Potential Questions for Exam in Game Theory — Spring 1999

Last update Appril 9, 1999 — Final list of questions

1. Define deterministic finite games in extensive form (class notes (1), pp. 5–6).
2. Define the finite deterministic game in normal form and give an example that relates game's extensive and normal forms. (class notes (2), pp. 1–2).
3. Define zero-sum games in Euclidean spaces (infinite games) with simultaneous decision making (saddle point solution). (class notes (2), pp. 3–5).
4. Define zero-sum games in Euclidean spaces (infinite games) with sequential decision making (minmax and maxmin solutions). (class notes (2), pp. 6–7, see also Chapter 4).
5. Define Nash strategies in Euclidean spaces, plot iso-cost curves and discuss the existence of Nash equilibria. (class notes (2), pp. 8–9, see also Chapter 4).
6. Define Stackelberg strategies in Euclidean spaces. (class notes (2), pp. 10–12).
7. Plot the iso-cost curves for Stackelberg strategies for the case when either player does better as the follower than the leader. (to be deduced from class notes (2), pages (8)-12)).
8. Define the Pareto (cooperative) strategies in Euclidean spaces (class notes (2), pages 12–13).
9. Define security strategies in normal (matrix) form zero-sum finite games and demonstrate them on a simple example. Define the lower and upper game values and discuss the existence of a saddle-point solution (class notes (3), pp. 1–4, Section 2.2).
10. Define mixed strategies in zero-sum finite games. Explain the need to mixed strategies, define mixed security strategies, and the saddle-point solution in mixed strategies. (class notes (3), pages 5–6, Section 2.2).
11. State and prove Lemma 2.1 (class notes (3), pp. 9–11, Section 2.2).
12. State and prove the minimax theorem (class notes (3), pp. 10–12a, see also comments from class notes (4), pp. 10) .
13. Show how to compute mixed strategies on a simple 2×2 or 2×3, 3×2 examples (class notes (3), pp. 13–14, Section 2.3).
14. Discuss informational structures in zero-sum finite games in extensive forms. Demonstrate the presentation using simple examples. (class notes (4), pages 1–3, Section 2.4).
15. Present the algorithm for solving zero-sum finite games in extensive form and demonstrate it on a simple example. (class notes (4), pp. 4–5, Section 2.4).
16. Discuss the need for introducing behavioral strategies and their relationship to mixed strategies (class notes (4), pp. 5–7, Section 2.4).
17. Define open-loop multi-act zero-sum finite games and demonstrate them using a simple tree (class notes (4), pages 7–8, Section 2.5).
18. Define feedback multi-act zero-sum finite games and demonstrate them using a simple tree (class notes (4), pages 9–10, Section 2.5).
19. Demonstrate a zero-sum finite game with chance moves using a simple tree (class notes (4), pp. 10, Section 2.6).
20. Define Nash equilibria in bimatrix games and demonstrate them on a simple example (class notes (5), pp. 1–3).
21. Define minimax security strategies in bimatrix game and demonstrate them on a simple example (class notes (5), pp. 4–5).
22. Define mixed strategies in Nash games and state Theorem 3.1 (class notes (5), pp. 5).
23. Define a Nash equilibrium for N-person finite Nash games in normal form and state the corresponding existence theorem for mixed strategies (class notes (5), pp. 6).
24. Discuss Nash strategies in extensive form with static and dynamic informational structure, draw the main conclusions, and present simple examples (class notes (5), pages 7–10).
25. Discuss Stackelberg strategies in bimatrix form, demonstrate a secured cost strategy on an example, and give definitions of reaction sets and secured equilibrium Stackelber strategy (class notes (6), pages 1–4).
26. Define reaction sets and equilibrium Stackelberg strategies in mixed strategies. Find the game cost for the leader in pure and mixed strategies (class notes (6), pages 5–7).
27. Explain the essence the Braess paradox without going into details (class notes (6), pages 8–10).
28. Define Nash equilibria, state the necessary conditions for Nash equilibria, and give definitions of reaction sets and reaction curves (class notes (7), pages 1–3).
29. Define stable and unstable Nash equilibrium strategies (class notes (7), page 4).
30. Discuss existence and uniqueness of Nash equilibria (class notes (7), pages 5–6).

31. Present main definitions for Stackelberg strategies (class notes (7), pages 7–8
32. Derive the Hamilton-Jacobi-Bellman equation and state the set of necessary conditions for dynamic optimization (class notes (8), pages 1–4).
33. Solve the linear-quadratic dynamic optimization problem and derive the Riccati equation (class notes (8), pages 5–6).
34. Derive the Hamilton-Jacobi-Bellman equation and state the set of necessary conditions for dynamic Nash games (class notes (9), pages 1–6).
35. Solve the linear-quadratic Nash game when both players use the open-loop strategies (class notes (9), pages 7–11).
36. Solve the linear-quadratic Nash game when both players use the feedback strategies (class notes (10), pages 12–15).
37. Find the optimal value for the performance criterion for the linear-quadratic Nash strategies (class notes (10), pages 17–18).
38. Derive the Isaacs equation of general zero-sum games and state necessary conditions for optimality (class notes (10), pages 18–21).
39. Solve the linear-quadratic zero-sum game (class notes (10), pages 21–22).
40. Define dynamic Stackelberg strategies and state the necessary conditions for optimality (class notes (11), pages 1–3).
41. Solve a linear-quadratic dynamic Stackelberg game (class notes (11), pages 3–4).

EXAM, APRIL 16, FRIDAY 6:30–9:20