

ECON 391
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Winter 2019, Assignment 1

The due date is Thursday, February 14th at 10:15 am, in class or in my mailbox. The assignment can be done in groups of up to three people. Only one group member needs to submit the assignment on behalf of the group.

1. (25 pts) The demand for and the supply of oil from Alberta's oil sands are $P = 120 - 0.5Q_D$ and $P = 1.5Q_S + 10$ respectively. These equations express the marginal social benefits and the marginal private costs. Thus, the supply function fails to incorporate the external costs associated with the production process of oil. These external costs are estimated to be $MEC = 5 + Q$.
 - (a) Find the competitive market equilibrium (market price and quantity) and calculate the total benefits, the total social costs and the total social surplus under the market equilibrium. (10 pts)
 - (b) Find the socially efficient equilibrium (efficient quantity and price) and calculate the total benefits, the total social costs and the total social surplus under the socially efficient equilibrium. (10 pts)
 - (c) What is the net social gain when the negative externality regarding the production process of oil is taken into account? (5 pts)
2. (20 pts) The following equations describe the willingness to pay of Anna, Bill, and Camille for a public park, where Q is the number of hectares for the park.

Anna's WTP:	$P_A = 5 - Q_A$
Bill's WTP:	$P_B = 8 - 2Q_B$
Camille's WTP:	$P_C = 4 - Q_C$

The marginal cost function to provide the park is given by,

$$MC = 3 + 3Q$$

- (a) Derive the market (aggregate) demand curve for the public park. What is the socially efficient provision (socially efficient number of hectares) for the park? Present the solution graphically. (15 pts)
 - (b) What are the possible reasons for which the market fails to provide the socially efficient quantity of the public park? Fully explain your answer. (5 pts)
3. (30 pts) A steel industry emits, among other harmful pollutants, carbon monoxide (CO). There are ten identical firms in this industry. Five of them are located near a city (urban area) while five of them are located in the country (rural area). They can install filters (scrubbers) in their exhausts to clean up part of their emissions. Their abatement costs

related to CO clean-up are described by $MAC_i = 600 - 12E_i$, where $i = 1, 2, \dots, 10$. The emissions of CO are locally dispersed. Due to higher population and structure density in the city, the marginal damage a unit of CO is causing in the urban area is higher than that in the rural area. More specifically these damages are described by $MD_U = 0.8E$ and $MD_R = 0.6E$.

- (a) Find the units of emissions these ten firms will emit if the CO emissions are left unregulated. How many units of emissions are released in each of the two areas? (8 pts)
 - (b) Find the aggregate marginal abatement cost functions for each of the two areas. (8 pts)
 - (c) What are the socially efficient levels of emissions in the urban and the rural areas? How many units of emissions must be abated (in each area) compared to the unregulated level so that efficiency will be achieved? (8 pts)
 - (d) If the government sets the pollution levels at the socially efficient levels of emissions in each of the two areas, calculate the total abatement cost per firm in each of the two areas. (6 pts)
4. (25 pts) Environment Canada is considering two projects to be undertaken in the near future. The BC projects focuses on restoring and improving fish access to high quality and healthy habitat in the Kootenay River and Columbia River watersheds in BC. The QC project concerns the protection of the natural environment and wildlife in the Côte-Nord region in QC. The costs and benefits of the two projects are represented in the following table (all the numbers are in million of dollars). Currently, the discount rate is 5%.

BC project		
Year	Cost	Benefit
0	\$10	\$0
1	-	\$4
2	-	\$4
3	-	\$3
4	-	\$3
5	-	\$3
6	-	\$3

QC project		
Year	Cost	Benefit
0	\$12	\$0
1	-	\$6
2	-	\$5
3	-	\$4
4	-	\$3
5	-	\$2

- (a) Find the present value of net benefits and the benefit-cost ratio of the two projects. (10 pts)
- (b) Assuming the Environment Canada can only undertake one project, which one should that be? Justify your answer. (5 pts)
- (c) Will you change your recommendation in part (b) if the interest rate is 8%? Explain your answer and comment on your finding. (10 pts)