Problem Set 13 (due date: 10.02.2014)

1. Consider a market for a homogeneous good with the inverse demand function $p = B - b\,x$ with the price p, the quantity x, and the positive parameters B and b. There are two potential competitors in the market, Firm 1 and Firm 2. The initial constant marginal costs are c_1 and c_2. An independent R&D lab auctions a new production technology which allows – without further investment – production with marginal costs of c.

   a) Determine the firms' equilibrium profits if both compete in quantities (Cournot competition).

   b) Assume that $c_1 = 5, c_2 = 10, B = 30$, and $b = \frac{1}{3}$.

      i. Determine each firm's maximum willingness to pay for the (exclusive) usage of the new technology if both firms compete in quantities and $c = 3$. Which firm has the higher willingness to pay?

      ii. How do results change for $c = 0$?

      iii. Which firm will buy the innovation with $c = 3$ and $c = 0$ if both firms compete in prices (Bertrand competition)?

      iv. Interpret and discuss your results from task (i), (ii), and (iii)!

   c) Now assume that $c_2 = \infty$. The other values from b) still apply.

      i. Determine the firms' maximum willingness to pay if $c = 4$. Assume that both firms compete in quantities if Firm 2 enters the market.

      ii. Determine the results if $c = 10$. Which firm will buy the technology?

   d) Explain in general why an incumbent will always buy the new technology even if the new technology does not yield a cost decrease, i.e. even if $c > c_1$. Interpret your conclusion economically. What outcome could we expect if both firms compete in prices (and $c_2 = \infty$)?

2. (Optional) Let the inverse demand for a particular product be given by $P = 250 - Q$. The product is offered by two Cournot firms each which has a current marginal cost of 100€. Both firms can invest a sum K to establish a research facility to develop a new process with lower marginal costs. The probability of success is ρ.

   a) Assume that the new process is expected to have marginal costs of 70€. Derive a relationship between K and ρ under which

      i. neither firm establishes a research facility

      ii. both firms establish a research facility

      iii. only one firm establishes a research facility

      [Hint: The Cournot profit is $\pi_i^{Cournot} = (B - 2c_i + c_j)/(9)b]$

   b) Under what circumstances is there "too much" R&D in that both firms spend on R&D whereas aggregate profit is greater if only one firm does so?

   c) Under what circumstances is there "too much" R&D in that neither firms spend on R&D whereas total surplus is greater if at least one firm does so?