# Results for instances from collection TeamFormation-QKP-1

# File Bibsonomy.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 9,269 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 30,711 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 661.9 | 0.01 | 143.16 | 173.35 | — | — | — | **0.00** | 2.56 | **0.60** | 120.1 | 177.9 | 120.0 | 120.0 | 120.0 | 2.4 | 120.0 |
| 5.0 | 956.2 | **0.00** | 133.43 | 105.33 | — | — | — | **0.00** | 3.85 | **0.56** | 120.1 | 177.3 | 120.0 | 120.0 | 120.0 | 3.1 | 120.0 |
| 10.0 | 1,386.0 | **0.00** | 89.46 | 96.28 | — | — | — | 0.01 | 0.01 | **0.54** | 120.0 | 176.6 | 120.0 | 120.0 | 120.0 | 3.3 | 12.0 |
| 25.0 | 2,284.9 | **0.00** | 58.92 | 56.15 | — | — | — | **0.00** | 0.00 | **1.03** | 121.1 | 180.5 | 120.0 | 120.0 | 120.0 | 5.3 | 15.0 |
| 50.0 | 3,227.8 | **0.00** | 36.94 | 35.47 | — | — | — | 0.01 | 1.00 | **1.64** | 122.1 | 175.7 | 120.0 | 120.0 | 120.0 | 4.4 | 120.0 |
| 75.0 | 3,786.6 | **0.00** | 24.51 | 13.56 | — | — | — | **0.00** | 0.00 | **1.94** | 120.3 | 197.2 | 120.0 | 120.0 | 120.0 | 2.6 | 7.0 |
| Avg | | **0.00** | 81.07 | 80.02 | — | — | — | 0.00 | 1.24 | **1.05** | 120.6 | 180.9 | 120.0 | 120.0 | 120.0 | 3.5 | 65.7 |
| Min | | **0.00** | 24.51 | 13.56 | — | — | — | **0.00** | **0.00** | **0.54** | 120.0 | 175.7 | 120.0 | 120.0 | 120.0 | 2.4 | 7.0 |
| Max | | **0.01** | 143.16 | 173.35 | — | — | — | **0.01** | 3.85 | **1.94** | 122.1 | 197.2 | 120.0 | 120.0 | 120.0 | 5.3 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 133 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0605 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.8280 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0357 |

# File DBLP.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,159 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 15,281 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 245.9 | **0.00** | 97.15 | 85.88 | — | — | — | **0.00** | **0.00** | **0.01** | 120.1 | 152.7 | 120.0 | 120.0 | 120.0 | 1.0 | 2.0 |
| 5.0 | 399.2 | 0.01 | 75.54 | 77.45 | — | — | — | **0.00** | **0.00** | **0.47** | 120.1 | 153.8 | 120.0 | 120.0 | 120.0 | 1.8 | 58.0 |
| 10.0 | 641.0 | **0.00** | 57.81 | 54.00 | — | — | — | **0.00** | **0.00** | **0.44** | 120.2 | 153.2 | 120.0 | 120.0 | 120.0 | 1.5 | 9.0 |
| 25.0 | 1,176.0 | 0.03 | 39.23 | 35.99 | — | — | — | **0.00** | 0.01 | **0.56** | 120.7 | 156.5 | 120.0 | 120.0 | 120.0 | 1.4 | 7.0 |
| 50.0 | 1,768.2 | **0.00** | 25.15 | 22.56 | — | — | — | **0.00** | 0.01 | **0.88** | 121.4 | 154.0 | 120.0 | 120.0 | 120.0 | 1.8 | 6.0 |
| 75.0 | 2,142.0 | **0.00** | 21.41 | 18.85 | — | — | — | **0.00** | **0.00** | 1.05 | 120.7 | 155.8 | 120.0 | 120.0 | 120.0 | **0.8** | 4.0 |
| Avg | | 0.01 | 52.72 | 49.12 | — | — | — | **0.00** | 0.00 | **0.57** | 120.5 | 154.3 | 120.0 | 120.0 | 120.0 | 1.4 | 14.3 |
| Min | | **0.00** | 21.41 | 18.85 | — | — | — | **0.00** | **0.00** | **0.01** | 120.1 | 152.7 | 120.0 | 120.0 | 120.0 | 0.8 | 2.0 |
| Max | | 0.03 | 97.15 | 85.88 | — | — | — | **0.00** | 0.01 | **1.05** | 121.4 | 156.5 | 120.0 | 120.0 | 120.0 | 1.8 | 58.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 153 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0572 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.6250 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0287 |

