Problem Session 2
GRA 6035 Mathematics

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BI Norwegian Business School

Problems

1. Compute the first and second order derivatives of the following functions, and use this to write down the Hessian matrix in each case:

a) $f(x,y,z) = xy + xz - yz$
b) $f(x,y,z) = x^2 + y^2 + z^2 + z^3 + 2yz - 2x + 12y$
c) $f(x,y) = x^2 + 4xy + 4y^2 + e^y - y$
d) $f(x,y,z) = x^2 + y^2 + y^4 + yz - 1$
e) $f(x,y,z) = \ln(x+1) + \ln(y+1) - \ln(z-1)$
f) $f(x,y,z) = z\sqrt{x^2+y^2}$
g) $f(x,y,z) = e^{xyz}$

2. Find all stationary points of the functions in Problem 1.

3. Classify the type of the stationary points of the functions in Problem 1.

4. Determine if the functions in Problem 1 are convex and/or concave.

5. We consider the Lagrange problem

$$\max / \min f(x,y,z) = 12x - 9y^2 + 2z^3 \quad \text{subject to} \quad \begin{cases} z - x = 0 \\ y - z = 0 \end{cases}$$

Write down the first order conditions of this Lagrange problem, and find all points that satisfy the first order conditions and the constraints. What is the solution to the max/min-problem?

6. We consider the Lagrange problem

$$\max / \min f(x,y,z) = 2x^2 + y^2 + 3z^2 \quad \text{subject to} \quad \begin{cases} x - y + 2z = 3 \\ x + y = 3 \end{cases}$$

Write down the first order conditions of this Lagrange problem, and find all points that satisfy the first order conditions and the constraints. What is the solution to the max/min-problem?