of the $\mathbb{R}$ cone.

Next, let us study an example. Assume that the power cone

$$x_4^{1/3} x_5^{2/3} \geq |x_8|$$

and the rotated quadratic cone

$$2x_3x_7 \geq x_1^2 + x_0^2, \quad x_3, x_7 \geq 0,$$

should be specified in the MPS file. One `CSECTION` is required for each cone and they are specified as follows:

```
*        1         2         3         4         5         6
*23456789012345678901234567890123456789012345678901234567890
CSECTION      konea     3e-1           PPOW
x4
x5
x8
CSECTION      koneb     0.0            RQUAD
x7
x3
x1
x0
```

In general, a `CSECTION` header has the format

```
CSECTION      [kname1]    [value1]     [ktype]
```

where the requirements for each field are as follows:

Field	Starting Position	Max Width	Required	Description
`[kname1]`	15	8	Yes	Name of the cone
`[value1]`	25	12	No	Cone parameter
`[ktype]`	40		Yes	Type of the cone.

The possible cone type keys are:

[ktype]	Members	[value1]	Interpretation.
ZERO	≥ 0	unused	Zero cone (11.3).
QUAD	≥ 1	unused	Quadratic cone (11.4).
RQUAD	≥ 2	unused	Rotated quadratic cone (11.5).
PEXP	3	unused	Primal exponential cone (11.6).
PPOW	≥ 2	α	Primal power cone (11.7).
DEXP	3	unused	Dual exponential cone (11.8).
DPOW	≥ 2	α	Dual power cone (11.9).

A record in the `CSECTION` has the format

```
[vname1]
```

where the requirements for each field are

Field	Starting Position	Max Width	required	Description
[vname1]	5	8	Yes	A valid variable name

A variable must occur in at most one `CSECTION`.

ENDATA

This keyword denotes the end of the MPS file.

11.2.2 Integer Variables

Using special bound keys in the `BOUNDS` section it is possible to specify that some or all of the variables should be integer-constrained i.e. be members of $\mathcal{J}$. However, an alternative method is available. This method is available only for backward compatibility and we recommend that it is not used. This method requires that markers are placed in the `COLUMNS` section as in the example:

```
COLUMNS
x1        obj       -10.0          c1        0.7
x1        c2        0.5            c3        1.0
x1        c4        0.1
* Start of integer-constrained variables.
MARK000   'MARKER'                 'INTORG'
x2        obj       -9.0           c1        1.0
x2        c2        0.8333333333   c3        0.66666667
x2        c4        0.25
x3        obj       1.0            c6        2.0
MARK001   'MARKER'                 'INTEND'
* End of integer-constrained variables.
```

Please note that special marker lines are used to indicate the start and the end of the integer variables. Furthermore be aware of the following

- All variables between the markers are assigned a default lower bound of 0 and a default upper bound of 1. **This may not be what is intended.** If it is not intended, the correct bounds should be defined in the `BOUNDS` section of the MPS formatted file.
- **MOSEK** ignores field 1, i.e. `MARK0001` and `MARK001`, however, other optimization systems require them.
- Field 2, i.e. `MARKER`, must be specified including the single quotes. This implies that no row can be assigned the name `MARKER`.
- Field 3 is ignored and should be left blank.

- Field 4, i.e. INTORG and INTEND, must be specified.
- It is possible to specify several such integer marker sections within the COLUMNS section.

11.2.3 General Limitations

- An MPS file should be an ASCII file.

11.2.4 Interpretation of the MPS Format

Several issues related to the MPS format are not well-defined by the industry standard. However, **MOSEK** uses the following interpretation:

- If a matrix element in the COLUMNS section is specified multiple times, then the multiple entries are added together.
- If a matrix element in a QSECTION section is specified multiple times, then the multiple entries are added together.

11.2.5 The Free MPS Format

MOSEK supports a free format variation of the MPS format. The free format is similar to the MPS file format but less restrictive, e.g. it allows longer names. However, a name must not contain any blanks.

Moreover, by default a line in the MPS file must not contain more than 1024 characters. By modifying the parameter *MSK_IPAR_READ_MPS_WIDTH* an arbitrary large line width will be accepted.

The free MPS format is default. To change to the strict and other formats use the parameter *MSK_IPAR_READ_MPS_FORMAT*.

> **Warning:** This file format is to a large extent deprecated. While it can still be used for linear and quadratic problems, for conic problems the Sec. 11.5 is recommended.

11.3 The OPF Format

The *Optimization Problem Format (OPF)* is an alternative to LP and MPS files for specifying optimization problems. It is row-oriented, inspired by the CPLEX LP format.

Apart from containing objective, constraints, bounds etc. it may contain complete or partial solutions, comments and extra information relevant for solving the problem. It is designed to be easily read and modified by hand and to be forward compatible with possible future extensions.

Intended use

The OPF file format is meant to replace several other files:

- The LP file format: Any problem that can be written as an LP file can be written as an OPF file too; furthermore it naturally accommodates ranged constraints and variables as well as arbitrary characters in names, fixed expressions in the objective, empty constraints, and conic constraints.
- Parameter files: It is possible to specify integer, double and string parameters along with the problem (or in a separate OPF file).
- Solution files: It is possible to store a full or a partial solution in an OPF file and later reload it.

11.3.1 The File Format

The format uses tags to structure data. A simple example with the basic sections may look like this:

```
[comment]
This is a comment. You may write almost anything here...
[/comment]

# This is a single-line comment.

[objective min 'myobj']
x + 3 y + x^2 + 3 y^2 + z + 1
[/objective]

[constraints]
[con 'con01'] 4 <= x + y  [/con]
[/constraints]

[bounds]
[b] -10 <= x,y <= 10  [/b]

[cone quad] x,y,z [/cone]
[/bounds]
```

A scope is opened by a tag of the form `[tag]` and closed by a tag of the form `[/tag]`. An opening tag may accept a list of unnamed and named arguments, for examples:

```
[tag value] tag with one unnamed argument [/tag]
[tag arg=value] tag with one named argument [/tag]
```

Unnamed arguments are identified by their order, while named arguments may appear in any order, but never before an unnamed argument. The `value` can be a quoted, single-quoted or double-quoted text string, i.e.

```
[tag 'value']     single-quoted value [/tag]
[tag arg='value'] single-quoted value [/tag]
[tag "value"]     double-quoted value [/tag]
[tag arg="value"] double-quoted value [/tag]
```

11.3.2 Sections

The recognized tags are

`[comment]`

A comment section. This can contain *almost* any text: Between single quotes (') or double quotes (") any text may appear. Outside quotes the markup characters ([and]) must be prefixed by backslashes. Both single and double quotes may appear alone or inside a pair of quotes if it is prefixed by a backslash.

`[objective]`

The objective function: This accepts one or two parameters, where the first one (in the above example `min`) is either `min` or `max` (regardless of case) and defines the objective sense, and the second one (above `myobj`), if present, is the objective name. The section may contain linear and quadratic expressions.

If several objectives are specified, all but the last are ignored.

`[constraints]`

This does not directly contain any data, but may contain subsections `con` defining a linear constraint.

`[con]`

Defines a single constraint; if an argument is present (`[con NAME]`) this is used as the name of the constraint, otherwise it is given a null-name. The section contains a constraint definition written as linear and quadratic expressions with a lower bound, an upper bound, with both or with an equality. Examples:

```
[constraints]
[con 'con1'] 0 <= x + y       [/con]
[con 'con2'] 0 >= x + y       [/con]
[con 'con3'] 0 <= x + y <= 10 [/con]
[con 'con4']      x + y  = 10 [/con]
[/constraints]
```

Constraint names are unique. If a constraint is specified which has the same name as a previously defined constraint, the new constraint replaces the existing one.

`[bounds]`

This does not directly contain any data, but may contain subsections `b` (linear bounds on variables) and `cone` (cones).

`[b]`

Bound definition on one or several variables separated by comma (,). An upper or lower bound on a variable replaces any earlier defined bound on that variable. If only one bound (upper or lower) is given only this bound is replaced. This means that upper and lower bounds can be specified separately. So the OPF bound definition:

```
[b]  x,y >= -10  [/b]
[b]  x,y <= 10   [/b]
```

results in the bound $-10 \leq x, y \leq 10$.

`[cone]`

Specifies a cone. A cone is defined as a sequence of variables which belong to a single unique cone. The supported cone types are:

- `quad`: a quadratic cone of n variables $x_1, \dots, x_n$ defines a constraint of the form

$$x_1^2 \geq \sum_{i=2}^{n} x_i^2, \quad x_1 \geq 0.$$

- `rquad`: a rotated quadratic cone of n variables $x_1, \dots, x_n$ defines a constraint of the form

$$2x_1 x_2 \geq \sum_{i=3}^{n} x_i^2, \quad x_1, x_2 \geq 0.$$

- `pexp`: primal exponential cone of 3 variables x_1, x_2, x_3 defines a constraint of the form

$$x_1 \geq x_2 \exp(x_3/x_2), \quad x_1, x_2 \geq 0.$$

- `ppow` with parameter $0 < \alpha < 1$: primal power cone of n variables $x_1, \dots, x_n$ defines a constraint of the form

$$x_1^{\alpha} x_2^{1-\alpha} \geq \sqrt{\sum_{j=3}^{n} x_j^2}, \quad x_1, x_2 \geq 0.$$

- `dexp`: dual exponential cone of 3 variables x_1, x_2, x_3 defines a constraint of the form

$$x_1 \geq -x_3 e^{-1} \exp(x_2/x_3), \quad x_3 \leq 0, x_1 \geq 0.$$

- `dpow` with parameter $0 < \alpha < 1$: dual power cone of n variables $x_1, \dots, x_n$ defines a constraint of the form

$$\left(\frac{x_1}{\alpha}\right)^{\alpha} \left(\frac{x_2}{1-\alpha}\right)^{1-\alpha} \geq \sqrt{\sum_{j=3}^{n^t} x_j^2}, \quad x_1, x_2 \geq 0.$$

- `zero`: zero cone of n variables $x_1, \dots, x_n$ defines a constraint of the form

$$x_1 = \cdots = x_n = 0$$

A `[bounds]`-section example:

```
[bounds]
[b]  0 <= x,y <= 10  [/b] # ranged bound
[b] 10 >= x,y >=  0  [/b] # ranged bound
[b]  0 <= x,y <= inf [/b] # using inf
[b]       x,y free   [/b] # free variables
# Let (x,y,z,w) belong to the cone K
[cone rquad] x,y,z,w  [/cone] # rotated quadratic cone
[cone ppow '3e-01' 'a'] x1, x2, x3 [/cone] # power cone with alpha=1/3 and name 'a'
[/bounds]
```

By default all variables are free.

`[variables]`

This defines an ordering of variables as they should appear in the problem. This is simply a space-separated list of variable names.

`[integer]`

This contains a space-separated list of variables and defines the constraint that the listed variables must be integer-valued.

