**Individual assignment I (answer sheet): Supply and Demand, Efficiency, Market failure**

**Task 1 – Market demand and supply**

Suppose the market demand function (expressed in Euros) for a normal product is P = 80 – q, and the marginal cost (in Euros) of producing it is MC = 1q, where P is the price of the product and q is the quantity demanded and/or supplied.

1. How much would be supplied by a competitive market?

Set MC=P, so 80 - 1q = 1q. Solving for q finds that q = 40 and P = 40.

1. Compute the consumer surplus and producer surplus. Show that their sum is maximized.

Consumer surplus is 40\*40/2 = 800. The producer surplus is similarly 800. The total economic surplus is 800 + 800 = 1600.

**Task 2 – Water demand and optimal allocation**

Two agents have the following marginal benefit functions for retail water:

* + MBA = 300 – 5w1
	+ MBB = 200 – 2w2
1. units of water are available in the economy for allocation between these agents.
2. What is the allocation of water between the two agents at which their marginal benefits are equal? Is it Pareto-optimal?
	* + Optimal allocation mean equalizing marginal benefits of agents: MBA = MBB.
		+ 300 – 5w1 = 200 – 2w2 → Express w1 in terms of w2 and plug into w1 + w2 = 76.
		+ W1 = 36, w2 = 40
		+ MBA = MBB = 120
		+ The allocation is Pareto-optimal as the benefit of none of the two agents can be increased without decreasing the benefit of the other → Tip: verify using Excel
3. What are the respective benefits for agents A and B in this case and what is the total welfare (aggregated benefit) in the economy?

Take the integral of the individual marginal benefit functions and fill in the allocation of water.

Benefit B1 = 7560

Benefit B2 = 6400

1. Can the total welfare be further increased by reallocating the water between the two agents?
🡪 Tip: verify using Excel

No, total welfare cannot be increased further.

**Task 3 – Water demand**

1. Explain what it means if a household is elastic in their (tap) water demand. Indicate the range in which the elasticity parameter Ɛ will lie for an elastic water demand.

Elastic means that if the price changes, demand also changes. If a household is elastic in water demand, it will demand less water when the price increases. The parameter Ɛ will be lower than -1 in the case demand for water is elastic. This means that the reduction in demand for water is relatively larger than the increase in the price of water.

1. Explain, using economic arguments, why a high income household could be more elastic in water demand than a lower income household.

Water is used for essential purposes (bathing, washing, drinking). It is a necessity. But you can also use it for other (luxury) things.

Low-income households may spend a larger proportion of their budget on necessities than high-income households. High-income households might use water also for other things.

Thus, high-income households may be more elastic because they can more easily reduce their consumption of water than low-income households.

**Task 4 – Water supply**

Customers A and B have the following demands for retail water:

* + wA = 1200-2p
	+ wB = 600-p

w’s represent thousands of liters of water and p is €/thousands of liters of water. The profit-maximizing utility supplying both customers has marginal processing costs of €10 per thousand liters and it can deliver 960,000 liters in total.

1. How much water will the profit-maximizing utility supply at what price?

Aggregate water demand: W = 1200 – 2p + 600 – p → W = 1800 – 3p

Profit of the utility company: π = revenue – costs → π = pW – cW → π = (p-c)W

Profit-maximization of the utility company: maximize(p – 10)(1800 – 3p) → solve for p

P\* = 305

W\* = 885.000

1. How should this water be divided between A and B?

WA\* = 590.000

WB\* = 295.000

1. Is there a surplus of water?

Surplus = 75.000

**Task 5 – Optimal allocation**

Suppose the state is trying to decide how many kilometers (km) of a scenic river it should preserve.

There are 100 people in the community, each of whom has an identical inverse demand function given by P = 10 – 1.0q, where q is the number of kms preserved and P is the per-km price he or she is willing to pay for q kilometers of preserved river.

1. If the marginal cost of preservation is €500 per km, how many km would be preserved in an efficient allocation?

This is a public good, so add the 100 demand curves vertically. This yields P = 1000 – 100q. This demand curve would intersect the marginal-cost curve when P = 500, which occurs when q = 5 km.

1. How large is the economic surplus?

The economic surplus is represented by a right triangle, where the height of the triangle is €500 (€1000, the point where the demand curve crosses the vertical axis, minus €500, the marginal cost) and the base is 5 km. The area of a right triangle is ½ \* base \* height → ½ \* €500 \* 5 = €1250

**Task 6 – Market failure**

What is the definition of a market failure? Which different causes for market failure do you know?

Market failure is an economic situation defined by an inefficient distribution of goods and services in the free market. In market failure, the individual incentives for rational behavior do not lead to rational outcomes for the group. In other words, each individual makes the correct decision for him/herself, but those prove to be wrong decisions for the group.

**Task 7 – Natural monopolies**

Under which circumstance would a natural monopoly arise? Give an explanation for why the water utility company is often a natural monopoly.

A natural monopoly will typically have very high fixed costs, meaning that it is impractical to have more than one firm producing the good. An example of a natural monopoly is the water utility company. It makes sense to have just one company providing a network of pipes and sewers because there are very high capital costs involved in setting up a national network of pipes and sewage systems. To have two different companies offering water wouldn’t make sense as the average cost would be very high compared to just one firm and one network.