

Urban Economics: EC 3381

National University of Singapore, Spring 2012

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Problem Set 4

(To be discussed in Week 10 and 11)

Question 1. Exercise 6.1 and 6.2

Question 2. Suppose for this problem that there are no congestion taxes. Consider a different demand function. Assume that

$$\begin{aligned} D(Q) &= 5, Q \in [0, 10] \\ &= 0, Q > 10. \end{aligned}$$

This demand is perfectly elastic at a price of 5 time units up to 10 drivers. An interpretation of this demand is that there are 10 drivers each with the same willingness to pay of 5 units of time to use the road.

(a) Suppose that initially capacity $X = 1$. What is the equilibrium number of drivers and the equilibrium time cost. Graph your answer.

(b) Suppose that capacity is raised to $X = 2$. What is the new equilibrium number of drivers and the new equilibrium time cost? Suppose it is costly to raise capacity to $X = 2$ compared with $X = 1$. What can you say about the welfare effects of this capacity expansion?

(c) You are in charge of the department of transportation. Assume you cannot impose a congestion tax. You get to pick capacity X and the cost per unit of capacity is $c = 25$ in units of time. Your choice of capacity can be any level $X \geq 0$ (and not just the levels $X = 1$ and $X = 2$ considered so far). What is the optimal level of capacity in this case?

(d) Suppose instead that the cost of capacity is

$$c = \frac{25}{32}.$$

Show that the optimal capacity is $X^* = 8$. What is the equilibrium time spent in traffic? What is total surplus net of highway construction costs?