Key Problems

Problem 1.

Check if the given sets are compact (closed and bounded), and if they are convex. It is useful to sketch the sets:

- a) $D = \{(x,y) : x, y \ge 0 \text{ and } 2x + 3y \le 6\}$ b) $D = \{(x,y) : 4x^2 + 9y^2 \le 36\}$
- c) $D = \{(x,y) : x,y \ge 1 \text{ and } 2x + 3y \ge 12\}$ d) $D = \{(x,y) : 4xy \le 1 \text{ and } x,y > 0\}$

Problem 2.

Solve the Lagrange problems:

a) max f(x,y,z) = x + 2y + 3z when $2x^2 + y^2 + 2z^2 = 9$ b) max / min $f(x,y,z) = x^2 + y^2 + z^2$ when $3x^2 + 2y^2 + 2z^2 = 12$

Problem 3.

Use the second order condition to solve the Lagrange problem:

- a) max $/\min f(x,y,z) = 4x^2 + 9y^2 + z^2$ when x + y + z = 1
- b) max / min f(x,y,z,w) = xw yz when $x^2 + 4y^2 = 4$ and $4z^2 + 9w^2 = 36$

Problem 4.

Determine if there are any admissible points such that the NDCQ fails when the constraints are given by:

a) xyz = 1b) $3x^2 + 3y^2 + 8z^2 = 1$ c) $x^3 + y^3 + z^3 = 0$ d) xy - zw = 1 and x + y + z + w = 4

Exercise Problems

Problems from the textbook:	[E] 6.1, 6.2, 6.3ab, 6.4, 6.11
Exam problems	Final exam $11/2019$ Question 4

Answers to Key Problems

Problem 1.

- a) Compact and convex set
- c) Convex, but not compact set (not bounded)
- b) Compact and convex set
- d) Not convex and not compact set (not bounded)

Problem 2.

a) $f_{\max} = 9$ b) $f_{\min} = 4$

Problem 3.

a) $f_{\min} = 36$ b) $f_{\max} = 4, \ f_{\min} = -4$

Problem 4.

a) None

- b) None
- c) (x,y,z) = (0,0,0) d) None