Assignment 8

Solve the following constrained nonlinear programming problem by using the Kuhn-Tucker condition and the interior point method:

$$\begin{aligned}&\min\,(x_1-1)^2+(x_2-1)^2\\&\text{s.t.}\quad x_1+x_2\le 1\end{aligned}$$

The original problem can be transformed as

$$\begin{aligned}&\min\,(x_1-1)^2+(x_2-1)^2\\&\text{s.t.}\quad -x_1-x_2\ge 1\end{aligned}$$

We can construct

$$Q(x,r)=(x_1-1)^2+(x_2-1)^2-rln(x_1+x_2)$$

Deriving the partial derivatives, we can get:

$$\frac{\partial Q}{\partial x_1}=2(x_1-1)-\frac{r}{x_1+x_2}$$
$$\frac{\partial Q}{\partial x_2}=2(x_2-1)-\frac{r}{x_1+x_2}$$

Using the Kuhn-Tucker condition, we can get:

$$x_1=x_2=\frac{1\pm\sqrt{1+r}}{2}$$

Let $r\to 0$, $x_1=x_2=0$ or 1.

Because $x_1=x_2=1$ is not a feasible solution for the problem,so the solution is:$x_1=x_2=0$.