# File IMDB.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 1,021 |
| Density ($\Delta$) | 2.1 % |
| Edges ($m$) | 11,224 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 23.1 | 1.95 | 12.66 | 4.13 | — | — | — | **0.00** | **0.00** | **0.01** | 1.7 | 5.3 | 120.0 | 120.0 | 120.0 | 4.0 | 16.0 |
| 5.0 | 44.2 | 0.09 | 12.23 | 2.59 | — | — | — | **0.00** | **0.00** | **0.01** | 3.1 | 8.8 | 120.0 | 120.0 | 120.0 | 1.9 | 48.0 |
| 10.0 | 81.6 | **0.00** | 31.94 | 0.89 | — | — | — | **0.00** | **0.00** | **0.00** | 5.9 | 6.3 | 120.0 | 120.0 | 120.0 | 1.7 | 1.0 |
| 25.0 | 167.3 | 0.10 | 34.29 | 0.97 | — | — | — | **0.00** | **0.00** | **0.01** | 14.1 | 12.2 | 120.0 | 120.0 | 120.0 | 4.6 | 23.0 |
| 50.0 | 253.2 | 0.03 | 19.51 | 1.98 | — | — | — | **0.00** | **0.00** | **0.01** | 27.4 | 19.3 | 120.0 | 120.0 | 120.0 | 1.3 | 14.0 |
| 75.0 | 291.6 | **0.00** | 4.17 | 0.80 | — | — | — | 0.01 | **0.00** | **0.01** | 39.2 | 9.2 | 120.0 | 120.0 | 120.0 | 0.6 | 2.0 |
| Avg | | 0.36 | 19.13 | 1.89 | — | — | — | 0.00 | **0.00** | **0.01** | 15.2 | 10.2 | 120.0 | 120.0 | 120.0 | 2.3 | 17.3 |
| Min | | **0.00** | 4.17 | 0.80 | — | — | — | **0.00** | **0.00** | **0.00** | 1.7 | 5.3 | 120.0 | 120.0 | 120.0 | 0.6 | 1.0 |
| Max | | 1.95 | 34.29 | 4.13 | — | — | — | 0.01 | **0.00** | **0.01** | 39.2 | 19.3 | 120.0 | 120.0 | 120.0 | 4.6 | 48.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 124 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0361 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.0940 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0110 |

# File StackOverflow.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 8,834 |
| Density ($\Delta$) | 0.2 % |
| Edges ($m$) | 62,277 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 117.2 | 0.04 | 0.54 | 0.44 | — | — | — | **0.00** | 0.60 | **0.62** | 120.0 | 172.5 | 120.0 | 120.0 | 120.0 | 46.7 | 120.0 |
| 5.0 | 223.8 | **0.00** | 0.67 | 0.44 | — | — | — | **0.00** | 0.58 | **0.40** | 120.3 | 172.9 | 120.0 | 120.0 | 120.0 | 22.2 | 120.0 |
| 10.0 | 398.6 | **0.00** | 0.41 | 0.32 | — | — | — | **0.00** | 0.44 | **0.86** | 120.0 | 174.0 | 120.0 | 120.0 | 120.0 | 11.8 | 120.0 |
| 25.0 | 729.9 | **0.00** | 1.00 | 0.85 | — | — | — | **0.00** | 0.01 | **0.84** | 120.2 | 173.4 | 120.0 | 120.0 | 120.0 | 10.8 | 79.0 |
| 50.0 | 1,006.4 | 0.03 | 1.22 | 1.17 | — | — | — | **0.00** | **0.00** | **1.34** | 121.5 | 170.9 | 120.0 | 120.0 | 120.0 | 8.1 | 28.0 |
| 75.0 | 1,130.9 | **0.00** | 1.41 | 1.40 | — | — | — | **0.00** | 0.23 | **1.76** | 122.7 | 177.0 | 120.0 | 120.0 | 120.0 | 3.4 | 120.0 |
| Avg | | 0.01 | 0.88 | 0.77 | — | — | — | **0.00** | 0.31 | **0.97** | 120.8 | 173.4 | 120.0 | 120.0 | 120.0 | 17.2 | 97.8 |
| Min | | **0.00** | 0.41 | 0.32 | — | — | — | **0.00** | **0.00** | **0.40** | 120.0 | 170.9 | 120.0 | 120.0 | 120.0 | 3.4 | 28.0 |
| Max | | 0.04 | 1.41 | 1.40 | — | — | — | **0.00** | 0.60 | **1.76** | 122.7 | 177.0 | 120.0 | 120.0 | 120.0 | 46.7 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 65 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.1047 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.7970 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0333 |

