NTNU
Department of Industrial Economics and Technology Management
Spring 2020

TIØ4285 Production and Network Economics
Assignment 4

Out: Thursday 6 February
In: Thursday 13 February 6pm
Supervision: Monday 10 February 4:15pm A31

Note that late exercises will not be approved.

Exercise 1. Cournot oligopoly with capacity constraints

Consider an oligopoly with N suppliers who produce and sell a commodity to a market. Supplier *i* has production cost function $c_i(q_i) = c_i q_i + \frac{1}{2} d_i (q_i)^2,\ with\ c_i, d_i \geq 0$, and a limit to production given by cap_i. The market price is given via $p = a - b \sum_i q_i$.

a. Set up the minimization problem for each supplier *i*.
b. Derive a complementarity problem using λ_i as dual variables for capacity constraints.
c. Determine the equilibrium price and quantities for the following parameter values: $N = 3, c_i = 2, d = \frac{1}{2}, a = 20, b = 1, cap_i = 5.$
d. Install GAMS (www.gams.com/download). Implement the model derived in part b. and solve it for the following parameter value combinations. Present the solution values in table form.

	1	**2**	**3**	**4**	**5**	**6**
parameter	**value**	**value**	**value**	**value**	**value**	**value**
N	3	3	3	3	4	4
a	20	20	20	20	20	20
b	1	1	1	1	1	1
c_i	2	1	1	1	1	2
cap_1	5	5	3	3	3	3
cap_2	5	5	3	4	3	3
cap_3	5	5	3	5	3	3
cap_4					3	3
variable						
p						
q_1						
q_2						
q_3						
q_4						
λ_1						
λ_2						
λ_3						
λ_4						

Discuss briefly for each supplier how MR=MC in each outcome.
Is the capacity limit restrictive in the last column?

Exercise 2. Social welfare maximization

In TIØ 4130 (& TIØ 4150) you have worked with XPRESS

Implement and solve the social welfare maximization problem discussed in the lecture.

Use parameter values $a = 20, b = 1, c = 2, d = 0.5$.

What are total supply, market price and social welfare in the equilibrium outcome?

Hints:

uses "mmxprs","mmquad"

declarations

    Q: mpvar;

    SW: qexp;

end-declarations