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1. (20%) Assume that a consumer purchases goods 1 and 2 with the amounts x_1 and x_2 respectively. The consumer's utility function is $u(x_1, x_2) = \sqrt{x_1} + x_2$. The prices for goods 1 and 2 are $(p_1, p_2) = (1,8)$ and his budget is 15.

(a) (10 %) We say the consumer prefers averages to extremes if any proportional combination of the two indifferent bundles of goods will be preferred to the initial bundles. Determine whether the consumer prefers averages to extremes or not.

(b) (10 %) If the price p_1 of good 1 rises to 4, please compute the consumer's compensating variation.

2. (20%) Consider the production function $f(L,K) = LK^3 + K^4$ defined on $L > 0,\ K > 0$.

(a) (10 %) Does the isoquant $q = f(L,K)$ reflect diminishing marginal rates of technical substitution ?

(b) (10 %) Compute the elasticity of substitution for $q = f(L,K)$.

3. (10 %) Suppose a firm hires L hours of labor services and rents K hours of machine services. Assume that the firm's production function $f(L,K)$ defined on $L \geq 0,\ K \geq 0$ exhibits increasing returns to scale and the wage of labor and the rental rate of capital are constant in the long run. Does the firm face economies of scale, no economies of scale, or diseconomies of scale?

4. (30%) A monopolist faces two consumers. The inverse demand $p_1=100-y_1$ describes the willingness to pay for the 1st consumer and $p_2=80-2y_2$ for the 2nd one, where y_i is the number of units purchased by the ith consumer. The firm faces no costs in production.

(a.) (10%) Suppose the firm only charges a uniform price p for any units purchased by either person. Find the social welfare in this case.

(b.) (10%) Suppose the firm exercises a two part tariff $T_i=A+py_i$. That is, it charges a fixed fee of A in addition to a uniform price p for any additional units purchased by each consumer. Find again the social welfare.

(c.) (10%) Suppose the firm can charge consumers with a nonlinear price schedule $T_i=f(y_i)$. As a result, consumer i pays T_i for purchasing y_i units where T_i may not necessarily be a linear function of y_i. Find the social welfare.

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5. (20%) Three firms (1, 2 & 3 respectively) sell identical products to an industry with the inverse demand $P=a-Q$, where P and Q are the price and total output separately. Each firm produces with a constant marginal costs $c_1=c-\varepsilon$, $c_2=c$, and $c_3=c+\varepsilon$ respectively with $a-c>\varepsilon>0$. The three firms are engaged in a quantity competition and let (q_1, q_2, q_3) be the quantity choices of the three firms.

(a.)(10%) Solve the Nash equilibrium output levels for each firm.

(b.)(10%) Suppose Firm 1 is a public firm so that its objective is to maximize the total social welfare while keep itself break-even. Again find the Nash equilibrium output levels for each firm in this mixed market.