# File Synthetic_01.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 37,120 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 247.0 | **0.00** | 88.71 | 94.63 | — | — | — | **0.00** | 0.09 | **0.19** | 120.1 | 153.1 | 120.0 | 120.0 | 120.0 | 3.1 | 120.0 |
| 5.0 | 408.3 | 0.05 | 75.71 | 64.62 | — | — | — | **0.00** | **0.00** | **0.36** | 120.0 | 152.7 | 120.0 | 120.0 | 120.0 | 4.6 | 6.0 |
| 10.0 | 662.7 | 0.01 | 56.51 | 50.66 | — | — | — | **0.00** | **0.00** | **0.35** | 120.3 | 152.7 | 120.0 | 120.0 | 120.0 | 4.5 | 11.0 |
| 25.0 | 1,209.5 | 0.03 | 34.93 | 27.26 | — | — | — | **0.00** | 2.04 | **0.49** | 120.5 | 154.6 | 120.0 | 120.0 | 120.0 | 10.0 | 120.0 |
| 50.0 | 1,820.6 | 0.01 | 14.17 | 8.95 | — | — | — | **0.00** | 0.01 | **0.76** | 120.8 | 152.0 | 120.0 | 120.0 | 120.0 | 9.6 | 33.0 |
| 75.0 | 2,216.2 | 0.01 | 4.31 | 2.19 | — | — | — | **0.00** | **0.00** | **0.99** | 121.2 | 152.7 | 120.0 | 120.0 | 120.0 | 3.9 | 21.0 |
| Avg | | 0.02 | 45.72 | 41.38 | — | — | — | **0.00** | 0.36 | **0.52** | 120.5 | 153.0 | 120.0 | 120.0 | 120.0 | 6.0 | 51.8 |
| Min | | **0.00** | 4.31 | 2.19 | — | — | — | **0.00** | **0.00** | **0.19** | 120.0 | 152.0 | 120.0 | 120.0 | 120.0 | 3.1 | 6.0 |
| Max | | 0.05 | 88.71 | 94.63 | — | — | — | **0.00** | 2.04 | **0.99** | 121.2 | 154.6 | 120.0 | 120.0 | 120.0 | 10.0 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 110 |
| Running time in seconds for writing input file ($t^{\text{write}}$) | 0.0805 |
| Running time in seconds for executing parametric cut procedure ($t^{\text{cut}}$) | 0.6560 |
| Running time in seconds for reading result file ($t^{\text{read}}$) | 0.0283 |

