Homework 5

Due December 3, 2015

Please submit your homework by email to haksun [dot] li {at} numericalmethod -dot- com.

Q1.

Read "Section 14.2.2, Practical Optimization - Algorithms and Engineering Applications", 2007.

a.

Write a Java class to convert an LP problem into and SDP problem. Solve an LP problem using both an LP solver and an SDP solver. Do they produce the same solutions?

Ref:

http://www.numericalmethod.com/javadoc/suanshu/com/numericalmethod/suanshu/optimization/multivariate/constrained/convex/sdp/socp/qp/lp/problem/LPProblem.html

http://www.numericalmethod.com/javadoc/suanshu/com/numericalmethod/suanshu/optimization/multivariate/constrained/convex/sdp/socp/qp/lp/simplex/solver/FerrisMangasarianWrightPhase2.html

http://www.numericalmethod.com/javadoc/suanshu/com/numericalmethod/suanshu/optimization/multivariate/constrained/convex/sdp/problem/SDPPrimalProblem.html

http://www.numericalmethod.com/javadoc/suanshu/com/numericalmethod/suanshu/optimization/multivariate/constrained/convex/sdp/pathfollowing/PrimalDualPathFollowingMinimizer.html

b.

Write a Java class to convert a general convex QP problem into and SDP problem. Solve a QP problem using both an QP solver and an SDP solver. Do they produce the same solutions?

http://www.numericalmethod.com/javadoc/suanshu/com/numericalmethod/suanshu/optimization/multivariate/constrained/convex/sdp/socp/qp/problem/QPProblem.html

http://www.numericalmethod.com/javadoc/suanshu/com/numericalmethod/suanshu/optimization/multivariate/constrained/convex/sdp/socp/qp/activeset/package-summary.html

Q2.

Show that the original problem in d'Aspremont 2008 is equivalent to the problem discussed in class, namely,

- $\min_{Y \in S^n} \mathrm{Tr}(AY)$
- s.t.,
  - Cardinality of $Y \leq k$
  - $\mathrm{Tr}(BY) = 1$
  - $Y \succcurlyeq 0$
  - Rank of $Y = 1$
- Change of variable
  - $Y = \frac{X}{\mathrm{Tr}(BY)}$

Specifically, prove the 1st, 2nd, 3rd and the 4th constraints.

Q3.

Read Lauritzen, S. (1996), 'Graphical Models'.

Explain why zeros in an inverse covariance matrix corresponds to conditionally independence.