`[hints]`

This may contain only non-essential data; for example estimates of the number of variables, constraints and non-zeros. Placed before all other sections containing data this may reduce the time spent reading the file.

In the `hints` section, any subsection which is not recognized by **MOSEK** is simply ignored. In this section a hint is defined as follows:

```
[hint ITEM] value [/hint]
```

The hints recognized by **MOSEK** are:

- `numvar` (number of variables),
- `numcon` (number of linear/quadratic constraints),
- `numanz` (number of linear non-zeros in constraints),
- `numqnz` (number of quadratic non-zeros in constraints).

`[solutions]`

This section can contain a set of full or partial solutions to a problem. Each solution must be specified using a `[solution]`-section, i.e.

```
[solutions]
[solution]...[/solution] #solution 1
[solution]...[/solution] #solution 2
#other solutions....
[solution]...[/solution] #solution n
[/solutions]
```

The syntax of a `[solution]`-section is the following:

```
[solution SOLTYPE status=STATUS]...[/solution]
```

where `SOLTYPE` is one of the strings

- `interior`, a non-basic solution,
- `basic`, a basic solution,
- `integer`, an integer solution,

and `STATUS` is one of the strings

- `UNKNOWN`,
- `OPTIMAL`,
- `INTEGER_OPTIMAL`,
- `PRIM_FEAS`,
- `DUAL_FEAS`,
- `PRIM_AND_DUAL_FEAS`,

- NEAR_OPTIMAL,
- NEAR_PRIM_FEAS,
- NEAR_DUAL_FEAS,
- NEAR_PRIM_AND_DUAL_FEAS,
- PRIM_INFEAS_CER,
- DUAL_INFEAS_CER,
- NEAR_PRIM_INFEAS_CER,
- NEAR_DUAL_INFEAS_CER,
- NEAR_INTEGER_OPTIMAL.

Most of these values are irrelevant for input solutions; when constructing a solution for simplex hot-start or an initial solution for a mixed integer problem the safe setting is UNKNOWN.

A [solution]-section contains [con] and [var] sections. Each [con] and [var] section defines solution information for a single variable or constraint, specified as list of KEYWORD/value pairs, in any order, written as

```
KEYWORD=value
```

Allowed keywords are as follows:

- sk. The status of the item, where the value is one of the following strings:
  - LOW, the item is on its lower bound.
  - UPR, the item is on its upper bound.
  - FIX, it is a fixed item.
  - BAS, the item is in the basis.
  - SUPBAS, the item is super basic.
  - UNK, the status is unknown.
  - INF, the item is outside its bounds (infeasible).
- lvl Defines the level of the item.
- sl Defines the level of the dual variable associated with its lower bound.
- su Defines the level of the dual variable associated with its upper bound.
- sn Defines the level of the variable associated with its cone.
- y Defines the level of the corresponding dual variable (for constraints only).

A [var] section should always contain the items sk, lvl, sl and su. Items sl and su are not required for integer solutions.

A [con] section should always contain sk, lvl, sl, su and y.

An example of a solution section

```
[solution basic status=UNKNOWN]
[var x0] sk=LOW    lvl=5.0      [/var]
[var x1] sk=UPR    lvl=10.0     [/var]
[var x2] sk=SUPBAS lvl=2.0  sl=1.5 su=0.0 [/var]

[con c0] sk=LOW    lvl=3.0 y=0.0 [/con]
[con c0] sk=UPR    lvl=0.0 y=5.0 [/con]
[/solution]
```

- [vendor] This contains solver/vendor specific data. It accepts one argument, which is a vendor ID – for **MOSEK** the ID is simply mosek – and the section contains the subsection parameters defining solver parameters. When reading a vendor section, any unknown vendor can be safely ignored. This is described later.

Comments using the # may appear anywhere in the file. Between the # and the following line-break any text may be written, including markup characters.

11.3.3 Numbers

Numbers, when used for parameter values or coefficients, are written in the usual way by the printf function. That is, they may be prefixed by a sign (+ or -) and may contain an integer part, decimal part and an exponent. The decimal point is always . (a dot). Some examples are

```
1
1.0
.0
1.
1e10
1e+10
1e-10
```

Some *invalid* examples are

```
e10   # invalid, must contain either integer or decimal part
.     # invalid
.e10  # invalid
```

More formally, the following standard regular expression describes numbers as used:

```
[+|-]?([0-9]+[.][0-9]*|[.][0-9]+)([eE][+|-]?[0-9]+)?
```

11.3.4 Names

Variable names, constraint names and objective name may contain arbitrary characters, which in some cases must be enclosed by quotes (single or double) that in turn must be preceded by a backslash. Unquoted names must begin with a letter (a-z or A-Z) and contain only the following characters: the letters a-z and A-Z, the digits 0-9, braces ({ and }) and underscore (_).

Some examples of legal names:

```
an_unquoted_name
another_name{123}
'single quoted name'
"double quoted name"
"name with \\"quote\\" in it"
"name with []s in it"
```

11.3.5 Parameters Section

In the vendor section solver parameters are defined inside the parameters subsection. Each parameter is written as

```
[p PARAMETER_NAME] value [/p]
```

where PARAMETER_NAME is replaced by a **MOSEK** parameter name, usually of the form MSK_IPAR_..., MSK_DPAR_... or MSK_SPAR_..., and the value is replaced by the value of that parameter; both integer values and named values may be used. Some simple examples are

```
[vendor mosek]
[parameters]
[p MSK_IPAR_OPF_MAX_TERMS_PER_LINE] 10     [/p]
[p MSK_IPAR_OPF_WRITE_PARAMETERS]   MSK_ON [/p]
[p MSK_DPAR_DATA_TOL_BOUND_INF]     1.0e18 [/p]
[/parameters]
[/vendor]
```

11.3.6 Writing OPF Files from MOSEK

To write an OPF file then make sure the file extension is .opf.

Then modify the following parameters to define what the file should contain:

MSK_IPAR_OPF_WRITE_SOL_BAS	Include basic solution, if defined.
MSK_IPAR_OPF_WRITE_SOL_ITG	Include integer solution, if defined.
MSK_IPAR_OPF_WRITE_SOL_ITR	Include interior solution, if defined.
MSK_IPAR_OPF_WRITE_SOLUTION	Include solutions if they are defined. If this is off, no solutions are included.
MSK_IPAR_OPF_WRITE_HEADER	Include a small header with comments.
MSK_IPAR_OPF_WRITE_PROBLEM	Include the problem itself — objective, constraints and bounds.
MSK_IPAR_OPF_WRITE_PARAMETE	Include all parameter settings.
MSK_IPAR_OPF_WRITE_HINTS	Include hints about the size of the problem.

11.3.7 Examples

This section contains a set of small examples written in OPF and describing how to formulate linear, quadratic and conic problems.

Linear Example `lo1.opf`

Consider the example:

$$\begin{array}{lccccccccc} \text{maximize} & 3x_0 & + & 1x_1 & + & 5x_2 & + & 1x_3 & & \\ \text{subject to} & 3x_0 & + & 1x_1 & + & 2x_2 & & & = & 30, \\ & 2x_0 & + & 1x_1 & + & 3x_2 & + & 1x_3 & \geq & 15, \\ & & & 2x_1 & & & + & 3x_3 & \leq & 25, \end{array}$$

having the bounds

$$\begin{array}{ccccc} 0 & \leq & x_0 & \leq & \infty, \\ 0 & \leq & x_1 & \leq & 10, \\ 0 & \leq & x_2 & \leq & \infty, \\ 0 & \leq & x_3 & \leq & \infty. \end{array}$$

In the `OPF` format the example is displayed as shown in Listing 11.1.

Listing 11.1: Example of an OPF file for a linear problem.

```
[comment]
  The lo1 example in OPF format
[/comment]

[hints]
  [hint NUMVAR] 4 [/hint]
  [hint NUMCON] 3 [/hint]
  [hint NUMANZ] 9 [/hint]
[/hints]
```

(continues on next page)

(continued from previous page)

```
[variables disallow_new_variables]
  x1 x2 x3 x4
[/variables]

[objective maximize 'obj']
   3 x1 + x2 + 5 x3 + x4
[/objective]

[constraints]
  [con 'c1'] 3 x1 +   x2 + 2 x3         = 30 [/con]
  [con 'c2'] 2 x1 +   x2 + 3 x3 +   x4 >= 15 [/con]
  [con 'c3']        2 x2        + 3 x4 <= 25 [/con]
[/constraints]

[bounds]
  [b] 0 <= * [/b]
  [b] 0 <= x2 <= 10 [/b]
[/bounds]
```

Quadratic Example qo1.opf

An example of a quadratic optimization problem is

$$\begin{array}{lccl} \text{minimize} & & & x_1^2 + 0.1x_2^2 + x_3^2 - x_1x_3 - x_2 \\ \text{subject to} & 1 & \leq & x_1 + x_2 + x_3, \\ & & & x \geq 0. \end{array}$$

This can be formulated in opf as shown below.

Listing 11.2: Example of an OPF file for a quadratic problem.

```
[comment]
  The qo1 example in OPF format
[/comment]

[hints]
  [hint NUMVAR] 3 [/hint]
  [hint NUMCON] 1 [/hint]
  [hint NUMANZ] 3 [/hint]
  [hint NUMQNZ] 4 [/hint]
[/hints]

[variables disallow_new_variables]
  x1 x2 x3
[/variables]

[objective minimize 'obj']
  # The quadratic terms are often written with a factor of 1/2 as here,
  # but this is not required.

   - x2 + 0.5 ( 2.0 x1 ^ 2 - 2.0 x3 * x1 + 0.2 x2 ^ 2 + 2.0 x3 ^ 2 )
[/objective]

[constraints]
  [con 'c1'] 1.0 <= x1 + x2 + x3 [/con]
[/constraints]
```

(continues on next page)

(continued from previous page)

```
[bounds]
  [b] 0 <= * [/b]
[/bounds]
```

Conic Quadratic Example cqo1.opf

Consider the example:

$$
\begin{array}{lccc}
\text{minimize} & x_3 + x_4 + x_5 & & \\
\text{subject to} & x_0 + x_1 + 2x_2 & = & 1, \\
& x_0, x_1, x_2 & \geq & 0, \\
& x_3 \geq \sqrt{x_0^2 + x_1^2}, & & \\
& 2x_4 x_5 \geq x_2^2. & &
\end{array}
$$

Please note that the type of the cones is defined by the parameter to `[cone ...]`; the content of the `cone`-section is the names of variables that belong to the cone. The resulting OPF file is in Listing 11.3.