# File Synthetic_02.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 36,061 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 292.9 | 0.01 | 111.79 | 109.85 | — | — | — | **0.00** | **0.00** | **0.44** | 120.0 | 153.0 | 120.0 | 120.0 | 120.0 | 1.7 | 13.0 |
| 5.0 | 485.9 | **0.00** | 104.31 | 83.29 | — | — | — | **0.00** | 0.07 | **0.21** | 120.1 | 152.2 | 120.0 | 120.0 | 120.0 | 5.1 | 120.0 |
| 10.0 | 789.2 | 0.04 | 76.57 | 46.27 | — | — | — | **0.00** | **0.00** | **0.41** | 120.0 | 153.7 | 120.0 | 120.0 | 120.0 | 12.3 | 21.0 |
| 25.0 | 1,412.8 | 0.01 | 43.84 | 30.21 | — | — | — | **0.00** | 0.29 | **0.53** | 120.4 | 157.0 | 120.0 | 120.0 | 120.0 | 11.3 | 120.0 |
| 50.0 | 2,069.3 | 0.05 | 17.06 | 9.49 | — | — | — | **0.00** | 0.01 | **0.81** | 120.1 | 156.0 | 120.0 | 120.0 | 120.0 | 9.0 | 24.0 |
| 75.0 | 2,488.1 | **0.00** | 4.75 | 3.03 | — | — | — | 0.01 | 0.05 | **1.00** | 121.4 | 157.1 | 120.0 | 120.0 | 120.0 | 4.2 | 120.0 |
| Avg | | 0.02 | 59.72 | 47.02 | — | — | — | **0.00** | 0.07 | **0.57** | 120.3 | 154.8 | 120.0 | 120.0 | 120.0 | 7.3 | 69.7 |
| Min | | **0.00** | 4.75 | 3.03 | — | — | — | **0.00** | **0.00** | **0.21** | 120.0 | 152.2 | 120.0 | 120.0 | 120.0 | 1.7 | 13.0 |
| Max | | 0.05 | 111.79 | 109.85 | — | — | — | **0.01** | 0.29 | **1.00** | 121.4 | 157.1 | 120.0 | 120.0 | 120.0 | 12.3 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 112 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0794 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.6100 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0282 |

# File Synthetic_03.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 35,714 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 258.8 | 0.01 | 128.21 | 102.78 | — | — | — | **0.00** | 0.16 | **0.45** | 120.1 | 153.3 | 120.0 | 120.0 | 120.0 | 4.3 | 120.0 |
| 5.0 | 437.3 | 0.01 | 100.21 | 72.12 | — | — | — | **0.00** | 0.01 | **0.24** | 120.2 | 153.6 | 120.0 | 120.0 | 120.0 | 4.5 | 28.0 |
| 10.0 | 714.8 | 0.01 | 68.24 | 56.20 | — | — | — | **0.00** | 0.02 | **0.34** | 120.2 | 152.3 | 120.0 | 120.0 | 120.0 | 9.3 | 120.0 |
| 25.0 | 1,292.3 | 0.01 | 31.78 | 22.05 | — | — | — | **0.00** | 0.00 | **0.63** | 120.8 | 153.1 | 120.0 | 120.0 | 120.0 | 14.5 | 45.0 |
| 50.0 | 1,922.2 | 0.02 | 13.86 | 10.14 | — | — | — | **0.00** | 0.00 | **0.76** | 120.4 | 153.9 | 120.0 | 120.0 | 120.0 | 8.6 | 20.0 |
| 75.0 | 2,338.7 | **0.00** | 4.59 | 2.52 | — | — | — | **0.00** | 0.00 | **0.97** | 122.0 | 155.4 | 120.0 | 120.0 | 120.0 | 3.8 | 16.0 |
| Avg | | 0.01 | 57.82 | 44.30 | — | — | — | **0.00** | 0.03 | **0.57** | 120.6 | 153.6 | 120.0 | 120.0 | 120.0 | 7.5 | 58.2 |
| Min | | **0.00** | 4.59 | 2.52 | — | — | — | **0.00** | 0.00 | **0.24** | 120.1 | 152.3 | 120.0 | 120.0 | 120.0 | 3.8 | 16.0 |
| Max | | 0.02 | 128.21 | 102.78 | — | — | — | **0.00** | 0.16 | **0.97** | 122.0 | 155.4 | 120.0 | 120.0 | 120.0 | 14.5 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 134 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0795 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.6250 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0273 |

