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OPTIMERING
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Answers and Comments[1]

1. Only c) and e) are correct.

2. **a)** Minimum point $(1/2, 1/2)$.

b) Converges to the saddle point $(-3/2, -3/2)$ in one step.

c) Any $\epsilon > 1$ makes $d = -(\epsilon I + H(0,0))^{-1}\nabla f(0,0)$ a descent direction.

3. **a)** Max $= 4$ at $x = (1,\ 0,\ 2)$.

b) The dual problem is

$$\min\,(2y_1 + 2y_2 + y_3) \quad \text{subject to} \quad \begin{cases} -y_2 - y_3 & \geq & 0, \\ y_1 + 3y_2 - y_3 & \geq & 1, \\ y_1 - 2y_2 + y_3 & \geq & 2, \\ y_1,\ y_2 & \geq & 0. \end{cases}$$

Min $= 4$ at $y = (2,\ 0,\ 0)$. The solution is unique.

4. **a)** See the book.

b) i. Convex. ii. Not convex.

c) Convex.

5. **a)** See the book.

b) Minimum exists. No CQ points. One KKT point $(0,0,1) =$ the minimum point.

6. **a)** The dual finction is

$$\Theta(u) = \begin{cases} u, & 0 \leq u \leq 1, \\ -\infty, & \text{otherwise.} \end{cases}$$

$\max_{u\geq 0} \Theta(u) = 1$ at $u = 1$. Since $\Theta(1) = f(0,0,1)$ there is no duality gap.

b) See the book.

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[1] For re-exams only answers are provided.