Listing 11.3: Example of an OPF file for a conic quadratic problem.

```
[comment]
  The cqo1 example in OPF format.
[/comment]

[hints]
  [hint NUMVAR] 6 [/hint]
  [hint NUMCON] 1 [/hint]
  [hint NUMANZ] 3 [/hint]
[/hints]

[variables disallow_new_variables]
  x1 x2 x3 x4 x5 x6
[/variables]

[objective minimize 'obj']
   x4 + x5 + x6
[/objective]

[constraints]
  [con 'c1']  x1 + x2 + 2e+00 x3 = 1e+00 [/con]
[/constraints]

[bounds]
  # We let all variables default to the positive orthant
  [b] 0 <= * [/b]

  # ...and change those that differ from the default
  [b] x4,x5,x6 free [/b]

  # Define quadratic cone: x4 >= sqrt( x1^2 + x2^2 )
  [cone quad 'k1'] x4, x1, x2 [/cone]

  # Define rotated quadratic cone: 2 x5 x6 >= x3^2
  [cone rquad 'k2'] x5, x6, x3 [/cone]
[/bounds]
```

Mixed Integer Example `milo1.opf`

Consider the mixed integer problem:

$$\begin{array}{lccl} \text{maximize} & x_0 + 0.64x_1 & & \\ \text{subject to} & 50x_0 + 31x_1 & \leq & 250, \\ & 3x_0 - 2x_1 & \geq & -4, \\ & x_0, x_1 \geq 0 & & \text{and integer} \end{array}$$

This can be implemented in `OPF` with the file in Listing 11.4.

Listing 11.4: Example of an OPF file for a mixed-integer linear problem.

```
[comment]
  The milo1 example in OPF format
[/comment]

[hints]
  [hint NUMVAR] 2 [/hint]
  [hint NUMCON] 2 [/hint]
  [hint NUMANZ] 4 [/hint]
[/hints]

[variables disallow_new_variables]
  x1 x2
[/variables]

[objective maximize 'obj']
   x1 + 6.4e-1 x2
[/objective]

[constraints]
  [con 'c1'] 5e+1 x1 + 3.1e+1 x2 <= 2.5e+2 [/con]
  [con 'c2'] -4 <= 3 x1 - 2 x2 [/con]
[/constraints]

[bounds]
  [b] 0 <= * [/b]
[/bounds]

[integer]
  x1 x2
[/integer]
```

11.4 The CBF Format

This document constitutes the technical reference manual of the *Conic Benchmark Format* with file extension: `.cbf` or `.CBF`. It unifies linear, second-order cone (also known as conic quadratic), exponential cone, power cone and semidefinite optimization with mixed-integer variables. The format has been designed with benchmark libraries in mind, and therefore focuses on compact and easily parsable representations. The CBF format separates problem structure from the problem data.

11.4.1 How Instances Are Specified

This section defines the spectrum of conic optimization problems that can be formulated in terms of the keywords of the CBF format.

In the CBF format, conic optimization problems are considered in the following form:

$$\begin{array}{lll} \min / \max & g^{obj} & \\ & g_i \in \mathcal{K}_i, & i \in \mathcal{I}, \\ \text{s.t.} & G_i \in \mathcal{K}_i, & i \in \mathcal{I}^{PSD}, \\ & x_j \in \mathcal{K}_j, & j \in \mathcal{J}, \\ & \overline{X}_j \in \mathcal{K}_j, & j \in \mathcal{J}^{PSD}. \end{array} \tag{11.10}$$

- **Variables** are either scalar variables, x_j for $j \in \mathcal{J}$, or matrix variables, $\overline{X}_j$ for $j \in \mathcal{J}^{PSD}$. Scalar variables can also be declared as integer.
- **Constraints** are affine expressions of the variables, either scalar-valued g_i for $i \in \mathcal{I}$, or matrix-valued G_i for $i \in \mathcal{I}^{PSD}$

$$g_i = \sum_{j \in \mathcal{J}^{PSD}} \langle F_{ij}, X_j \rangle + \sum_{j \in \mathcal{J}} a_{ij} x_j + b_i,$$

$$G_i = \sum_{j \in \mathcal{J}} x_j H_{ij} + D_i.$$

- The **objective function** is a scalar-valued affine expression of the variables, either to be minimized or maximized. We refer to this expression as g^{obj}

$$g^{obj} = \sum_{j \in \mathcal{J}^{PSD}} \langle F_j^{obj}, X_j \rangle + \sum_{j \in \mathcal{J}} a_j^{obj} x_j + b^{obj}.$$

As of version 4 of the format, CBF files can represent the following non-parametric cones $\mathcal{K}$:

- **Free domain** - A cone in the linear family defined by

$$\{x \in \mathbb{R}^n\}, \text{ for } n \geq 1.$$

- **Positive orthant** - A cone in the linear family defined by

$$\{x \in \mathbb{R}^n \mid x_j \geq 0 \text{ for } j = 1, \ldots, n\}, \text{ for } n \geq 1.$$

- **Negative orthant** - A cone in the linear family defined by

$$\{x \in \mathbb{R}^n \mid x_j \leq 0 \text{ for } j = 1, \ldots, n\}, \text{ for } n \geq 1.$$

- **Fixpoint zero** - A cone in the linear family defined by

$$\{x \in \mathbb{R}^n \mid x_j = 0 \text{ for } j = 1, \ldots, n\}, \text{ for } n \geq 1.$$

- **Quadratic cone** - A cone in the second-order cone family defined by

$$\left\{ \begin{pmatrix} p \\ x \end{pmatrix} \in \mathbb{R} \times \mathbb{R}^{n-1},\ p^2 \geq x^T x,\ p \geq 0 \right\},\ \text{for } n \geq 2.$$

- **Rotated quadratic cone** - A cone in the second-order cone family defined by

$$\left\{ \begin{pmatrix} p \\ q \\ x \end{pmatrix} \in \mathbb{R} \times \mathbb{R} \times \mathbb{R}^{n-2},\ 2pq \geq x^T x,\ p \geq 0,\ q \geq 0 \right\},\ \text{for } n \geq 3.$$

- **Exponential cone** - A cone in the exponential cone family defined by

$$\text{cl}(S_1) = S_1 \cup S_2$$

  where,

$$S_1 = \left\{ \begin{pmatrix} t \\ s \\ r \end{pmatrix} \in \mathbb{R}^3,\ t \geq s e^{\frac{r}{s}},\ s \geq 0 \right\}.$$

  and,

$$S_2 = \left\{ \begin{pmatrix} t \\ s \\ r \end{pmatrix} \in \mathbb{R}^3,\ t \geq 0,\ r \leq 0,\ s = 0 \right\}.$$

- **Dual Exponential cone** - A cone in the exponential cone family defined by

$$\text{cl}(S_1) = S_1 \cup S_2$$

  where,

$$S_1 = \left\{ \begin{pmatrix} t \\ s \\ r \end{pmatrix} \in \mathbb{R}^3,\ et \geq (-r) e^{\frac{s}{r}},\ -r \geq 0 \right\}.$$

  and,

$$S_2 = \left\{ \begin{pmatrix} t \\ s \\ r \end{pmatrix} \in \mathbb{R}^3,\ et \geq 0,\ s \geq 0,\ r = 0 \right\}.$$

- **Radial geometric mean cone** - A cone in the power cone family defined by

$$\left\{ \begin{pmatrix} p \\ x \end{pmatrix} \in \mathbb{R}_+^k \times \mathbb{R}^1,\ \left(\prod_{j=1}^{k} p_j \right)^{\frac{1}{k}} \geq |x| \right\},\ \text{for } n = k + 1 \geq 2.$$

- **Dual radial geometric mean cone** - A cone in the power cone family defined by

$$\left\{ \begin{pmatrix} p \\ x \end{pmatrix} \in \mathbb{R}_+^k \times \mathbb{R}^1,\ \left(\prod_{j=1}^{k} k p_j \right)^{\frac{1}{k}} \geq |x| \right\},\ \text{for } n = k + 1 \geq 2.$$

and, the following parametric cones:

- **Radial power cone -** A cone in the power cone family defined by

$$\left\{ \left(\begin{array}{c} p \\ x \end{array} \right) \in \mathbb{R}^k_+ \times \mathbb{R}^{n-k}, \ \left(\prod_{j=1}^{k} p_j^{\alpha_j} \right)^{\frac{1}{\sigma}} \geq \|x\|_2 \right\}, \text{ for } n \geq k \geq 1.$$

  where, $\sigma = \sum_{j=1}^{k} \alpha_j$ and $\alpha = \mathbb{R}^k_{++}$.

- **Dual radial power cone -** A cone in the power cone family defined by

$$\left\{ \left(\begin{array}{c} p \\ x \end{array} \right) \in \mathbb{R}^k_+ \times \mathbb{R}^{n-k}, \ \left(\prod_{j=1}^{k} \left(\frac{\sigma p_j}{\alpha_j} \right)^{\alpha_j} \right)^{\frac{1}{\sigma}} \geq \|x\|_2 \right\}, \text{ for } n \geq k \geq 1.$$

  where, $\sigma = \sum_{j=1}^{k} \alpha_j$ and $\alpha = \mathbb{R}^k_{++}$.

11.4.2 The Structure of CBF Files

This section defines how information is written in the CBF format, without being specific about the type of information being communicated.

All information items belong to exactly one of the three groups of information. These information groups, and the order they must appear in, are:

1. File format.
2. Problem structure.
3. Problem data.

The first group, file format, provides information on how to interpret the file. The second group, problem structure, provides the information needed to deduce the type and size of the problem instance. Finally, the third group, problem data, specifies the coefficients and constants of the problem instance.

Information items

The format is composed as a list of information items. The first line of an information item is the `KEYWORD`, revealing the type of information provided. The second line - of some keywords only - is the `HEADER`, typically revealing the size of information that follows. The remaining lines are the `BODY` holding the actual information to be specified.

```
KEYWORD
BODY

KEYWORD
HEADER
BODY
```

The `KEYWORD` determines how each line in the `HEADER` and `BODY` is structured. Moreover, the number of lines in the `BODY` follows either from the `KEYWORD`, the `HEADER`, or from another information item required to precede it.

File encoding and line width restrictions

The format is based on the US-ASCII printable character set with two extensions as listed below. Note, by definition, that none of these extensions can be misinterpreted as printable US-ASCII characters:

- A line feed marks the end of a line, carriage returns are ignored.
- Comment-lines may contain unicode characters in UTF-8 encoding.

The line width is restricted to 512 bytes, with 3 bytes reserved for the potential carriage return, line feed and null-terminator.

Integers and floating point numbers must follow the ISO C decimal string representation in the standard C locale. The format does not impose restrictions on the magnitude of, or number of significant digits in numeric data, but the use of 64-bit integers and 64-bit IEEE 754 floating point numbers should be sufficient to avoid loss of precision.

Comment-line and whitespace rules

The format allows single-line comments respecting the following rule:

- Lines having first byte equal to '`#`' (US-ASCII 35) are comments, and should be ignored. Comments are only allowed between information items.

Given that a line is not a comment-line, whitespace characters should be handled according to the following rules:

- Leading and trailing whitespace characters should be ignored.
  - The seperator between multiple pieces of information on one line, is either one or more whitespace characters.
- Lines containing only whitespace characters are empty, and should be ignored. Empty lines are only allowed between information items.

