Exam in ECON5200/9200B, Fall 2021
Problem 1
Weight: 40%, with equal weight on each subproblem.

Please read carefully "Back to Fundamentals: Equilibrium in Abstract Economies" by Michael Richter and Ariel Rubinstein, in the *American Economic Review* 105(8): 2570–2594.

1. Explain in your own words the concept of "convex economy." What is the advantage of adopting such concept? Is an Edgeworth-box economy—defined in Section 15.B of Mas-Colell et al.—a convex economy?

2. At p. 2579, the authors make the following claim "In standard economic models, where the set is a subset $\mathcal{X}$ of an Euclidean space, the following hold: (i) The set of linear orderings generates the convex geometry. (ii) The public ordering (price system) is a linear ordering." Prove their claim.

3. Explain the authors' extension of the first fundamental theorem of welfare economics (Claim 5, (i)) for an exchange economy and compare it to Proposition 16.C.1 from Mas-Colell et al.

4. Consider the problem of allocating the desks of the open-space office at Ullevål to the faculty of the economic department. Formalize the setting and discuss what the results of the paper tell about the equilibria of this problem.

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Problem 2

Weight: 36%,
with weight 6% on subproblems (a), (b), and (d),
and with weight 18% on subproblem (c).

Please read carefully "Aggregation and Linearity in the Provision of Intertemporal Incentives" by Bengt Holmstöm and Paul Milgrom, in *Econometrica* **55** (1987), 303–328.

(a) Consider the hidden action model in Section 14.B of Mas-Colell et al. where effort is not observable. Provide an example of distributions $F(\pi|e_H)$ and $F(\pi|e_L)$ on $[\underline{\pi}, \bar{\pi}]$ such that the former first-order stochastically dominates the latter, but where the optimal compensation scheme for implementing e_H is not monotone.

(b) In the same model, provide an example of distributions $F(\pi|e_H)$ and $F(\pi|e_L)$ on $[\underline{\pi}, \bar{\pi}]$ such that the former first-order stochastically dominates the latter and where the optimal compensation scheme for implementing e_H is affine. Specify the assumptions that you make on the utility function $u(w, e) = v(w) - g(e)$.

(c) The paper by Holmström and Milgrom is motivated by the apparent fact that real-world compensation schemes are simple, when compared to, e.g., the kind of optimal compensation scheme you have derived under point (a). Provide a detailed description of their analysis.

(d) Discuss other reasons why real-world compensation schemes are simpler than what the hidden action model in Section 14.B of Mas-Colell et al. implies.

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Problem 3

Weight: 24%,

with weight 6% on each subproblem.

Please read carefully "Optimal Auction Design" by Roger B. Myerson, in *Mathematics of Operations Research* **6** (1981), 58–73. While we learned mechanism design from Ch 23 in Mas-Colell et al., consider also Example 27.1 in Osborne & Rubinstein.

(a) Formulate the second-price auction of Example 27.1 in Osborne & Rubinstein as a Bayesian game and show that this game has a Nash equilibrium where all players bid their valuations.

(b) Consider now the same situation, but with the difference that $v_i - \max_{j \in N \setminus \{i\}} a_j$ is replaced by $v_i - a_i$. This turns the game into a first-price auction. Formulate this as a Bayesian game and characterize a symmetric Nash equilibrium.

(c) Use the paper by Roger Myerson to argue that the expected revenue for the auctioneer is the same for both auctions.

(d) Provide a general discussion of what assumptions this 'revenue equalization theorem' is based on.