# File Synthetic_04.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 35,232 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 235.9 | **0.00** | 79.88 | 48.31 | — | — | — | **0.00** | **0.00** | **0.36** | 120.0 | 152.4 | 120.0 | 120.0 | 120.0 | 3.7 | 4.0 |
| 5.0 | 420.0 | **0.00** | 80.48 | 37.82 | — | — | — | **0.00** | 4.10 | **0.16** | 120.2 | 153.8 | 120.0 | 120.0 | 120.0 | 4.0 | 120.0 |
| 10.0 | 705.6 | **0.00** | 63.81 | 41.33 | — | — | — | 0.01 | **0.00** | **0.33** | 120.3 | 152.9 | 120.0 | 120.0 | 120.0 | 12.0 | 9.0 |
| 25.0 | 1,282.8 | **0.00** | 32.44 | 20.17 | — | — | — | **0.00** | 0.01 | **0.49** | 120.8 | 157.7 | 120.0 | 120.0 | 120.0 | 13.6 | 46.0 |
| 50.0 | 1,885.7 | 0.03 | 14.84 | 10.85 | — | — | — | **0.00** | 0.01 | **0.84** | 122.5 | 155.0 | 120.0 | 120.0 | 120.0 | 7.9 | 24.0 |
| 75.0 | 2,270.5 | **0.00** | 4.90 | 3.18 | — | — | — | **0.00** | **0.00** | **1.01** | 123.2 | 158.9 | 120.0 | 120.0 | 120.0 | 3.5 | 18.0 |
| Avg | | 0.01 | 46.06 | 26.94 | — | — | — | **0.00** | 0.69 | **0.53** | 121.2 | 155.1 | 120.0 | 120.0 | 120.0 | 7.4 | 36.8 |
| Min | | **0.00** | 4.90 | 3.18 | — | — | — | **0.00** | **0.00** | **0.16** | 120.0 | 152.4 | 120.0 | 120.0 | 120.0 | 3.5 | 4.0 |
| Max | | 0.03 | 80.48 | 48.31 | — | — | — | **0.01** | 4.10 | **1.01** | 123.2 | 158.9 | 120.0 | 120.0 | 120.0 | 13.6 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 101 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0810 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.6250 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0324 |

# File Synthetic_05.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 37,894 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 263.4 | 0.02 | 107.63 | 76.11 | — | — | — | **0.00** | 0.20 | **0.32** | 120.0 | 152.6 | 120.0 | 120.0 | 120.0 | 3.1 | 120.0 |
| 5.0 | 451.4 | **0.00** | 100.73 | 66.96 | — | — | — | **0.00** | 3.26 | **0.32** | 120.0 | 154.0 | 120.0 | 120.0 | 120.0 | 2.6 | 120.0 |
| 10.0 | 728.2 | 0.02 | 71.28 | 48.80 | — | — | — | **0.00** | 0.05 | **0.28** | 120.3 | 152.7 | 120.0 | 120.0 | 120.0 | 5.3 | 120.0 |
| 25.0 | 1,297.9 | **0.00** | 35.17 | 27.19 | — | — | — | **0.00** | 0.01 | **0.60** | 120.2 | 152.5 | 120.0 | 120.0 | 120.0 | 9.0 | 31.0 |
| 50.0 | 1,914.2 | 0.01 | 12.29 | 7.29 | — | — | — | **0.00** | **0.00** | **0.75** | 120.6 | 156.6 | 120.0 | 120.0 | 120.0 | 8.5 | 43.0 |
| 75.0 | 2,315.3 | **0.00** | 5.02 | 2.58 | — | — | — | **0.00** | 0.07 | **0.96** | 121.8 | 154.4 | 120.0 | 120.0 | 120.0 | 4.1 | 120.0 |
| Avg | | 0.01 | 55.35 | 38.16 | — | — | — | **0.00** | 0.60 | **0.54** | 120.5 | 153.8 | 120.0 | 120.0 | 120.0 | 5.4 | 92.3 |
| Min | | **0.00** | 5.02 | 2.58 | — | — | — | **0.00** | **0.00** | **0.28** | 120.0 | 152.5 | 120.0 | 120.0 | 120.0 | 2.6 | 31.0 |
| Max | | 0.02 | 107.63 | 76.11 | — | — | — | **0.00** | 3.26 | **0.96** | 121.8 | 156.6 | 120.0 | 120.0 | 120.0 | 9.0 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 177 |
| Running time in seconds for writing input file ($t^{\text{write}}$) | 0.0824 |
| Running time in seconds for executing parametric cut procedure ($t^{\text{cut}}$) | 0.6250 |
| Running time in seconds for reading result file ($t^{\text{read}}$) | 0.0276 |

