i Candidate instructions

ECON3220/4220 – Microeconomics 3

- Written examination
- Thursday, 12 December 2024 at 15.00 (3 hours)

About the exam

- The examination consists of four questions with several sub-questions.
- Question 1 counts for 10%, question 2 counts for 20%, question 3 counts for 40% and question 4 counts for 30% of the exam grade.
- The examination text is in English and you submit your response in Norwegian, Danish, Swedish or English.

Digital candidate instruction

You will find candidate instructions for the school examination as an external resource in the text. The candidate instructions show how UiO conducts the school examination.

Examination support material

- Open book examination, where all printed and written resources are allowed.

Digital sketches

- You may use sketches on all questions.
- You are to use the sketching paper handed to you.
- You can use more than one sketching sheet per question.
- Read the instruction for filling out sketching sheets below.
- You will NOT be given extra time to fill out the "general information" on the sketching sheets (task codes, candidate number etc.)

After the exam:

You will not have access to your answer right after the exam. The reason is that the sketches must be scanned into your answer. You will have access to the answer after approx. 2-3 days. You are encouraged to check your answer and see that all scantron sheets have been included and are correctly placed. If something is not correct, you must immediately send an email to post@econ.uio.no.

1 Define and explain the following terms:

- auction,
- pure strategy,
- mixed strategy,
- Nash equilibrium.

1 Answer to Question 1

Fill in your answer here

Format

Words: 0

Maximum marks: 0

2 Two agents engage in activities to influence the outcome of a decision process (think, for example, of the allocation of a right to exploit a natural resource). The effort exerted by agent *i* is denoted $e_i \geq 0$, *i* = 1,2. The agents decide simultaneously how much effort to exert. The agent exerting the most effort succeeds in tilting the outcome of the process to his or her advantage; specifically, if $e_1 > e_2$, agent 1 receives the value $v_1 > 0$, while agent 2 receives zero; correspondingly, if $e_2 > e_1$, agent 2 receives the value $v_2 > 0$, while agent 1 receives zero; if $e_1 = e_2$, both agents receive zero. Values and efforts are measured in the same unit.

a)
Explain why the payoff to player *i* is $v_i - e_i$ if $e_i > e_j$ and $-e_i$ if $e_i \leq e_j$, $i, j = 1, 2, i \neq j$.

b)
Explain why this set up (or game) may be analysed as an all-pay auction.

2(a) Answer to Question 2a)

Fill in your answer here

Format B I U x_2 x^2 I_x Ω Σ

Words: 0

Maximum marks: 0

2(b) Answer to Question 2b)

Fill in your answer here

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Words: 0

Maximum marks: 0

3 We continue with the set up presented in question 2, and suppose it is common knowledge that $v_1 = v_2 = v$.

a)

Explain why there does not exist a Nash equilibrium in pure strategies.

b)

Explain that in any mixed-strategy equilibrium the expected payoff to each agent must be zero (hint: consider the expected payoff at the lower bound of the support of the mixed strategies).

c)

Consider a symmetric mixed-strategy equilibrium in which agent $i, i = 1, 2$, chooses e_i according to the probability function (or cumulative distribution function) $F(e)$, with $F(0) = 0, F(v) = 1$ and $F'(e) > 0$ for all $e \in [0, v]$. Demonstrate that the expected payoff from exerting effort e is $F(e)v - e$, that $F(e) = \frac{e}{v}$ (i.e. *F* is uniform) and that $Ee = \frac{v}{2}$. What is the expected total amount of effort spent? Explain.

d)

Suppose the amount of effort exerted by any agent is capped, i.e. $e_i \leq \bar{e}, i = 1, 2.$ Discuss how the cap affects the outcome. Restricting attention to the two agents, does the cap increase efficiency?

3(a)

Answer to Question 3a)

Fill in your answer here

Format

Words: 0

Maximum marks: 0

3(b)

Answer to Question 3b)

Fill in your answer here

Format

Words: 0

Maximum marks: 0

3(c)

Answer to Question 3c)

Fill in your answer here

Format

Words: 0

Maximum marks: 0

3(d) **Answer to Question 3d)**

Fill in your answer here

Format B I U x_2 x^2 I_x

Ω Σ

Words: 0

Maximum marks: 0

4 Again in the same set up as in question 2, suppose now that it is common knowledge that the values v_1 and v_2 are independently and uniformly distributed between zero and v.

a)

Consider a symmetric equilibrium in which agent i spends effort according to the function $e_i = e(v_i), i = 1, 2.$. Demonstrate that the expected payoff to agent i is given by $Pr\{v_j \leq e^{-1}(e_i)\}v_i - e_i, i, j = 1, 2, j \neq i$ (where e^{-1} is the inverse function of e) and show that $e(v_i) = \frac{1}{2v}v_i^2$. What is the expected total amount of effort spent? Explain.

b)

Suppose again that the amount of effort exerted by any agent is capped, i.e. $e_i \leq \bar{e}, i = 1, 2.$Discuss how the cap affects the outcome. Does the cap increase efficiency?

4(a)
# Answer to Question 4a)

Fill in your answer here

Format B I U x_2 x^2 I_x Ω Σ

Words: 0

Maximum marks: 0

4(b)

Answer to Question 4b)

Fill in your answer here

Format

Words: 0

Maximum marks: 0