

1. A catering company needs to serve food to as many people  $Q$  as possible subject to their budget of  $B = 100$ . They need to provide the food,  $F$ , as well as the cooking staff,  $S$  (can have partial units of  $F$  and  $S$ ). Each unit of food costs  $P_F$  and each staff member costs  $P_S$ . The relationship between the inputs  $F$  and  $S$  and people served  $Q$  is  $Q = FS$ . The company needs to choose  $F$  and  $S$  to maximize  $Q$  while still staying below their budget of  $B = 100$ .

- What is the objective function for this problem?
- What is the constraint?
- Which of the variables,  $\{B, F, S, Q, P_F, P_S\}$ , are exogenous? Which are endogenous? Explain.
- Write a complete statement of the constrained optimization problem.

2. Suppose that you are selling computers and you can allocate your budget to either internet or television advertising. You want to maximize new sales generated, which is determined by the following function:

$$S(I, T) = \ln \left( (4I + 1)(1 + T)^2 \right)$$

where  $I$  is the number of dollars spend on internet and  $T$  is the number of dollars spent on  $T$ . Suppose you have just received an extra \$1 to to spend and you have to spend it all on I or all on T, how would you want to spend it if you currently have (Hint: calculate marginal sales generated from the additional \$1 on each option.)

- $I = 0$  and  $T = 0$
- $I = 5$  and  $T = 0$
- $I = 0$  and  $T = 5$
- $I = 5$  and  $T = 5$

3. Suppose the supply curve for pizza is given by  $Q^S = 20 + 4P$ , where  $Q^S$  is the quantity offered for sale when the prices is  $P$ . Also, suppose the demand curve for pizza is given by  $Q^D = 100 - 3PI$ , where  $Q^D$  is the quantity of pizza demanded when the price is  $P$  and the level of income is  $I$ . Assume  $I$  is an exogenous variable.

- Using algebra, determine the equilibrium price and quantity in terms of the exogenous variable  $I$ .
- Explain why the market for pizza would not be in equilibrium if the price of pizza were 8 and  $I = 4$ .
- Now suppose that income rises from  $I = 4$  to  $I = 12$ . Using comparative statics analysis, find the impact of the change in income on the equilibrium price and quantity of pizza.
- Calculate the income elasticity of demand for at the equilibrium when income is  $I = 4$  and also when income is  $I = 12$ .

4. Consider the following supply and demand curves for cameras:

$$Q^S = 20 + 2P_C - 15P_S$$

$$Q^D = 100 - 3P_C + 20P_S$$

where  $P_S$  is the cost of smartphones and  $P_C$  is the cost of cameras.

- Determine the equilibrium supply and demand in terms of the variable  $P_S$ .
- Using comparative statics, discuss how the equilibrium price and quantity change as the price of smartphones changes.
- Determine the price elasticity of supply and price elasticity of demand as a function of  $P_S$ .
- Let  $P_S = 1$ , for what values of  $P_C$  is the price elasticity of demand elastic, unitary elastic, and inelastic?
- Determine the cross-price elasticity of demand for cameras with respect to the price for smartphones  $\varepsilon_{Q^D, P_S}$ , what can we say about smartphones and cameras (demand substitutes or complements)?

5. Which of the following statements suggest a positive analysis and which a normative analysis? Please explain.

- A professional sports team in Tucson would increase economic activity in Pima County.
- Termination of non-stop flights between Tucson and Los Angeles will decrease housing prices in Tucson.
- Adding more bicycle lanes in Tucson will increase the number of residents that bike.
- University of Arizona should increase the price of football tickets because it would increase revenues.

6. For the following pairs of goods, would you expect the cross-price elasticity of demand to be positive, negative, or zero? Briefly explain.

- Electricity and Air Conditioners.
- Solar Power and Coal Power.
- Airplane Tickets and Train Tickets.
- Paper clips and Bicycles.
- Cell phone data plans and smartphones.

7. In each of the following pairs of goods, identify the one which you would expect to have a greater price elasticity of demand. Briefly explain.

- Toyota Corollas vs. 4-door cars in general.
- Flights from Chicago to Milwaukee versus Flights from Chicago to Hawaii.
- A refrigerator in the long-run versus the short-run.
- Paper clips or tickets to the movies.