11.4.3 Problem Specification

The problem structure

The problem structure defines the objective sense, whether it is minimization and maximization. It also defines the index sets, $\mathcal{J}$, $\mathcal{J}^{PSD}$, $\mathcal{I}$ and $\mathcal{I}^{PSD}$, which are all numbered from zero, $\{0, 1, \ldots\}$, and empty until explicitly constructed.

- **Scalar variables** are constructed in vectors restricted to a conic domain, such as $(x_0, x_1) \in \mathbb{R}^2_+$, $(x_2, x_3, x_4) \in \mathcal{Q}^3$, etc. In terms of the Cartesian product, this generalizes to

$$x \in \mathcal{K}_1^{n_1} \times \mathcal{K}_2^{n_2} \times \cdots \times \mathcal{K}_k^{n_k}$$

  which in the CBF format becomes:

```
VAR
n k
K1 n1
K2 n2
...
Kk nk
```

  where $\sum_i n_i = n$ is the total number of scalar variables. The list of supported cones is found in Table 11.3. Integrality of scalar variables can be specified afterwards.

- **PSD variables** are constructed one-by-one. That is, $X_j \succeq \mathbf{0}^{n_j \times n_j}$ for $j \in \mathcal{J}^{PSD}$, constructs a matrix-valued variable of size $n_j \times n_j$ restricted to be symmetric positive semidefinite. In the CBF format, this list of constructions becomes:

```
PSDVAR
N
n1
n2
...
nN
```

where N is the total number of PSD variables.

- **Scalar constraints** are constructed in vectors restricted to a conic domain, such as $(g_0, g_1) \in \mathbb{R}^2_+$, $(g_2, g_3, g_4) \in \mathcal{Q}^3$, etc. In terms of the Cartesian product, this generalizes to

$$g \in \mathcal{K}_1^{m_1} \times \mathcal{K}_2^{m_2} \times \cdots \times \mathcal{K}_k^{m_k}$$

which in the CBF format becomes:

```
CON
m k
K1 m1
K2 m2
..
Kk mk
```

where $\sum_i m_i = m$ is the total number of scalar constraints. The list of supported cones is found in Table 11.3.

- **PSD constraints** are constructed one-by-one. That is, $G_i \succeq \mathbf{0}^{m_i \times m_i}$ for $i \in \mathcal{I}^{PSD}$, constructs a matrix-valued affine expressions of size $m_i \times m_i$ restricted to be symmetric positive semidefinite. In the CBF format, this list of constructions becomes

```
PSDCON
M
m1
m2
..
mM
```

where M is the total number of PSD constraints.

With the objective sense, variables (with integer indications) and constraints, the definitions of the many affine expressions follow in problem data.

Problem data

The problem data defines the coefficients and constants of the affine expressions of the problem instance. These are considered zero until explicitly defined, implying that instances with no keywords from this information group are, in fact, valid. Duplicating or conflicting information is a failure to comply with the standard. Consequently, two coefficients written to the same position in a matrix (or to transposed positions in a symmetric matrix) is an error.

The affine expressions of the objective, g^{obj}, of the scalar constraints, g_i, and of the PSD constraints, G_i, are defined separately. The following notation uses the standard trace inner product for matrices, $\langle X, Y \rangle = \sum_{i,j} X_{ij} Y_{ij}$.

- The affine expression of the objective is defined as

$$g^{obj} = \sum_{j \in \mathcal{J}^{PSD}} \langle F_j^{obj}, X_j \rangle + \sum_{j \in \mathcal{J}} a_j^{obj} x_j + b^{obj},$$

in terms of the symmetric matrices, F_j^{obj}, and scalars, a_j^{obj} and b^{obj}.

- The affine expressions of the scalar constraints are defined, for $i \in \mathcal{I}$, as

$$g_i = \sum_{j \in \mathcal{J}^{PSD}} \langle F_{ij}, X_j \rangle + \sum_{j \in \mathcal{J}} a_{ij} x_j + b_i,$$

  in terms of the symmetric matrices, F_{ij}, and scalars, a_{ij} and b_i.

- The affine expressions of the PSD constraints are defined, for $i \in \mathcal{I}^{PSD}$, as

$$G_i = \sum_{j \in \mathcal{J}} x_j H_{ij} + D_i,$$

  in terms of the symmetric matrices, H_{ij} and D_i.

List of cones

The format uses an explicit syntax for symmetric positive semidefinite cones as shown above. For scalar variables and constraints, constructed in vectors, the supported conic domains and their sizes are given as follows.

Table 11.3: Cones available in the CBF format

Name	CBF keyword	Cone family	Cone size
Free domain	`F`	linear	$n \geq 1$
Positive orthant	`L+`	linear	$n \geq 1$
Negative orthant	`L-`	linear	$n \geq 1$
Fixpoint zero	`L=`	linear	$n \geq 1$
Quadratic cone	`Q`	second-order	$n \geq 1$
Rotated quadratic cone	`QR`	second-order	$n \geq 2$
Exponential cone	`EXP`	exponential	$n = 3$
Dual exponential cone	`EXP*`	exponential	$n = 3$
Radial geometric mean cone	`GMEANABS`	power	$n = k + 1 \geq 2$
Dual radial geometric mean cone	`GMEANABS*`	power	$n = k + 1 \geq 2$
Radial power cone (parametric)	`POW`	power	$n \geq k \geq 1$
Dual radial power cone (parametric)	`POW*`	power	$n \geq k \geq 1$

11.4.4 File Format Keywords

VER

Description: The version of the Conic Benchmark Format used to write the file.
`HEADER`: None
`BODY`: One line formatted as:

```
INT
```

This is the version number.
Must appear exactly once in a file, as the first keyword.

POWCONES

Description: Define a lookup table for power cone domains.
`HEADER`: One line formatted as:

```
INT INT
```

This is the number of cones to be specified and the combined length of their dense parameter vectors.

`BODY`: **A list of chunks each specifying the dense parameter vector of a power cone.**
`CHUNKHEADER`: One line formatted as:

```
INT
```

This is the parameter vector length.

CHUNKBODY: A list of lines formatted as:

```
REAL
```

This is the parameter vector values. The number of lines should match the number stated in the chunk header.

The cone specified at index k (with 0-based indexing) is registered under the CBF name @k:POW.

POW*CONES

Description: Define a lookup table for dual power cone domains.
HEADER: One line formatted as:

```
INT INT
```

This is the number of cones to be specified and the combined length of their dense parameter vectors.

BODY: A list of chunks each specifying the dense parameter vector of a dual power cone.
CHUNKHEADER: One line formatted as:

```
INT
```

This is the parameter vector length.

CHUNKBODY: A list of lines formatted as:

```
REAL
```

This is the parameter vector values. The number of lines should match the number stated in the chunk header.

The cone specified at index k (with 0-based indexing) is registered under the CBF name @k:POW*.

OBJSENSE

Description: Define the objective sense.
HEADER: None
BODY: One line formatted as:

```
STR
```

having MIN indicates minimize, and MAX indicates maximize. Upper-case letters are required.
Must appear exactly once in a file.

PSDVAR

Description: Construct the PSD variables.
HEADER: One line formatted as:

```
INT
```

This is the number of PSD variables in the problem.
BODY: A list of lines formatted as:

```
INT
```

This indicates the number of rows (equal to the number of columns) in the matrix-valued PSD variable. The number of lines should match the number stated in the header.

VAR

Description: Construct the scalar variables.

HEADER: One line formatted as:

```
INT INT
```

This is the number of scalar variables, followed by the number of conic domains they are restricted to.

BODY: A list of lines formatted as:

```
STR INT
```

This indicates the cone name (see Table 11.3), and the number of scalar variables restricted to this cone. These numbers should add up to the number of scalar variables stated first in the header. The number of lines should match the second number stated in the header.

INT

Description: Declare integer requirements on a selected subset of scalar variables.

HEADER: one line formatted as:

```
INT
```

This is the number of integer scalar variables in the problem.

BODY: a list of lines formatted as:

```
INT
```

This indicates the scalar variable index $j \in \mathcal{J}$. The number of lines should match the number stated in the header.

Can only be used after the keyword VAR.

PSDCON

Description: Construct the PSD constraints.

HEADER: One line formatted as:

```
INT
```

This is the number of PSD constraints in the problem.

BODY: A list of lines formatted as:

```
INT
```

This indicates the number of rows (equal to the number of columns) in the matrix-valued affine expression of the PSD constraint. The number of lines should match the number stated in the header.

Can only be used after these keywords: PSDVAR, VAR.

CON

Description: Construct the scalar constraints.

HEADER: One line formatted as:

```
INT INT
```

This is the number of scalar constraints, followed by the number of conic domains they restrict to.

BODY: A list of lines formatted as:

```
STR INT
```

This indicates the cone name (see Table 11.3), and the number of affine expressions restricted to this cone. These numbers should add up to the number of scalar constraints stated first in the header. The number of lines should match the second number stated in the header.

Can only be used after these keywords: PSDVAR, VAR

OBJFCOORD

Description: Input sparse coordinates (quadruplets) to define the symmetric matrices F_j^{obj}, as used in the objective.

`HEADER`: One line formatted as:

```
INT
```

This is the number of coordinates to be specified.

`BODY`: A list of lines formatted as:

```
INT INT INT REAL
```

This indicates the PSD variable index $j \in \mathcal{J}^{PSD}$, the row index, the column index and the coefficient value. The number of lines should match the number stated in the header.

OBJACOORD

Description: Input sparse coordinates (pairs) to define the scalars, a_j^{obj}, as used in the objective.

`HEADER`: One line formatted as:

```
INT
```

This is the number of coordinates to be specified.

`BODY`: A list of lines formatted as:

```
INT REAL
```

This indicates the scalar variable index $j \in \mathcal{J}$ and the coefficient value. The number of lines should match the number stated in the header.

OBJBCOORD

Description: Input the scalar, b^{obj}, as used in the objective.

`HEADER`: None.

`BODY`: One line formatted as:

```
REAL
```

This indicates the coefficient value.

FCOORD

Description: Input sparse coordinates (quintuplets) to define the symmetric matrices, F_{ij}, as used in the scalar constraints.

`HEADER`: One line formatted as:

```
INT
```

This is the number of coordinates to be specified.

`BODY`: A list of lines formatted as:

```
INT INT INT INT REAL
```

This indicates the scalar constraint index $i \in \mathcal{I}$, the PSD variable index $j \in \mathcal{J}^{PSD}$, the row index, the column index and the coefficient value. The number of lines should match the number stated in the header.

ACOORD

Description: Input sparse coordinates (triplets) to define the scalars, a_{ij}, as used in the scalar constraints.
`HEADER`: One line formatted as:

```
INT
```

This is the number of coordinates to be specified.
`BODY`: A list of lines formatted as:

```
INT INT REAL
```

This indicates the scalar constraint index $i \in \mathcal{I}$, the scalar variable index $j \in \mathcal{J}$ and the coefficient value. The number of lines should match the number stated in the header.