# File Synthetic_06.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 35,072 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 248.9 | 0.04 | 105.49 | 69.88 | — | — | — | **0.00** | 5.16 | **0.39** | 120.0 | 152.8 | 120.0 | 120.0 | 120.0 | 3.7 | 120.0 |
| 5.0 | 419.1 | 0.07 | 78.23 | 52.19 | — | — | — | **0.00** | 0.01 | **0.38** | 120.0 | 152.3 | 120.0 | 120.0 | 120.0 | 3.8 | 8.0 |
| 10.0 | 685.9 | **0.00** | 63.36 | 41.36 | — | — | — | **0.00** | **0.00** | **0.42** | 120.2 | 153.6 | 120.0 | 120.0 | 120.0 | 9.6 | 22.0 |
| 25.0 | 1,249.7 | 0.01 | 34.71 | 26.18 | — | — | — | **0.00** | **0.00** | **0.60** | 120.8 | 156.3 | 120.0 | 120.0 | 120.0 | 12.9 | 22.0 |
| 50.0 | 1,861.7 | 0.01 | 11.50 | 9.91 | — | — | — | **0.00** | 0.01 | **0.73** | 121.3 | 152.4 | 120.0 | 120.0 | 120.0 | 9.0 | 33.0 |
| 75.0 | 2,250.0 | **0.00** | 4.18 | 2.18 | — | — | — | 0.01 | 0.06 | **0.93** | 120.3 | 156.3 | 120.0 | 120.0 | 120.0 | 3.4 | 120.0 |
| Avg | | 0.02 | 49.58 | 33.62 | — | — | — | **0.00** | 0.87 | **0.58** | 120.4 | 153.9 | 120.0 | 120.0 | 120.0 | 7.1 | 54.2 |
| Min | | **0.00** | 4.18 | 2.18 | — | — | — | **0.00** | **0.00** | **0.38** | 120.0 | 152.3 | 120.0 | 120.0 | 120.0 | 3.4 | 8.0 |
| Max | | 0.07 | 105.49 | 69.88 | — | — | — | **0.01** | 5.16 | **0.93** | 121.3 | 156.3 | 120.0 | 120.0 | 120.0 | 12.9 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 143 |
| Running time in seconds for writing input file ($t^{\text{write}}$) | 0.0781 |
| Running time in seconds for executing parametric cut procedure ($t^{\text{cut}}$) | 0.6100 |
| Running time in seconds for reading result file ($t^{\text{read}}$) | 0.0285 |

# File Synthetic_07.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 36,840 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 291.6 | 0.04 | 135.38 | 156.20 | — | — | — | **0.00** | 0.02 | **0.37** | 120.1 | 153.3 | 120.0 | 120.0 | 120.0 | 2.3 | 120.0 |
| 5.0 | 490.2 | 0.01 | 110.26 | 84.40 | — | — | — | **0.00** | 4.14 | **0.24** | 120.2 | 154.3 | 120.0 | 120.0 | 120.0 | 4.3 | 120.0 |
| 10.0 | 788.4 | **0.00** | 83.76 | 53.60 | — | — | — | **0.00** | 0.01 | **0.28** | 120.0 | 153.6 | 120.0 | 120.0 | 120.0 | 3.3 | 66.0 |
| 25.0 | 1,389.5 | **0.00** | 35.75 | 29.38 | — | — | — | **0.00** | 0.01 | **0.48** | 120.1 | 156.3 | 120.0 | 120.0 | 120.0 | 9.0 | 29.0 |
| 50.0 | 2,026.6 | **0.00** | 14.60 | 10.52 | — | — | — | **0.00** | 0.41 | **0.97** | 122.8 | 153.7 | 120.0 | 120.0 | 120.0 | 9.2 | 120.0 |
| 75.0 | 2,429.5 | **0.00** | 5.55 | 3.33 | — | — | — | **0.00** | **0.00** | **1.06** | 120.1 | 157.5 | 120.0 | 120.0 | 120.0 | 4.3 | 36.0 |
| Avg | | 0.01 | 64.22 | 56.24 | — | — | — | **0.00** | 0.76 | **0.57** | 120.6 | 154.8 | 120.0 | 120.0 | 120.0 | 5.4 | 81.8 |
| Min | | **0.00** | 5.55 | 3.33 | — | — | — | **0.00** | **0.00** | **0.24** | 120.0 | 153.3 | 120.0 | 120.0 | 120.0 | 2.3 | 29.0 |
| Max | | 0.04 | 135.38 | 156.20 | — | — | — | **0.00** | 4.14 | **1.06** | 122.8 | 157.5 | 120.0 | 120.0 | 120.0 | 9.2 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 133 |
| Running time in seconds for writing input file ($t^{\text{write}}$) | 0.0832 |
| Running time in seconds for executing parametric cut procedure ($t^{\text{cut}}$) | 0.6100 |
| Running time in seconds for reading result file ($t^{\text{read}}$) | 0.0290 |

