ECON 5760
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Problem Set 2

Problem 1. For this problem you are to write a script (m-file) called bilinear.m that is capable of implementing bilinear interpolation for an arbitrary function $f(x_1, x_2)$.

a. Using your function above, approximate the function $f(x_1, x_2) = ln(x_1) + ln(x_2)$ at points $x_1 = 2$ and $x_2 = 3$ using the points $x_{1i} = 1.90$, $x_{1i+1} = 2.10$, $x_{1j} = 2.90$, $x_{1j+1} = 3.10$ to do a bilinear approximation. What is the absolute deviation between $\hat{f}(x_1, x_2)$ and $f(x_1, x_2)$ at the points under consideration?

b. Now consider the function below:

$$f(x_1, x_2) = \begin{cases} 4x_1 + 3x_2, & \text{if } x_1, x_2 \leq 2 \\ x_1^2 + x_2^2, & \text{if } x_1, x_2 > 2 \\ 0, & \text{otherwise} \end{cases} \tag{1}$$

Using the surf.m function in Matlab, graph the function over the range of values $x_1 \in (1, 4)$ and $x_2 \in (1, 4)$. Label the graph appropriately.

Using your bilinear.m code, approximate the function above at the points $x_1 = 2.1$ and $x_2 = 2.05$. How good is the linear approximation?

Problem 2. Write a function called CDJac.m that calculates the Jacobian for an arbitrary multivariate function $f(x_1, x_2, ...x_k)$ at any point in the support of $x_1, x_2, ...x_k$.

a. Use this code to approximate the derivative of the multivariate function $f(x_1, x_2) = ln(x_1) + ln(x_2)$. What is the approximation error of your estimate?

b. Now, use your code to estimate the Jacobian of the function defined by Equation (1) above. Is the derivative accurate across the entire support for x_1 and x_2?