1 Example 1 — A Dense Example

2 Example 2 — A Dense Example

3 Example 3 — A Dense Example

4 Example 4 — A MDS Example

5 Example 5 — A MDS Example

6 Example 6 — A Convex Sparse Example

$$\min_{x \in \mathbb{R}^n} \quad \frac{a}{4} \sum_{i=1}^{n} (x_i - 1)^4 \tag{1}$$

$$\text{s.t.} \quad 4ax_1 + 2ax_2 = 10a \tag{2}$$
$$5a \leq 2ax_1 + ax_3 \tag{3}$$
$$a \leq 2ax_1 + 0.5ax_i \leq 2an \tag{4}$$
$$x_1 \ free, \tag{5}$$
$$0.0 \leq x_2, \tag{6}$$
$$1.5 \leq x_3 \leq 10 \tag{7}$$
$$0.5 \leq x_i, \qquad \forall i = 4, ..., n \tag{8}$$

Here $n \geq 3$ and $a > 0$ are parameters which can be tuned via user's inputs. If they are not specified by the user, they are set to the default values, $n = 3$ and $a = 1.0$.

The analytical solution is obtained at $x_1 = 1.75$, $x_2 = x_3 = 1.5$, and $x_i = 1$ for $i \geq 4$. The objective value is 0.110352. File nlpSparse_ex6_driver.cpp provides more details about the usage of this example.

7   Example 7 — A Nonconvex Sparse Example

$$\min_{x \in \mathbb{R}^n} \quad -\frac{a}{4} \sum_{i=1}^{n} (x_i - 1)^4 + 0.5 \sum_{i=1}^{n} x_i^2 \tag{9}$$

$$\text{s.t.} \quad 4x_1 + 2x_2 = 10 \tag{10}$$

$$4x_1 + 2x_2 = 10 \tag{11}$$

$$5 \le 2x_1 + x_3 \tag{12}$$

$$4x_1 + 2x_3 \le 19 \tag{13}$$

$$1 \le 2x_1 + 0.5x_i \le 2n \tag{14}$$

$$x_1 \ free, \tag{15}$$

$$0.0 \le x_2, \tag{16}$$

$$1.5 \le x_3 \le 10 \tag{17}$$

$$0.5 \le x_i, \qquad \forall i = 4, ..., n \tag{18}$$

Here $n \ge 3$ and $a > 0$ are parameters which can be tuned via user's inputs. If they are not specified by the user, they are set to the default values, $n = 3$ and $a = 0.1$. Note that the equality constraints (10) and (11) are duplicate. As a result, the constraint Jacobian matrix is rank deficient and may introduce numerical difficulties. File nlpSparse_ex7_driver.cpp provides more details about the usage of this example.

8   Example 8 — A Primal Decomposition Example

9   Example 9 — A Primal Decomposition Example