# File Synthetic_08.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.2 % |
| Edges ($m$) | 38,673 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 242.1 | 0.07 | 83.76 | 102.69 | — | — | — | **0.00** | 15.66 | **0.37** | 120.1 | 153.1 | 120.0 | 120.0 | 120.0 | 2.3 | 120.0 |
| 5.0 | 419.8 | **0.00** | 69.22 | 73.43 | — | — | — | **0.00** | 7.54 | **0.30** | 120.0 | 153.0 | 120.0 | 120.0 | 120.0 | 3.4 | 120.0 |
| 10.0 | 698.1 | **0.00** | 55.56 | 37.36 | — | — | — | **0.00** | 0.01 | **0.35** | 120.3 | 153.1 | 120.0 | 120.0 | 120.0 | 5.2 | 13.0 |
| 25.0 | 1,275.0 | **0.00** | 29.79 | 20.29 | — | — | — | 0.01 | 0.01 | **0.54** | 120.2 | 153.9 | 120.0 | 120.0 | 120.0 | 9.0 | 33.0 |
| 50.0 | 1,896.6 | 0.01 | 13.50 | 9.16 | — | — | — | **0.00** | 0.01 | **0.81** | 121.3 | 153.9 | 120.0 | 120.0 | 120.0 | 10.1 | 32.0 |
| 75.0 | 2,293.9 | **0.00** | 3.82 | 2.55 | — | — | — | **0.00** | 0.07 | **0.96** | 120.6 | 155.4 | 120.0 | 120.0 | 120.0 | 4.0 | 120.0 |
| Avg | | 0.01 | 42.61 | 40.91 | — | — | — | **0.00** | 3.88 | **0.55** | 120.4 | 153.7 | 120.0 | 120.0 | 120.0 | 5.7 | 73.0 |
| Min | | **0.00** | 3.82 | 2.55 | — | — | — | **0.00** | 0.01 | **0.30** | 120.0 | 153.0 | 120.0 | 120.0 | 120.0 | 2.3 | 13.0 |
| Max | | 0.07 | 83.76 | 102.69 | — | — | — | **0.01** | 15.66 | **0.96** | 121.3 | 155.4 | 120.0 | 120.0 | 120.0 | 10.1 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 123 |
| Running time in seconds for writing input file ($t^{\text{write}}$) | 0.0841 |
| Running time in seconds for executing parametric cut procedure ($t^{\text{cut}}$) | 0.6090 |
| Running time in seconds for reading result file ($t^{\text{read}}$) | 0.0286 |

# File Synthetic_09.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 35,055 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 244.3 | 0.08 | 105.69 | 92.01 | — | — | — | **0.00** | 0.11 | **0.35** | 120.1 | 153.4 | 120.0 | 120.0 | 120.0 | 4.3 | 120.0 |
| 5.0 | 427.0 | 0.02 | 93.61 | 54.03 | — | — | — | **0.00** | 7.65 | **0.30** | 120.1 | 153.2 | 120.0 | 120.0 | 120.0 | 4.2 | 120.0 |
| 10.0 | 720.9 | **0.00** | 70.55 | 51.14 | — | — | — | **0.00** | 0.00 | **0.31** | 120.1 | 152.2 | 120.0 | 120.0 | 120.0 | 3.3 | 6.0 |
| 25.0 | 1,329.8 | 0.01 | 39.13 | 29.03 | — | — | — | **0.00** | 0.00 | **0.65** | 120.6 | 155.0 | 120.0 | 120.0 | 120.0 | 13.1 | 18.0 |
| 50.0 | 1,980.0 | 0.01 | 14.63 | 10.94 | — | — | — | **0.00** | 0.17 | **0.98** | 120.1 | 153.7 | 120.0 | 120.0 | 120.0 | 8.5 | 120.0 |
| 75.0 | 2,389.4 | **0.00** | 4.90 | 3.28 | — | — | — | **0.00** | 0.00 | **1.15** | 120.7 | 153.6 | 120.0 | 120.0 | 120.0 | 3.3 | 18.0 |
| Avg | | 0.02 | 54.75 | 40.07 | — | — | — | **0.00** | 1.32 | **0.62** | 120.3 | 153.5 | 120.0 | 120.0 | 120.0 | 6.1 | 67.0 |
| Min | | **0.00** | 4.90 | 3.28 | — | — | — | **0.00** | 0.00 | **0.30** | 120.1 | 152.2 | 120.0 | 120.0 | 120.0 | 3.3 | 6.0 |
| Max | | 0.08 | 105.69 | 92.01 | — | — | — | **0.00** | 7.65 | **1.15** | 120.7 | 155.0 | 120.0 | 120.0 | 120.0 | 13.1 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 128 |
| Running time in seconds for writing input file ($t^{\text{write}}$) | 0.0829 |
| Running time in seconds for executing parametric cut procedure ($t^{\text{cut}}$) | 0.6250 |
| Running time in seconds for reading result file ($t^{\text{read}}$) | 0.0279 |

