

XAI HW4

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November 2, 2022

1 Exercise 1

$$\begin{aligned}f(x_1, x_2) &= (x_1 + x_2)^2 \\x_1, x_2 &\sim U[0, 1] \\x_1 &= x_2\end{aligned}$$

1.1 PD Profile

$$\begin{aligned}g_{PD}^1(z) &= \mathbf{E}_{x_2 \sim U[-1, 1]}(z + x_2)^2 \\&= z^2 + 2z\mathbf{E}_{x_2 \sim U[-1, 1]}x_2 + \mathbf{E}_{x_2 \sim U[-1, 1]}x_2^2 \\&= z^2 + \int_{-1}^1 \frac{1}{2}v^2 dv \\&= z^2 + 1/3\end{aligned}\tag{1}$$

1.2 ME Profile

$$\begin{aligned}g_{MP}^1(z) &= \mathbf{E}_{x_2 | x_1 = z}(z + x_2)^2 \\&= \mathbf{E}_{x_2 | x_1 = z}4z^2 \\&= 4z^2\end{aligned}\tag{2}$$

1.3 ALE Profile

$$\begin{aligned}g_{ALE}^1(z) &= \int_{-1}^z (\mathbf{E}_{x_2 | x_1 = v} \frac{\partial (x_1 + x_2)^2}{\partial x_1} dv) \\&= \int_{-1}^z (\mathbf{E}_{x_2 | x_1 = v} [2x_1 + 2x_2] dv) \\&= \int_{-1}^z (\mathbf{E}_{x_2 | x_1 = v} [4v] dv) \\&= \int_{-1}^z 4v dv \\&= 2z^2 - 2\end{aligned}\tag{3}$$