Name: Notes

SM275 · Mathematical Methods for Economics Fall 2019 · Uhan

Quiz 8 – 6 November 2019

Instructions. You have 15 minutes to complete this quiz. You may use your calculator. You may not use any other materials (e.g., notes, homework, books).

Show all your work. To receive full credit, your solutions must be completely correct, sufficiently justified, and easy to follow.

Problem	Weight	Score
1	1	
2	1	
3	1	
4	1	
5	1	
Total		/ 50

For Problems 1-4, let

$$f(x, y, z) = xy + xz + 2yz + \frac{1}{x}$$

Problem 1. Find the gradient of f.

- Problems 1-4 are based on textbook problem 14.1e from the textbook, assigned for homework.
- Take a look at Sections 3 and 4 of Lesson 16 for the relevant definitions.
- Be careful when taking partial derivatives.

Problem 2. Find the Hessian of f.

Problem 3. $(-1, \frac{1}{2}, \frac{1}{2})$ is a critical point of f. Find the principal minors of f at $(-1, \frac{1}{2}, \frac{1}{2})$.

Problem 4. Classify the critical point $\left(-1, \frac{1}{2}, \frac{1}{2}\right)$ as a local minimum, local maximum, or saddle point. Briefly explain why.

Problem 5. Suppose a company sells one product in two markets. Let

Q_1 = number of units produced for market 1 $\qquad$ Q_2 = number of units produced for market 2

P_1 = unit price in market 1 $\qquad$ P_2 = unit price in market 2

$R_1 = P_1 Q_1$ = revenue from market 1 $\qquad$ $R_2 = P_2 Q_2$ = revenue from market 2

C = cost of production

Assume $Q_1 = -2P_1 + 40$, $Q_2 = -3P_2 + 48$, $C = 10(Q_1 + Q_2)$.

Suppose the company decides to sell in both markets at the same time. Write the profit as a function of Q_1 and Q_2, the number of units produced in markets 1 and 2. Do not find the maximum profit.

- This problem is based on textbook problem 15.3c, assigned for homework.
- Also see Section 2 of Lesson 7 for a similar example.