Economics 220, Jan 2022 **Your Name:** Dhyey Dharmendrakumar Marani
Homework 3

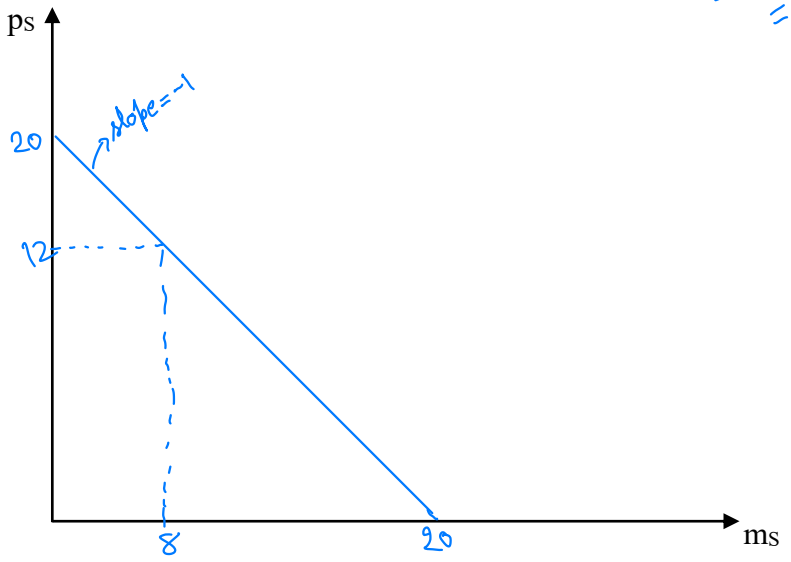
1. Sølvig absolutely detests mosquitos, and has the following demand function for mosquito control services:

$m_S = 20 - p_S$ or equivalently $p_S = 20 - m_S$

where m_S is the quantity of mosquito control Sølvig purchases (number of weeks per year that she runs her "mosquito magnet" machine, for example); and p_S is the price Sølvig pays for mosquito services; or alternatively, we can interpret p_S as the *marginal benefit* Solvig receives from a unit of mosquito services.

Sketch Sølvig's demand function. How much mosquito control will Sølvig purchase if the cost of mosquito control is p = 12 per unit?

$m_S = 20 - p_S$
$= 20 - 12 = 8$ Ans

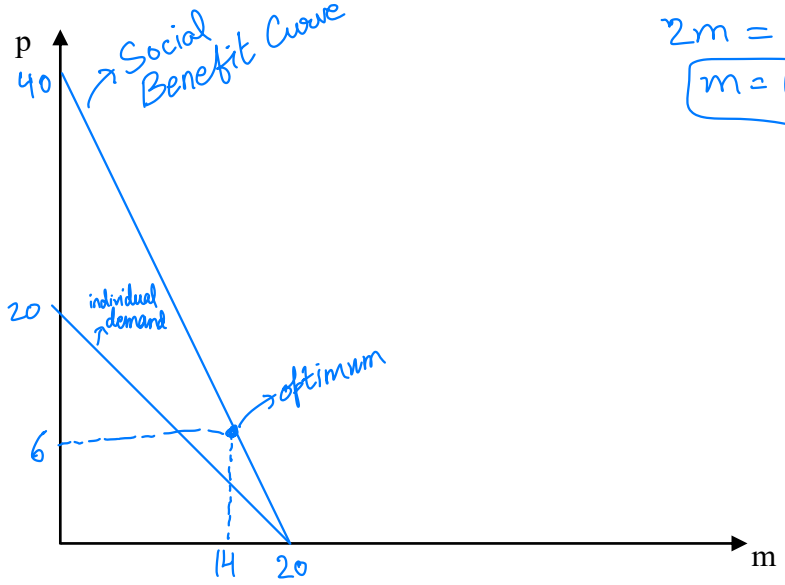


2. Sølvig's neighbor Thrainn, like Sølvig, also hates mosquitos with a raging passion that is reflected in an identical demand function:

$$p_T = 20 - m_T$$

Mosquito control, m, is an example of a public good: both Sølvig and Thrainn benefit from mosquito control services purchased by either of them ($m_S = m_T = m$). Sketch the social demand for this public good. What is the socially optimal level of mosquito control (given that the cost of mosquito control, p, is still \$12 per unit)?
[remember, to find the "social demand" for a public good we need to sum the demand curves vertically]

Social Benefit $= 2(20 - m)$
$= 40 - 2m = 12$
$2m = 28$
$m = 14$



3. Four towns share a common water source. By buying open land along the watershed (area from which the water flows) the towns can preserve its purity from sewage, road runoff, etc. The land demand schedule for each town based on water treatment costs saved can be expressed as

$$P = \$34{,}000 - 10Q_d$$

where Q_d is the number of acres of land purchased and P is the price the town would be willing to pay (ie., the marginal private benefit to the town).

If the cost of land is $30,000 per acre, how much land will be purchased if each town acts independently?

Case 1 — if towns ignores existence of others:

Q_d by one town $= \frac{34000 - P}{10}$

Q_d by 4 towns if act independently $= 4\left(\frac{34000 - 30000}{10}\right) = \boxed{1600}$

Case 2 — if each town considers the positive externalities of other towns:

Once one of the towns has preserved 400 acres, other towns already benefit from them, so at 30000$/acre according to the individual demand curve the individual quantity demanded will be 400 acres. This is due to positive externality, but we cannot say about how these 400 will be distributed among 4 towns.

How much land will the towns purchase if they form a joint commission for land purchases? (a graph may be useful)

$$\text{Social Benefit} = 4(34000 - 10Q) = 30000$$

$$\Rightarrow 34000 - 10Q = 7500$$

$$\Rightarrow 10Q = 26500 \Rightarrow \boxed{Q = 2650}$$

What is the socially efficient solution and why?

Jointly Buying land would be a socially efficient solution as everyone will get access to more land (2650 acres) and it takes into consideration all 4 towns as part of a positive externality.

How would the answers change if the price of land was $36,000 per acre?

individual case with new price

if the price of land was $36000 per acre, then it would not make sense to buy land individually because at this price the individual town-wise quantity demanded comes negative from the formula, which means its zero.

joint commission case with new price

$4(34000 - 10Q) = 36000$ (9000)

$25000 = 10Q$

$Q = 2500$ → socially efficient quantity achieved by collaboration.

Thus, this will be new social optimum.