



## Homework 4

due October 15, 2018

Homework must be submitted before the beginning of the lecture in piles by group number on the due day. Submissions in any other way or time will be ignored. Your name and your group number must be clearly visible on the TOP-RIGHT CORNER of your paper. Any paper which does not resemble work by a student of a world-class institution (not in A4 sheets, not clean, illegible, unnamed, unstapled, unlabeled tasks, final results not in boxes etc.) will be penalized with up to 50 points at the discretion of the grader. Do not submit your work in plastic covers. Copying in homework will be penalized with a 0 in that assignment and an additional penalty of 10 points in the course homework average. Students who give their homework away for others to copy from will be penalized with 0 in that assignment and a penalty of 30 points in their course homework average. Repeated offenders will be terminated from the course.

1. Two firms produce differentiated goods and compete by simultaneously setting prices. The demand for firm 1 output is  $q_1 = a - bp_1 + dp_2$ , and for firm 2 is  $q_2 = a - bp_2 + dp_1$ . Costs are  $c_1$  and  $c_2$ .
  - (a) What is the equilibrium profit of each firm? [10p]
  - (b) Show that the firms wish their products to be as homogeneous as possible and explain why this happens. [10p]
  - (c) Assume that the two firms colluded. What would be their profit? [5p]
  
2.  $M$  is a monopolist in a market protected by exogenous barriers. The market demand is  $p = 12 - q$  and cost is zero.
  - (a) Calculate the equilibrium price, quantity and profits for  $M$ . [5p]
  - (b) The industry regulator announces that next period the barriers will be uplifted and any firm can enter this industry. Firm  $E$  is the only firm considering entry. Find the equilibrium price, quantities and profits if the industry becomes a Cournot duopoly. [5p]
  - (c) Find the equilibrium price, quantities and profits if the industry becomes a Stackelberg duopoly with  $M$  leading. [5p]
  - (d) Assume now that the regulator charges a fee  $f$  per period to  $E$  for the use of the public distribution network that  $M$  has helped develop, while  $M$  (as a developer) is allowed to access it for free. Find the fee  $f^C$  such that  $E$  will marginally abort entering in a Cournot duopoly market with  $M$ . [10p]
  - (e) Find the fee  $f^S$  such that  $E$  will marginally abort entering in a Stackelberg duopoly market with  $M$  as a leader. [10p]
  
3. Consider the following entities, each belonging to an entirely different market with identical linear demands and have identical constant MC: (A) a Cournot duopolist; (B) a Stackelberg leader; (C) a single-price monopolist; (D) a first-degree price discriminating monopolist; (E) a Bertrand duopolist; (F) a PC firm.
  - (a) Show algebraically which entity/entities will sell the highest quantity. [10p]
  - (b) Show algebraically which entity/entities will sell at least one unit at the highest price. [10p]
  - (c) Explain which of the above market/s will exhibit the lowest deadweight loss. [5p]
  - (d) Explain which market/s will yield the highest consumer surplus. [5p]
  
4. Two firms compete by sequentially setting quantities in an industry where the market demand is  $q = A - p$ . Firm L moves first and has cost  $C_L = cq_L$ ; Firm F moves second and has zero costs. What is the value of  $c$  that makes the two firms' optimal outputs equal? [10p]

Good afternoon!

*"...but Bill Gates, Steve Jobs, Mark Zuckerberg and many others became successful without being good students. Work experience is what matters, not education."* This is what many students who ruin their student performance for the sake of some job say in order to rationalize their choices. It is wrong in several levels:

1. Gates, Jobs, Zuckerberg and others are the 0.1% of dropouts who knew what they were doing and became successful on their own. The rest 99.9% would earn more if they had stayed in education.
2. Gates, Jobs, Zuckerberg and others did not look to be hired. They created their own paths, started their own companies and shaped new industries. This involved risks. Today, we know their names because the risks they took came up. Some equally competent people took similar risks who did not come up and thus no one heard about them.
3. Gates, Jobs, Zuckerberg and others did not drop out because they were failing with their studies. They dropped out because their area of interest was new, very fast developing and the knowledge they would have acquired at the university was not useful in the pursuit of their goals.
4. Finally, Gates, Jobs, Zuckerberg and the others did not "half-ass" their studies because they needed a diploma to add in their CV. They understood that their priorities were different; they dropped out of university completely and pursued their plan full-time. Because successful people do something right or they do not do it at all.

So, graduating with 4/10 does not make you Bill Gates, Steve Jobs or Mark Zuckerberg.

Kosmas

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*Estimated completion time: 120 min*

*Difficulty level (normalized to exam standards): 1. 5/5 2. 7/5 3. 5/5 4. 5/5*