

# Winter Retake Exam

## January 2018

First Name: \_\_\_\_\_

Last Name: \_\_\_\_\_

Group: \_\_\_\_\_

### Rules

1. Pages 2 – 5 contain tasks. Page 6 is intentionally blank and can be used for scratch paper.
2. Answer all tasks. Time: 90 min.
3. The space below each task indicates the *length of the right answer*. Use only this space.
4. Keep your answers *short and up-to-the-point*. Points will be taken off for redundant information.
5. Write in neat English handwriting. Anything I cannot read or understand in the first attempt is wrong.
6. Use only *blue* or *black* pen – no other colors.
7. You may use a non-programmable electronic calculator.
8. According to ICEF's rules, for examinations lasting less than 120 min students are NOT allowed to leave the examination room until ready to turn in their paper.
9. During the exam you are not allowed to have within your immediate reach a *phone* or an *peripheral of a phone* or any other *communication device* or any unauthorized by the examiner *written or printed material*. If such material is detected, you will be prosecuted for cheating independently of its function or its relevance or its use or its intention to use.
10. Your paper will be immediately voided in case of *any kind of communication* with another examinee or contact with *another examinee's paper* or for *facilitating access* to your paper. Your paper may be voided *after the fact*, in case cheating is verified by the cameras located in the examination room.

*I have read and understood the examination rules. I pledge on my honor that I will not cheat, copy, or use unauthorized materials or devices.*

Date and signature: \_\_\_\_\_

*Papers with unsigned honor pledge will receive zero.*

*Καλή επιτυχία! – Good luck! – Удачи!*

1. The profit of a firm can take one of two values,  $\Pi_1$  and  $\Pi_2$ , where  $\Pi_2 > \Pi_1$ . The firm is run by a manager who chooses between two levels of effort,  $e = 1$  (high) and  $e = 0$  (low). The manager's utility function is  $U = w^{1/2} - e$ , where  $w$  is her wage. Whether the firm makes  $\Pi_1$  or  $\Pi_2$  depends on the manager's effort and on the firm's environment, which is uncertain. In particular, if the manager's effort is high, the profit is  $\Pi_2$  with probability 0.8 and  $\Pi_1$  with probability 0.2. If the manager's effort is low, the profit is  $\Pi_2$  with probability 0.3 and  $\Pi_1$  with probability 0.7. Before the manager decides on the level of effort, the owners of the firm choose a contract for the manager which specifies the value of  $w$  for each of the two possible values of  $\Pi$ . The owners' objective is to maximize expected net profit  $E(\Pi - w)$ . Given the incentive scheme chosen by the owners, the manager decides whether to take the job and, if she accepts, chooses  $e$  to maximize her expected utility  $E(U)$ . Her reservation wage is  $w_0 = 4$ . After the manager has made her choice, the profit is observed and the manager gets paid.

(a) What is the optimal contract if the owners can observe the manager's effort? [9p]

(b) What is the optimal contract if the owners cannot observe the manager's effort? [9p]

(c) If the owners cannot observe the manager's effort, how much would they be ready to pay to a professional auditor who can tell the exact level of manager's effort? [7p]

2. Consider a *prisoner's dilemma type of game* between agents H and M, who can either *collude* or *cheat*. Both agents have discount factor  $\delta = 0.95$ . It is a fact that this game will be repeated exactly 3 times (rounds) and afterwards the agents will never have any other interaction. It is common knowledge that H believes that the game will last infinitely. M knows that the game will last for 3 rounds. M also knows that H believes that M believes that the game will last infinitely. Predict the outcome of this game in every round. [10p]

3. Consider the following static game between Alice and Beatrice.

		Beatrice	
		<i>Odd</i>	<i>Even</i>
Alice	<i>Red</i>	0 , 1	1 , 0
	<i>Black</i>	1 , 0	0 , $a$

- (a) Find the NE for this game (pure or mixed). [10p]

- (b) Graph the strategies of the two players in the appropriate graph assuming that  $a > 1$ . [5p]

4. Firm 1 and firm 2 compete by simultaneously setting prices. The demand for firm 1 is  $q_1 = a - bp_1 + dp_2$ , and the demand for firm 2 is  $q_2 = a - bp_2 + dp_1$ . Assume that costs are zero.

(a) Find the equilibrium profit of each firm. [6p]

(b) Show that the firms wish their products to be as homogeneous as possible. [6p]

(c) Imagine that instead of two there are  $N$  firms. Demand for any firm  $i$  is  $q_i = a - bp_i + d\bar{p}$ , where  $\bar{p}$  is the average price set by firms other than  $i$ . What are the equilibrium prices? [7p]

(d) Are consumers better off as the number of firms increases? [6p]

5. Maria is asked to go to the prom by two different guys: Pyotr and Vladimir. She thinks who she likes more and chooses to go with Pyotr. After she makes this decision and before she announces it to either man, Evgeniy makes her an offer, too. Maria thinks about it again and decides to go to the dance with Evgeniy. State the independence VNM axiom and explain if Maria violates it. [6p]

6. Create a game bi-matrix in which a mixed strategy strictly dominates a pure strategy. [5p]

7. The kinked demand model.

(a) Explain how the model works. Use a graph to demonstrate. [7p]

(b) Describe how the model can be used to explain the behavior of firms in a price-war context. [7p]

Scrap paper (write your name if you de-attach this page from the booklet): \_\_\_\_\_