BCOORD

Description: Input sparse coordinates (pairs) to define the scalars, b_i, as used in the scalar constraints.
`HEADER`: One line formatted as:

```
INT
```

This is the number of coordinates to be specified.
`BODY`: A list of lines formatted as:

```
INT REAL
```

This indicates the scalar constraint index $i \in \mathcal{I}$ and the coefficient value. The number of lines should match the number stated in the header.

HCOORD

Description: Input sparse coordinates (quintuplets) to define the symmetric matrices, H_{ij}, as used in the PSD constraints.
`HEADER`: One line formatted as:

```
INT
```

This is the number of coordinates to be specified.
`BODY`: A list of lines formatted as

```
INT INT INT INT REAL
```

This indicates the PSD constraint index $i \in \mathcal{I}^{PSD}$, the scalar variable index $j \in \mathcal{J}$, the row index, the column index and the coefficient value. The number of lines should match the number stated in the header.

DCOORD

Description: Input sparse coordinates (quadruplets) to define the symmetric matrices, D_i, as used in the PSD constraints.
`HEADER`: One line formatted as

```
INT
```

This is the number of coordinates to be specified.
`BODY`: A list of lines formatted as:

```
INT INT INT REAL
```

This indicates the PSD constraint index $i \in \mathcal{I}^{PSD}$, the row index, the column index and the coefficient value. The number of lines should match the number stated in the header.

11.4.5 CBF Format Examples

Minimal Working Example

The conic optimization problem (11.11) , has three variables in a quadratic cone - first one is integer - and an affine expression in domain 0 (equality constraint).

$$\begin{array}{ll} \text{minimize} & 5.1\, x_0 \\ \text{subject to} & 6.2\, x_1 + 7.3\, x_2 - 8.4 \in \{0\} \\ & x \in \mathcal{Q}^3, \; x_0 \in \mathbb{Z}. \end{array} \tag{11.11}$$

Its formulation in the Conic Benchmark Format begins with the version of the CBF format used, to safeguard against later revisions.

```
VER
4
```

Next follows the problem structure, consisting of the objective sense, the number and domain of variables, the indices of integer variables, and the number and domain of scalar-valued affine expressions (i.e., the equality constraint).

```
OBJSENSE
MIN

VAR
3 1
Q 3

INT
1
0

CON
1 1
L= 1
```

Finally follows the problem data, consisting of the coefficients of the objective, the coefficients of the constraints, and the constant terms of the constraints. All data is specified on a sparse coordinate form.

```
OBJACOORD
1
0 5.1

ACOORD
2
0 1 6.2
0 2 7.3

BCOORD
1
0 -8.4
```

This concludes the example.

Mixing Linear, Second-order and Semidefinite Cones

The conic optimization problem (11.12), has a semidefinite cone, a quadratic cone over unordered subindices, and two equality constraints.

$$
\begin{array}{lrcl}
\text{minimize} & \left\langle \begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}, X_1 \right\rangle + x_1 & & \\
\text{subject to} & \left\langle \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, X_1 \right\rangle + x_1 & = & 1.0\,, \\
 & \left\langle \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}, X_1 \right\rangle + x_0 + x_2 & = & 0.5\,, \\
 & x_1 \geq \sqrt{x_0^2 + x_2^2}\,, & & \\
 & X_1 \succeq \mathbf{0}\,. & &
\end{array}
\tag{11.12}
$$

The equality constraints are easily rewritten to the conic form, $(g_0, g_1) \in \{0\}^2$, by moving constants such that the right-hand-side becomes zero. The quadratic cone does not fit under the `VAR` keyword in this variable permutation. Instead, it takes a scalar constraint $(g_2, g_3, g_4) = (x_1, x_0, x_2) \in \mathcal{Q}^3$, with scalar variables constructed as $(x_0, x_1, x_2) \in \mathbb{R}^3$. Its formulation in the CBF format is reported in the following list

```
# File written using this version of the Conic Benchmark Format:
#     | Version 4.
VER
4

# The sense of the objective is:
#     | Minimize.
OBJSENSE
MIN

# One PSD variable of this size:
#     | Three times three.
PSDVAR
1
3

# Three scalar variables in this one conic domain:
#     | Three are free.
VAR
3 1
F 3

# Five scalar constraints with affine expressions in two conic domains:
#     | Two are fixed to zero.
#     | Three are in conic quadratic domain.
CON
5 2
L= 2
Q 3

# Five coordinates in F^{obj}_j coefficients:
#     | F^{obj}[0][0,0] = 2.0
#     | F^{obj}[0][1,0] = 1.0
#     | and more...
OBJFCOORD
5
```

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```
0 0 0 2.0
0 1 0 1.0
0 1 1 2.0
0 2 1 1.0
0 2 2 2.0

# One coordinate in a^{obj}_j coefficients:
#     | a^{obj}[1] = 1.0
OBJACOORD
1
1 1.0

# Nine coordinates in F_ij coefficients:
#     | F[0,0][0,0] = 1.0
#     | F[0,0][1,1] = 1.0
#     | and more...
FCOORD
9
0 0 0 0 1.0
0 0 1 1 1.0
0 0 2 2 1.0
1 0 0 0 1.0
1 0 1 0 1.0
1 0 2 0 1.0
1 0 1 1 1.0
1 0 2 1 1.0
1 0 2 2 1.0

# Six coordinates in a_ij coefficients:
#     | a[0,1] = 1.0
#     | a[1,0] = 1.0
#     | and more...
ACOORD
6
0 1 1.0
1 0 1.0
1 2 1.0
2 1 1.0
3 0 1.0
4 2 1.0

# Two coordinates in b_i coefficients:
#     | b[0] = -1.0
#     | b[1] = -0.5
BCOORD
2
0 -1.0
1 -0.5
```

Mixing Semidefinite Variables and Linear Matrix Inequalities

The standard forms in semidefinite optimization are usually based either on semidefinite variables or linear matrix inequalities. In the CBF format, both forms are supported and can even be mixed as shown.

$$
\begin{array}{lllll}
\text{minimize} & \left\langle \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, X_1 \right\rangle + x_1 + x_2 + 1 & & & \\
\text{subject to} & \left\langle \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, X_1 \right\rangle - x_1 - x_2 & \geq & 0.0\,, \\
& x_1 \begin{bmatrix} 0 & 1 \\ 1 & 3 \end{bmatrix} + x_2 \begin{bmatrix} 3 & 1 \\ 1 & 0 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} & \succeq & \mathbf{0}\,, \\
& X_1 \succeq \mathbf{0}\,. & &
\end{array}
\tag{11.13}
$$

Its formulation in the CBF format is written in what follows

```
# File written using this version of the Conic Benchmark Format:
#     | Version 4.
VER
4

# The sense of the objective is:
#     | Minimize.
OBJSENSE
MIN

# One PSD variable of this size:
#     | Two times two.
PSDVAR
1
2

# Two scalar variables in this one conic domain:
#     | Two are free.
VAR
2 1
F 2

# One PSD constraint of this size:
#     | Two times two.
PSDCON
1
2

# One scalar constraint with an affine expression in this one conic domain:
#     | One is greater than or equal to zero.
CON
1 1
L+ 1

# Two coordinates in F^{obj}_j coefficients:
#     | F^{obj}[0][0,0] = 1.0
#     | F^{obj}[0][1,1] = 1.0
OBJFCOORD
2
0 0 0 1.0
0 1 1 1.0

# Two coordinates in a^{obj}_j coefficients:
```

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```
#     | a^{obj}[0] = 1.0
#     | a^{obj}[1] = 1.0
OBJACOORD
2
0 1.0
1 1.0

# One coordinate in b^{obj} coefficient:
#     | b^{obj} = 1.0
OBJBCOORD
1.0

# One coordinate in F_ij coefficients:
#     | F[0,0][1,0] = 1.0
FCOORD
1
0 0 1 0 1.0

# Two coordinates in a_ij coefficients:
#     | a[0,0] = -1.0
#     | a[0,1] = -1.0
ACOORD
2
0 0 -1.0
0 1 -1.0

# Four coordinates in H_ij coefficients:
#     | H[0,0][1,0] = 1.0
#     | H[0,0][1,1] = 3.0
#     | and more...
HCOORD
4
0 0 1 0 1.0
0 0 1 1 3.0
0 1 0 0 3.0
0 1 1 0 1.0

# Two coordinates in D_i coefficients:
#     | D[0][0,0] = -1.0
#     | D[0][1,1] = -1.0
DCOORD
2
0 0 0 -1.0
0 1 1 -1.0
```

The exponential cone

The conic optimization problem (11.14), has one equality constraint, one quadratic cone constraint and an exponential cone constraint.

$$
\begin{array}{ll}
\text{minimize} & x_0 - x_3 \\
\text{subject to} & x_0 + 2\,x_1 - x_2 \in \{0\} \\
& (5.0, x_0, x_1) \in \mathcal{Q}^3 \\
& (x_2, 1.0, x_3) \in EXP.
\end{array}
\tag{11.14}
$$

The nonlinear conic constraints enforce $\sqrt{x_0^2 + x_1^2} \leq 0.5$ and $x_3 \leq \log(x_2)$.

```
# File written using this version of the Conic Benchmark Format:
#       | Version 3.
VER
3

# The sense of the objective is:
#       | Minimize.
OBJSENSE
MIN

# Four scalar variables in this one conic domain:
#       | Four are free.
VAR
4 1
F 4

# Seven scalar constraints with affine expressions in three conic domains:
#       | One is fixed to zero.
#       | Three are in conic quadratic domain.
#       | Three are in exponential cone domain.
CON
7 3
L= 1
Q 3
EXP 3

# Two coordinates in a^{obj}_j coefficients:
#       | a^{obj}[0] = 1.0
#       | a^{obj}[3] = -1.0
OBJACOORD
2
0 1.0
3 -1.0

# Seven coordinates in a_ij coefficients:
#       | a[0,0] = 1.0
#       | a[0,1] = 2.0
#       | and more...
ACOORD
7
0 0 1.0
0 1 2.0
0 2 -1.0
2 0 1.0
3 1 1.0
4 2 1.0
6 3 1.0
```

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```
# Two coordinates in b_i coefficients:
#       | b[1] = 5.0
#       | b[5] = 1.0
BCOORD
2
1 5.0
5 1.0
```

Parametric cones

The problem (11.15), has three variables in a power cone with parameter $\alpha_1 = (1, 1)$ and two power cone constraints each with parameter $\alpha_0 = (8, 1)$.

$$\begin{array}{ll} \text{minimize} & x_3 \\ \text{subject to} & (1.0, x_1, x_1 + x_2) \in POW_{\alpha_0} \\ & (1.0, x_2, x_1 + x_2) \in POW_{\alpha_0} \\ & x \in POW_{\alpha_1}. \end{array} \tag{11.15}$$

The nonlinear conic constraints enforce $x_3 \leq x_1 x_2$ and $x_1 + x_2 \leq \min(x_1^{\frac{1}{9}}, x_2^{\frac{1}{9}})$.

