Past Exam Paper 2

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2. (a) $g_1(x) = x_1^2 + x_2^2 - 6$ $g_2(x) = x_1 - 3x_2 - 1$

$\nabla^2 g_1(x) = 2I \succ 0$, $\nabla^2 g_2(x) = 0$. convex.

Find Slater point $(0,0)$ Slater con. holds.

MFCQ holds on every feasible point

KKT con.

$$\begin{cases} \begin{bmatrix} -6x_1 \\ 1 \end{bmatrix} + \lambda_1 \begin{bmatrix} 2x_1 \\ 2x_2 \end{bmatrix} + \lambda_2 \begin{bmatrix} 1 \\ -3 \end{bmatrix} = 0 \\ \lambda_1 (x_1^2 + x_2^2 - 6) = 0 \\ \lambda_2 (x_1 - 3x_2 + 1) = 0 \\ \lambda_1, \lambda_2 \geq 0 \end{cases}$$

(b) MFCQ holds on Ω. Then we have

$\lambda_1 \nabla g_1(x) = 0 \Rightarrow \lambda_1 = 0$

$\lambda_2 \nabla g_2(x) = 0 \Rightarrow \lambda_2 = 0$

In S. $\nabla G_1(x) = \nabla g_1(x) + \nabla g_2(x)$

$\lambda \nabla G_1(x) = \lambda (\nabla g_1(x) + \nabla g_2(x))$

It is False. because if $\nabla g_1(x) + \nabla g_2(x) = 0$.

cannot $\Rightarrow \lambda = 0$

$x^5 + 1$, $x^3 - 1$

3. (I) (II) Similarly

$-\infty < v_p = v_d < +\infty$

$= 11.3$.

4. S Similarly