Problem Set 3

1.) Suppose there are two inputs in the production function, labor and capital, and these two inputs are perfect substitutes. The existing technology permits one machine to do the work of three persons. The firm wants to produce 100 units of output. Suppose the price of capital is €750 per machine per week. What combination of inputs will the firm use if the weekly salary of each worker is €300? What combination of inputs will the firm use if the weekly salary of each worker is €225? What is the elasticity of labor demand as the wage falls from €300 to €225?

2.) This problem accustomes you in working with a Cobb–Douglas production function with constant returns to scale, which is important for the study of labor demand. Assume a production function $F$ with the arguments $E$ (labor) and $K$ (capital), i.e. $q = f(E, K)$.

a) Let the production function be

$$f(E, K) = A \cdot E^\beta \cdot K^\alpha .$$

What is the elasticity of production, the marginal product (MP), and the average product (AP)? What is the link between MP and AP?

b) What do constant returns to scale imply for a Cobb–Douglas production function? Assume constant returns to scale in the following. Determine the cost minimizing labor and capital demand for given output and factor prices. What is the wage elasticity of labor demand? What is the elasticity of labor demand in response to changes in capital user costs? Show that the sum of factor remunerations equals the value of production.

c) Assume monopolistic competition on the market for the output good where the price elasticity of demand $\eta_{y,P}$ lies above unity. Determine the profit maximizing labor demand and the capital demand. Identify the substitution and the scale effect.

3.) Determine whether the following statements are true, false, or uncertain. Give reasons for your answer.

a) In a monopsonistic labor market, an increase in the minimum wage can lead to higher employment.

b) The labor demand for persons increases when the markup on wages for overtime is doubled.
c) Due to an increase of subsidies for solar energy production, the resulting increase in the demand for workers in solar energy is the higher the larger the elasticity of substitution in production.

d) Increasing the weekly hours during which machines are running results in an increase of employment in the steal industry.

e) For a limitational technology, a decline in capital user costs leads to higher employment.

4.) The union of the “Black Forrest Cuckoo Clock Workers” (BFC) faces a labor demand function, where an hourly wage of € 12 implies demand for 20,000 hours of work and an hourly wage of € 15 demand for 10,000 hours of wor Arbeitsstunden. The union of the “Freiburg Bread Bakers” (FBB) faces a labor demand function, where an hourly wage of € 18 implies demand for 30,000 hours of work and an hourly wage of € 15 demand for 33,000 hours of wor Arbeitsstunden.

a) Which labor demand curve is more elastic?

b) Which union is more successful in raising the total wage bill \( \equiv (\text{hourly wage}) \times (\text{total hours worked}) \)?

c) How plausible do you consider the qualitative results under a) and b)? Relate your answer to the elasticity of commodity demand and the substitution possibility in the production technology.

5.) Part–time workers receive a lower hourly wage than full–time workers in similar jobs. After a change of government, the new government plans to stop this discrimination. Discuss the employment effects of the following policy reforms. Make reasonable assumptions for your answer.

a) The government decides that all workers doing the same job should get the same hourly wage (“equal pay for equal work”).

b) The government decides that net hourly wages of part–time workers and full–time workers are equalized through progressive taxation.