```
# File written using this version of the Conic Benchmark Format:
#       | Version 3.
VER
3

# Two power cone domains defined in a total of four parameters:
#       | @0:POW (specification 0) has two parameters:
#       | alpha[0] = 8.0.
#       | alpha[1] = 1.0.
#       | @1:POW (specification 1) has two parameters:
#       | alpha[0] = 1.0.
#       | alpha[1] = 1.0.
POWCONES
2 4
2
8.0
1.0
2
1.0
1.0

# The sense of the objective is:
#       | Maximize.
OBJSENSE
MAX

# Three scalar variable in this one conic domain:
#       | Three are in power cone domain (specification 1).
VAR
3 1
@1:POW 3

# Six scalar constraints with affine expressions in two conic domains:
#       | Three are in power cone domain (specification 0).
#       | Three are in power cone domain (specification 0).
```

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```
CON
6 2
@0:POW 3
@0:POW 3

# One coordinate in a^{obj}_j coefficients:
#       | a^{obj}[2] = 1.0
OBJACOORD
1
2 1.0

# Six coordinates in a_ij coefficients:
#       | a[1,0] = 1.0
#       | a[2,0] = 1.0
#       | and more...
ACOORD
6
1 0 1.0
2 0 1.0
2 1 1.0
4 1 1.0
5 0 1.0
5 1 1.0

# Two coordinates in b_i coefficients:
#       | b[0] = 1.0
#       | b[3] = 1.0
BCOORD
2
0 1.0
3 1.0
```

11.5 The PTF Format

The PTF format is a human-readable, natural text format that supports all linear, conic and mixed-integer features.

11.5.1 The overall format

The format is indentation based, where each section is started by a head line and followed by a section body with deeper indentation that the head line. For example:

```
Header line
   Body line 1
   Body line 1
   Body line 1
```

Section can also be nested:

```
Header line A
   Body line in A
   Header line A.1
      Body line in A.1
      Body line in A.1
   Body line in A
```

The indentation of blank lines is ignored, so a subsection can contain a blank line with no indentation. The character # defines a line comment and anything between the # character and the end of the line is ignored.

In a PTF file, the first section must be a `Task` section. The order of the remaining section is arbitrary, and sections may occur multiple times or not at all.

MOSEK will ignore any top-level section it does not recognize.

Names

In the description of the format we use following definitions for name strings:

```
NAME: PLAIN_NAME | QUOTED_NAME
PLAIN_NAME: [a-zA-Z_] [a-zA-Z0-9_-.!|]
QUOTED_NAME: "'" ( [^'\\\r\n] | "\\" ( [\\rn] | "x" [0-9a-fA-F] [0-9a-fA-F] ) )* "'"
```

Expressions

An expression is a sum of terms. A term is either a linear term (a coefficient and a variable name, where the coefficient can be left out if it is 1.0), or a matrix inner product.

An expression:

```
EXPR: EMPTY | [+-]? TERM ( [+-] TERM )*
TERM: LINEAR_TERM | MATRIX_TERM
```

A linear term

```
LINEAR_TERM: FLOAT? NAME
```

A matrix term

```
MATRIX_TERM: "<" FLOAT? NAME ( [+-] FLOAT? NAME)* ";" NAME ">"
```

Here the right-hand name is the name of a (semidefinite) matrix variable, and the left-hand side is a sum of symmetric matrixes. The actual matrixes are defined in a separate section.

Expressions can span multiple lines by giving subsequent lines a deeper indentation.

For example following two section are equivalent:

```
# Everything on one line:
x1 + x2 + x3 + x4

# Split into multiple lines:
x1
  + x2
  + x3
  + x4
```

11.5.2 `Task` section

The first section of the file must be a `Task`. The text in this section is not used and may contain comments, or meta-information from the writer or about the content.

Format:

```
Task NAME
   Anything goes here...
```

`NAME` is a the task name.

11.5.3 `Objective` section

The `Objective` section defines the objective name, sense and function. The format:

```
"Objective" NAME?
   ( "Minimize" | "Maximize" ) EXPR
```

For example:

```
Objective 'obj'
   Minimize x1 + 0.2 x2 + < M1 ; X1 >
```

11.5.4 `Constraints` section

The constraints section defines a series of constraints. A constraint defines a term $A \cdot x + b \in K$. For linear constraints `A` is just one row, while for conic constraints it can be multiple rows. If a constraint spans multiple rows these can either be written inline separated by semi-colons, or each expression in a separete sub-section.

Simple linear constraints:

```
"Constraints"
  NAME? "[" [-+] (FLOAT | "Inf") (";" [-+] (FLOAT | "Inf") )? "]" EXPR
```

If the brackets contain two values, they are used as upper and lower bounds. It they contain one value the constraint is an equality.

For example:

```
Constraints
  'c1' [0;10] x1 + x2 + x3
  [0] x1 + x2 + x3
```

Constraint blocks put the expression either in a subsection or inline. The cone type (domain) is written in the brackets, and **MOSEK** currently supports following types:

- `SOC(N)` Second order cone of dimension `N`
- `RSOC(N)` Rotated second order cone of dimension `N`
- `PSD(N)` Symmetric positive semidefinite cone of dimension `N`. This contains `N*(N+1)/2` elements.
- `PEXP` Primal exponential cone of dimension 3
- `DEXP` Dual exponential cone of dimension 3
- `PPOW(N,P)` Primal power cone of dimension `N` with parameter `P`
- `DPOW(N,P)` Dual power cone of dimension `N` with parameter `P`
- `ZERO(N)` The zero-cone of dimension `N`.

```
"Constraints"
  NAME? "[" DOMAIN "]" EXPR_LIST
```

For example:

```
Constraints
   'K1' [SOC(3)] x1 + x2 ; x2 + x3 ; x3 + x1
   'K2' [RSOC(3)]
      x1 + x2
      x2 + x3
      x3 + x1
```

11.5.5 Variables section

Any variable used in an expression must be defined in a variable section. The variable section defines each variable domain.

```
"Variables"
   NAME "[" [-+] (FLOAT | "Inf") (";" [-+] (FLOAT | "Inf") )? "]"
   NAME "[" DOMAIN "]" NAMES

   For example, a linear variable
```

```
Variables
   x1 [0;Inf]
```

As with constraints, members of a conic domain can be listed either inline or in a subsection:

```
Variables
   k1 [SOC(3)] x1 ; x2 ; x3
   k2 [RSOC(3)]
      x1
      x2
      x3
```

11.5.6 Integer section

This section contains a list of variables that are integral. For example:

```
Integer
   x1 x2 x3
```

11.5.7 SymmetricMatrixes section

This section defines the symmetric matrixes used for matrix coefficients in matrix inner product terms. The section lists named matrixes, each with a size and a number of non-zeros. Only non-zeros in the lower triangular part should be defined.

```
"SymmetricMatrixes"
   NAME "SYMMAT" "(" INT ")"  ( "(" INT "," INT "," FLOAT ")" )*
   ...
```

For example:

```
SymmetricMatrixes
   M1 SYMMAT(3) (0,0,1.0) (1,1,2.0) (2,1,0.5)
   M2 SYMMAT(3)
      (0,0,1.0)
      (1,1,2.0)
      (2,1,0.5)
```

11.5.8 `Solutions` section

Each subsection defines a solution. A solution defines for each constraint and for each variable exactly one primal value and either one (for conic domains) or two (for linear domains) dual values. The values follow the same logic as in the **MOSEK** C API. A primal and a dual solution status defines the meaning of the values primal and dual (solution, certificate, unknown, etc.)

The format is this:

```
"Solutions"
   "Solution" WHICHSOL
      "ProblemStatus" PROSTA PROSTA?
   "SolutionStatus" SOLSTA SOLSTA?
   "Objective" FLOAT FLOAT
   "Variables"
      # Linear variable status: level, slx, sux
      NAME "[" STATUS "]" FLOAT (FLOAT FLOAT)?
      # Conic variable status: level, snx
      NAME
         "[" STATUS "]" FLOAT FLOAT?
         ...
   "Constraints"
      # Linear variable status: level, slx, sux
      NAME "[" STATUS "]" FLOAT (FLOAT FLOAT)?
      # Conic variable status: level, snx
      NAME
         "[" STATUS "]" FLOAT FLOAT?
         ...
```

Following values for `WHICHSOL` are supported:

- `interior` Interior solution, the result of an interior-point solver.
- `basic` Basic solution, as produced by a simplex solver.
- `integer` Integer solution, the solution to a mixed-integer problem. This does not define a dual solution.

Following values for `PROSTA` are supported:

- `unknown` The problem status is unknown
- `feasible` The problem has been proven feasible
- `infeasible` The problem has been proven infeasible
- `illposed` The problem has been proved to be ill posed
- `infeasible_or_unbounded` The problem is infeasible or unbounded

Following values for `SOLSTA` are supported:

- `unknown` The solution status is unknown
- `feasible` The solution is feasible
- `optimal` The solution is optimal
- `infeas_cert` The solution is a certificate of infeasibility
- `illposed_cert` The solution is a certificate of illposedness

Following values for `STATUS` are supported:

- `unknown` The value is unknown
- `super_basic` The value is super basic

- `at_lower` The value is basic and at its lower bound
- `at_upper` The value is basic and at its upper bound
- `fixed` The value is basic fixed
- `infinite` The value is at infinity

11.5.9 Examples

Linear example `lo1.ptf`

```
Task ''
    # Written by MOSEK v10.0.13
    # problemtype: Linear Problem
    # number of linear variables: 4
    # number of linear constraints: 3
    # number of old-style A nonzeros: 9
Objective obj
    Maximize + 3 x1 + x2 + 5 x3 + x4
Constraints
    c1 [3e+1] + 3 x1 + x2 + 2 x3
    c2 [1.5e+1;+inf] + 2 x1 + x2 + 3 x3 + x4
    c3 [-inf;2.5e+1] + 2 x2 + 3 x4
Variables
    x1 [0;+inf]
    x2 [0;1e+1]
    x3 [0;+inf]
    x4 [0;+inf]
```

Conic example `cqo1.ptf`

```
Task ''
    # Written by MOSEK v10.0.17
    # problemtype: Conic Problem
    # number of linear variables: 6
    # number of linear constraints: 1
    # number of  old-style cones: 0
    # number of positive semidefinite variables: 0
    # number of positive semidefinite matrixes: 0
    # number of affine conic constraints: 2
    # number of disjunctive constraints: 0
    # number scalar affine expressions/nonzeros : 6/6
    # number of old-style A nonzeros: 3
Objective obj
    Minimize + x4 + x5 + x6
Constraints
    c1 [1] + x1 + x2 + 2 x3
    k1 [QUAD(3)]
        @ac1: + x4
        @ac2: + x1
        @ac3: + x2
    k2 [RQUAD(3)]
        @ac4: + x5
        @ac5: + x6
        @ac6: + x3
Variables
```

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```
    x4
    x1 [0;+inf]
    x2 [0;+inf]
    x5
    x6
    x3 [0;+inf]
```

Disjunctive example `djc1.ptf`