# File Synthetic_10.txt

| Property of graph | Value |
|---|---|
| Nodes ($n$) | 7,000 |
| Density ($\Delta$) | 0.1 % |
| Edges ($m$) | 37,554 |

| | | Deviation from best OFV (%) | | | | | | | | Running time (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\gamma$ | Best OFV | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly | **QKBP** | RG | IHEA | LDP | DP | QK | Gurobi | Hexaly |
| 2.5 | 262.7 | **0.00** | 87.16 | 80.62 | — | — | — | **0.00** | **0.00** | **0.01** | 120.1 | 152.4 | 120.0 | 120.0 | 120.0 | 1.3 | 6.0 |
| 5.0 | 447.7 | 0.04 | 99.36 | 54.60 | — | — | — | **0.00** | 0.09 | **0.33** | 120.1 | 152.5 | 120.0 | 120.0 | 120.0 | 7.7 | 120.0 |
| 10.0 | 738.8 | **0.00** | 77.03 | 43.27 | — | — | — | **0.00** | 0.01 | **0.35** | 120.2 | 154.4 | 120.0 | 120.0 | 120.0 | 9.6 | 18.0 |
| 25.0 | 1,319.7 | **0.00** | 29.99 | 23.77 | — | — | — | **0.00** | 0.25 | **0.57** | 120.8 | 153.7 | 120.0 | 120.0 | 120.0 | 9.1 | 120.0 |
| 50.0 | 1,950.0 | **0.00** | 11.46 | 6.57 | — | — | — | 0.01 | 0.22 | **0.91** | 121.7 | 156.7 | 120.0 | 120.0 | 120.0 | 8.6 | 120.0 |
| 75.0 | 2,349.1 | **0.00** | 3.40 | 1.98 | — | — | — | **0.00** | **0.00** | **0.96** | 121.7 | 154.2 | 120.0 | 120.0 | 120.0 | 3.9 | 38.0 |
| Avg | | 0.01 | 51.40 | 35.13 | — | — | — | **0.00** | 0.09 | **0.52** | 120.8 | 154.0 | 120.0 | 120.0 | 120.0 | 6.7 | 70.3 |
| Min | | **0.00** | 3.40 | 1.98 | — | — | — | **0.00** | **0.00** | **0.01** | 120.1 | 152.4 | 120.0 | 120.0 | 120.0 | 1.3 | 6.0 |
| Max | | 0.04 | 99.36 | 80.62 | — | — | — | 0.01 | 0.25 | **0.96** | 121.7 | 156.7 | 120.0 | 120.0 | 120.0 | 9.6 | 120.0 |

**QKBP** is the contribution in this paper

| QKBP-specific information | Value |
|---|---|
| Number of breakpoints | 151 |
| Running time in seconds for writing input file ($t^{\mathrm{write}}$) | 0.0916 |
| Running time in seconds for executing parametric cut procedure ($t^{\mathrm{cut}}$) | 0.6400 |
| Running time in seconds for reading result file ($t^{\mathrm{read}}$) | 0.0274 |