```
Task djc1
Objective ''
    Minimize + 2 'x[0]' + 'x[1]' + 3 'x[2]' + 'x[3]'
Constraints
    @c0 [-10;+inf] + 'x[0]' + 'x[1]' + 'x[2]' + 'x[3]'
    @D0 [OR]
        [AND]
            [NEGATIVE(1)]
                + 'x[0]' - 2 'x[1]' + 1
            [ZERO(2)]
                + 'x[2]'
                + 'x[3]'
        [AND]
            [NEGATIVE(1)]
                + 'x[2]' - 3 'x[3]' + 2
            [ZERO(2)]
                + 'x[0]'
                + 'x[1]'
    @D1 [OR]
        [ZERO(1)]
            + 'x[0]' - 2.5
        [ZERO(1)]
            + 'x[1]' - 2.5
        [ZERO(1)]
            + 'x[2]' - 2.5
        [ZERO(1)]
            + 'x[3]' - 2.5
Variables
    'x[0]'
    'x[1]'
    'x[2]'
    'x[3]'
```

11.6 The Task Format

The Task format is **MOSEK**'s native binary format. It contains a complete image of a **MOSEK** task, i.e.

- Problem data: Linear, conic, semidefinite and quadratic data
- Problem item names: Variable names, constraints names, cone names etc.
- Parameter settings
- Solutions

There are a few things to be aware of:

- Status of a solution read from a file will *always* be unknown.
- Parameter settings in a task file *always override* any parameters set on the command line or in a parameter file.

The format is based on the *TAR* (USTar) file format. This means that the individual pieces of data in a `.task` file can be examined by unpacking it as a *TAR* file. Please note that the inverse may not work: Creating a file using *TAR* will most probably not create a valid **MOSEK** Task file since the order of the entries is important.

11.7 The JSON Format

MOSEK provides the possibility to read/write problems and solutions in JSON format. The official JSON website http://www.json.org provides plenty of information along with the format definition. JSON is an industry standard for data exchange and JSON files can be easily written and read in most programming languages using dedicated libraries.

MOSEK uses two JSON-based formats:

- **JTASK**, for storing problem instances together with solutions and parameters. The JTASK format contains the same information as a native **MOSEK** task *task format*, that is a very close representation of the internal data storage in the task object.

  You can write a JTASK file specifying the extension `.jtask`. When the parameter *MSK_IPAR_WRITE_JSON_INDENTATION* is set the JTASK file will be indented to slightly improve readability.
- **JSOL**, for storing solutions and information items.

11.7.1 JTASK Specification

The JTASK is a dictionary containing the following sections. All sections are optional and can be omitted if irrelevant for the problem.

- `$schema`: JSON schema.
- `Task/name`: The name of the task (string).
- `Task/INFO`: Information about problem data dimensions and similar. These are treated as hints when reading the file.
  - `numvar`: number of variables (int32).
  - `numcon`: number of constraints (int32).
  - `numcone`: number of cones (int32, deprecated).
  - `numbarvar`: number of symmetric matrix variables (int32).
  - `numanz`: number of nonzeros in A (int64).
  - `numsymmat`: number of matrices in the symmetric matrix storage E (int64).
  - `numafe`: number of affine expressions in AFE storage (int64).
  - `numfnz`: number of nonzeros in F (int64).
  - `numacc`: number of affine conic constraints (ACCs) (int64).
  - `numdjc`: number of disjunctive constraints (DJCs) (int64).
  - `numdom`: number of domains (int64).
  - `mosekver`: MOSEK version (list(int32)).
- `Task/data`: Numerical and structural data of the problem.
  - `var`: Information about variables. All fields present must have the same length as `bk`. All or none of `bk`, `bl`, and `bu` must appear.
    - `name`: Variable names (list(string)).

* bk: Bound keys (list(string)).
* bl: Lower bounds (list(double)).
* bu: Upper bounds (list(double)).
* type: Variable types (list(string)).

- con: Information about linear constraints. All fields present must have the same length as bk. All or none of bk, bl, and bu must appear.
  * name: Constraint names (list(string)).
  * bk: Bound keys (list(string)).
  * bl: Lower bounds (list(double)).
  * bu: Upper bounds (list(double)).
- barvar: Information about symmetric matrix variables. All fields present must have the same length as dim.
  * name: Barvar names (list(string)).
  * dim: Dimensions (list(int32)).
- objective: Information about the objective.
  * name: Objective name (string).
  * sense: Objective sense (string).
  * c: The linear part c of the objective as a sparse vector. Both arrays must have the same length.
    · subj: indices of nonzeros (list(int32)).
    · val: values of nonzeros (list(double)).
  * cfix: Constant term in the objective (double).
  * Q: The quadratic part Q^o of the objective as a sparse matrix, only lower-triangular part included. All arrays must have the same length.
    · subi: row indices of nonzeros (list(int32)).
    · subj: column indices of nonzeros (list(int32)).
    · val: values of nonzeros (list(double)).
  * barc: The semidefinite part $\overline{C}$ of the objective (list). Each element of the list is a list describing one entry $\overline{C}_j$ using three fields:
    · index j (int32).
    · weights of the matrices from the storage E forming $\overline{C}_j$ (list(double)).
    · indices of the matrices from the storage E forming $\overline{C}_j$ (list(int64)).
- A: The linear constraint matrix A as a sparse matrix. All arrays must have the same length.
  * subi: row indices of nonzeros (list(int32)).
  * subj: column indices of nonzeros (list(int32)).
  * val: values of nonzeros (list(double)).
- bara: The semidefinite part $\overline{A}$ of the constraints (list). Each element of the list is a list describing one entry $\overline{A}_{ij}$ using four fields:
  * index i (int32).
  * index j (int32).
  * weights of the matrices from the storage E forming $\overline{A}_{ij}$ (list(double)).
  * indices of the matrices from the storage E forming $\overline{A}_{ij}$ (list(int64)).
- AFE: The affine expression storage.
  * numafe: number of rows in the storage (int64).
  * F: The matrix F as a sparse matrix. All arrays must have the same length.
    · subi: row indices of nonzeros (list(int64)).
    · subj: column indices of nonzeros (list(int32)).
    · val: values of nonzeros (list(double)).
  * g: The vector g of constant terms as a sparse vector. Both arrays must have the same length.

        · `subi`: indices of nonzeros (list(int64)).
        · `val`: values of nonzeros (list(double)).
    * `barf`: The semidefinite part $\overline{F}$ of the expressions in AFE storage (list). Each element of the list is a list describing one entry $\overline{F}_{ij}$ using four fields:
        · index i (int64).
        · index j (int32).
        · weights of the matrices from the storage E forming $\overline{F}_{ij}$ (list(double)).
        · indices of the matrices from the storage E forming $\overline{F}_{ij}$ (list(int64)).
  - `domains`: Information about domains. All fields present must have the same length as `type`.
    * `name`: Domain names (list(string)).
    * `type`: Description of the type of each domain (list). Each element of the list is a list describing one domain using at least one field:
        · domain type (string).
        · (except `pexp`, `dexp`) dimension (int64).
        · (only `ppow`, `dpow`) weights (list(double)).
  - `ACC`: Information about affine conic constraints (ACC). All fields present must have the same length as `domain`.
    * `name`: ACC names (list(string)).
    * `domain`: Domains (list(int64)).
    * `afeidx`: AFE indices, grouped by ACC (list(list(int64))).
    * `b`: constant vectors b, grouped by ACC (list(list(double))).
  - `DJC`: Information about disjunctive constraints (DJC). All fields present must have the same length as `termsize`.
    * `name`: DJC names (list(string)).
    * `termsize`: Term sizes, grouped by DJC (list(list(int64))).
    * `domain`: Domains, grouped by DJC (list(list(int64))).
    * `afeidx`: AFE indices, grouped by DJC (list(list(int64))).
    * `b`: constant vectors b, grouped by DJC (list(list(double))).
  - `MatrixStore`: The symmetric matrix storage E (list). Each element of the list is a list describing one entry E using four fields in sparse matrix format, lower-triangular part only:
    * dimension (int32).
    * row indices of nonzeros (list(int32)).
    * column indices of nonzeros (list(int32)).
    * values of nonzeros (list(double)).
  - `Q`: The quadratic part Q^c of the constraints (list). Each element of the list is a list describing one entry Q^c_i using four fields in sparse matrix format, lower-triangular part only:
    * the row index i (int32).
    * row indices of nonzeros (list(int32)).
    * column indices of nonzeros (list(int32)).
    * values of nonzeros (list(double)).
  - `qcone` (deprecated). The description of cones. All fields present must have the same length as `type`.
    * `name`: Cone names (list(string)).
    * `type`: Cone types (list(string)).
    * `par`: Additional cone parameters (list(double)).
    * `members`: Members, grouped by cone (list(list(int32))).
- `Task/solutions`: Solutions. This section can contain up to three subsections called:
  - `interior`
  - `basic`

- integer

corresponding to the three solution types in MOSEK. Each of these sections has the same structure:

- prosta: problem status (string).
- solsta: solution status (string).
- xx, xc, y, slc, suc, slx, sux, snx: one for each component of the solution of the same name (list(double)).
- skx, skc, skn: status keys (list(string)).
- doty: the dual $\dot{y}$ solution, grouped by ACC (list(list(double))).
- barx, bars: the primal/dual semidefinite solution, grouped by matrix variable (list(list(double))).

- Task/parameters: Parameters.
  - iparam: Integer parameters (dictionary). A dictionary with entries of the form name:value, where name is a shortened parameter name (without leading MSK_IPAR_) and value is either an integer or string if the parameter takes values from an enum.
  - dparam: Double parameters (dictionary). A dictionary with entries of the form name:value, where name is a shortened parameter name (without leading MSK_DPAR_) and value is a double.
  - sparam: String parameters (dictionary). A dictionary with entries of the form name:value, where name is a shortened parameter name (without leading MSK_SPAR_) and value is a string. Note that this section is allowed but MOSEK ignores it both when writing and reading JTASK files.

11.7.2 JSOL Specification

The JSOL is a dictionary containing the following sections. All sections are optional and can be omitted if irrelevant for the problem.

- $schema: JSON schema.
- Task/name: The name of the task (string).
- Task/solutions: Solutions. This section can contain up to three subsections called:
  - interior
  - basic
  - integer

  corresponding to the three solution types in MOSEK. Each of these section has the same structure:

  - prosta: problem status (string).
  - solsta: solution status (string).
  - xx, xc, y, slc, suc, slx, sux, snx: one for each component of the solution of the same name (list(double)).
  - skx, skc, skn: status keys (list(string)).
  - doty: the dual $\dot{y}$ solution, grouped by ACC (list(list(double))).
  - barx, bars: the primal/dual semidefinite solution, grouped by matrix variable (list(list(double))).
- Task/information: Information items from the optimizer.
  - int32: int32 information items (dictionary). A dictionary with entries of the form name: value.
  - int64: int64 information items (dictionary). A dictionary with entries of the form name: value.
  - double: double information items (dictionary). A dictionary with entries of the form name: value.

11.7.3 A jtask example

Listing 11.5: A formatted **jtask** file for a simple portfolio optimization problem.

```
{
   "$schema":"http://mosek.com/json/schema#",
   "Task/name":"Markowitz portfolio with market impact",
   "Task/INFO":{"numvar":7,"numcon":1,"numcone":0,"numbarvar":0,"numanz":6,"numsymmat":0,"numafe":13,"numfnz":12,"numacc":4,"numdjc":0,"numdom":3,"mosekver":[10,0,0,3]},
   "Task/data":{
      "var":{
         "name":["1.0","x[0]","x[1]","x[2]","t[0]","t[1]","t[2]"],
         "bk":["fx","lo","lo","lo","fr","fr","fr"],
         "bl":[1,0.0,0.0,0.0,-1e+30,-1e+30,-1e+30],
         "bu":[1,1e+30,1e+30,1e+30,1e+30,1e+30,1e+30],
         "type":["cont","cont","cont","cont","cont","cont","cont"]
      },
      "con":{
         "name":["budget[]"],
         "bk":["fx"],
         "bl":[1],
         "bu":[1]
      },
      "objective":{
         "sense":"max",
         "name":"obj",
         "c":{
            "subj":[1,2,3],
            "val":[0.1073,0.0737,0.0627]
         },
         "cfix":0.0
      },
      "A":{
         "subi":[0,0,0,0,0,0],
         "subj":[1,2,3,4,5,6],
         "val":[1,1,1,0.01,0.01,0.01]
      },
      "AFE":{
         "numafe":13,
         "F":{
            "subi":[1,1,1,2,2,3,4,6,7,9,10,12],
            "subj":[1,2,3,2,3,3,4,1,5,2,6,3],
            "val":[0.166673333200005,0.0232190712557243,0.0012599496030238,0.102863378954911,-0.00222873156550421,0.0338148677744977,1,1,1,1,1,1]
         },
         "g":{
            "subi":[0,5,8,11],
            "val":[0.035,1,1,1]
         }
      },
      "domains":{
         "type":[["r",0],
                 ["quad",4],
                 ["ppow",3,[0.6666666666666666,0.33333333333333337]]]
      },
      "ACC":{
```

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```
         "name":["risk[]","tz[0]","tz[1]","tz[2]"],
         "domain":[1,2,2,2],
         "afeidx":[[0,1,2,3],
                   [4,5,6],
                   [7,8,9],
                   [10,11,12]]
      }
   },
   "Task/solutions":{
      "interior":{
         "prosta":"unknown",
         "solsta":"unknown",
         "skx":["fix","supbas","supbas","supbas","supbas","supbas","supbas"],
         "skc":["fix"],
         "xx":[1,0.10331580274282556,0.11673185566457132,0.7724326587076371,0.
↪033208600335718846,0.03988270849469869,0.6788769587942524],
         "xc":[1],
         "slx":[0.0,-5.585840467641202e-10,-8.945844685006369e-10,-7.815248786428623e-
↪11,0.0,0.0,0.0],
         "sux":[0.0,0.0,0.0,0.0,0.0,0.0,0.0],
         "snx":[0.0,0.0,0.0,0.0,0.0,0.0,0.0],
         "slc":[0.0],
         "suc":[-0.046725814048521205],
         "y":[0.046725814048521205],
         "doty":[[-0.6062603164682975,0.3620818321879349,0.17817754087278295,0.
↪4524390346223723],
                 [-4.6725842015519993e-4,-7.708781121860897e-6,2.24800624747081e-4],
                 [-4.6725842015519993e-4,-9.268264309496919e-6,2.390390600079771e-4],
                 [-4.6725842015519993e-4,-1.5854982159992136e-4,6.159249331148646e-4]]
      }
   },
   "Task/parameters":{
      "iparam":{
         "LICENSE_DEBUG":"ON",
         "MIO_SEED":422
      },
      "dparam":{
         "MIO_MAX_TIME":100
      },
      "sparam":{
      }
   }
}
```

11.8 The Solution File Format

MOSEK can output solutions to a text file:

- *basis solution file* (extension `.bas`) if the problem is optimized using the simplex optimizer or basis identification is performed,
- *interior solution file* (extension `.sol`) if a problem is optimized using the interior-point optimizer and no basis identification is required,
- *integer solution file* (extension `.int`) if the problem is solved with the mixed-integer optimizer.

All solution files have the format:

```
NAME                 : <problem name>
PROBLEM STATUS       : <status of the problem>
SOLUTION STATUS      : <status of the solution>
OBJECTIVE NAME       : <name of the objective function>
PRIMAL OBJECTIVE     : <primal objective value corresponding to the solution>
DUAL OBJECTIVE       : <dual objective value corresponding to the solution>

CONSTRAINTS
INDEX  NAME     AT ACTIVITY    LOWER LIMIT   UPPER LIMIT   DUAL LOWER   DUAL UPPER
?      <name>   ?? <a value>   <a value>     <a value>     <a value>    <a value>

AFFINE CONIC CONSTRAINTS
INDEX  NAME     I          ACTIVITY    DUAL
?      <name>   <a value>  <a value>   <a value>

VARIABLES
INDEX  NAME     AT ACTIVITY    LOWER LIMIT   UPPER LIMIT   DUAL LOWER   DUAL UPPER    [CONIC DUAL]
?      <name>   ?? <a value>   <a value>     <a value>     <a value>    <a value>     [<a value>]

SYMMETRIC MATRIX VARIABLES
INDEX  NAME     I           J             PRIMAL        DUAL
?      <name>   <a value>   <a value>     <a value>     <a value>
```

The fields `?`, `??` and `<>` will be filled with problem and solution specific information as described below. The solution contains sections corresponding to parts of the input. Empty sections may be omitted and fields in `[]` are optional, depending on what type of problem is solved.

- `HEADER`

  In this section, first the name of the problem is listed and afterwards the problem and solution status are shown. Next the primal and dual objective values are displayed.

- `CONSTRAINTS`
  - `INDEX`: A sequential index assigned to the constraint by **MOSEK**
  - `NAME`: The name of the constraint assigned by the user or autogenerated.
  - `AT`: The status key `bkc` of the constraint as in Table 11.4.
  - `ACTIVITY`: the activity `xc` of the constraint expression.
  - `LOWER LIMIT`: the lower bound `blc` of the constraint.
  - `UPPER LIMIT`: the upper bound `buc` of the constraint.
  - `DUAL LOWER`: the dual multiplier `slc` corresponding to the lower limit on the constraint.
  - `DUAL UPPER`: the dual multiplier `suc` corresponding to the upper limit on the constraint.

- `AFFINE CONIC CONSTRAINTS`
  - `INDEX`: A sequential index assigned to the affine expressions by **MOSEK**
  - `NAME`: The name of the affine conic constraint assigned by the user or autogenerated.
  - `I`: The sequential index of the affine expression in the affine conic constraint.
  - `ACTIVITY`: the activity of the `I`-th affine expression in the affine conic constraint.
  - `DUAL`: the dual multiplier `doty` for the `I`-th entry in the affine conic constraint.

- `VARIABLES`
  - `INDEX`: A sequential index assigned to the variable by **MOSEK**
  - `NAME`: The name of the variable assigned by the user or autogenerated.
  - `AT`: The status key `bkx` of the variable as in Table 11.4.

– ACTIVITY: the value xx of the variable.
– LOWER LIMIT: the lower bound blx of the variable.
– UPPER LIMIT: the upper bound bux of the variable.
– DUAL LOWER: the dual multiplier slx corresponding to the lower limit on the variable.
– DUAL UPPER: the dual multiplier sux corresponding to the upper limit on the variable.
– CONIC DUAL: the dual multiplier skx corresponding to a conic variable (deprecated).

- SYMMETRIC MATRIX VARIABLES
  – INDEX: A sequential index assigned to each symmetric matrix entry by **MOSEK**
  – NAME: The name of the symmetric matrix variable assigned by the user or autogenerated.
  – I: The row index in the symmetric matrix variable.
  – J: The column index in the symmetric matrix variable.
  – PRIMAL: the value of barx for the (I, J)-th entry in the symmetric matrix variable.
  – DUAL: the dual multiplier bars for the (I, J)-th entry in the symmetric matrix variable.

Table 11.4: Status keys.

Status key	Interpretation
UN	Unknown status
BS	Is basic
SB	Is superbasic
LL	Is at the lower limit (bound)
UL	Is at the upper limit (bound)
EQ	Lower limit is identical to upper limit
**	Is infeasible i.e. the lower limit is greater than the upper limit.

Example.

Below is an example of a solution file.

Listing 11.6: An example of .sol file.

```
NAME                    :
PROBLEM STATUS          : PRIMAL_AND_DUAL_FEASIBLE
SOLUTION STATUS         : OPTIMAL
OBJECTIVE NAME          : OBJ
PRIMAL OBJECTIVE        : 0.70571049347734
DUAL OBJECTIVE          : 0.70571048919757

CONSTRAINTS
INDEX      NAME           AT ACTIVITY                 LOWER LIMIT        UPPER LIMIT ␣
↪       DUAL LOWER               DUAL UPPER

AFFINE CONIC CONSTRAINTS
INDEX      NAME           I          ACTIVITY                 DUAL
0          A1             0          1.0000000009656          0.54475821296644
1          A1             1          0.50000000152223         0.32190455246225
2          A2             0          0.25439922724695         0.4552417870329
3          A2             1          0.17988741850378         -0.32190455246178
4          A2             2          0.17988741850378         -0.32190455246178

VARIABLES
INDEX      NAME           AT ACTIVITY                 LOWER LIMIT        UPPER LIMIT ␣
↪       DUAL LOWER               DUAL UPPER
```

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```
0           X1              SB 0.25439922724695         NONE                NONE          ␣
↪       0                         0
1           X2              SB 0.17988741850378         NONE                NONE          ␣
↪       0                         0
2           X3              SB 0.17988741850378         NONE                NONE          ␣
↪       0                         0

SYMMETRIC MATRIX VARIABLES
INDEX       NAME            I         J         PRIMAL                   DUAL
0           BARX1           0         0         0.21725733689874         1.1333372337141
1           BARX1           1         0         -0.25997257078534        0.
↪67809544651396
2           BARX1           2         0         0.21725733648507         -0.
↪3219045527104
3           BARX1           1         1         0.31108610088839         1.1333372332693
4           BARX1           2         1         -0.25997257078534        0.
↪67809544651435
5           BARX1           2         2         0.21725733689874         1.1333372337145
6           BARX2           0         0         4.8362272828127e-10      0.
↪54475821339698
7           BARX2           1         0         0                        0
8           BARX2           1         1         4.8362272828127e-10      0.
↪54475821339698
```

Bibliography

[Naz87] J. L. Nazareth. *Computer Solution of Linear Programs*. Oxford University Press, New York, 1987.

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