Game Theory **Andreas Blume**
Principles **Final Exam**

1. A Nash equilibrium is strict when

   (a) it is a pure strategy equilibrium.
   (b) it consists of strategies that are unique best replies to one another.
   (c) it is a mixed strategy equilibrium.
   (d) there are other equilibria that give one of the players the same payoffs.

2. A mixed strategy equilibrium requires

   (a) that the player who is mixing is indifferent between the strategies she is using.
   (b) that the opponent of the player who is mixing is indifferent between the strategies that the mixing player is using.
   (c) that all players receive the same payoff regardless of the outcome of the game.
   (d) that one player always receives the highest payoff.

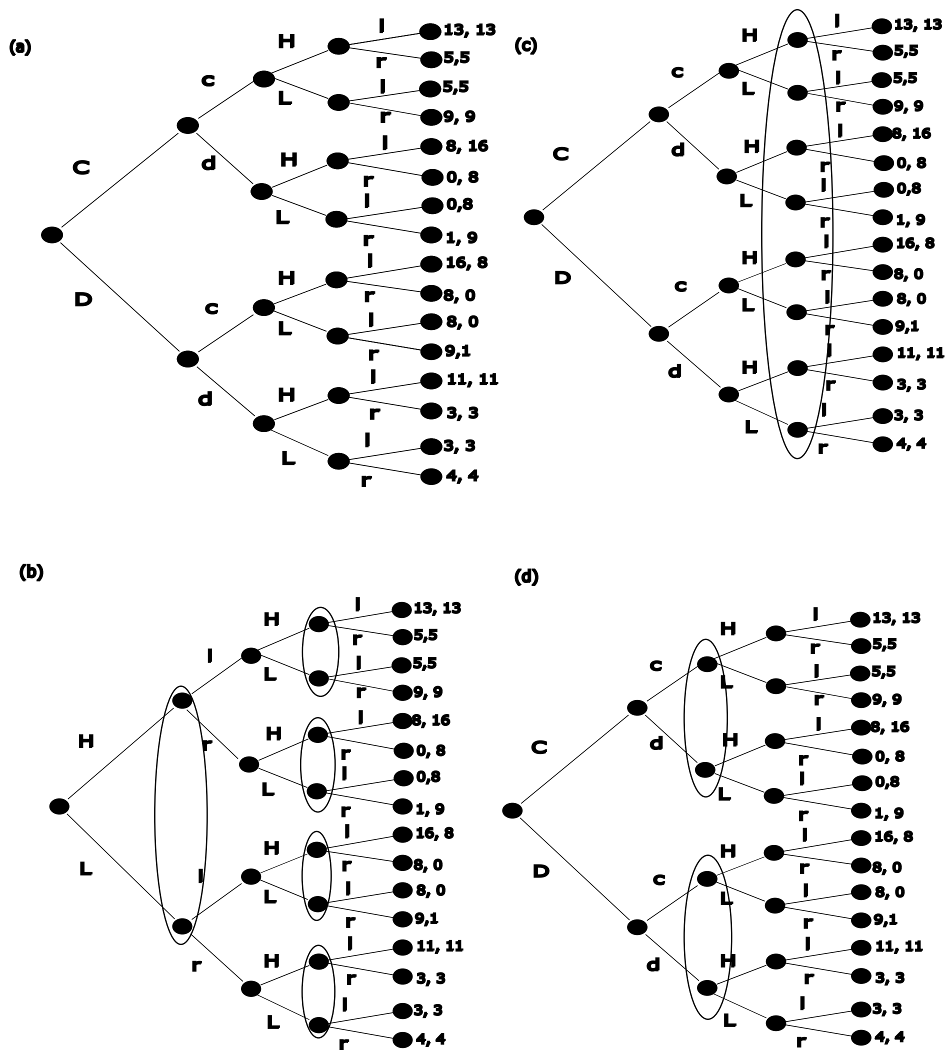
For questions 3-6 consider the following two-period game. In the first period Alice and Bob play the stage game

		Bob	
		c	d
Alice	C	(5,5)	(0,8)
	D	(8,0)	(1,1)

The game will be played simultaneously by both players. After which, they will find out the outcome of the first stage. Then Alice and Bob play the stage game:

		Bob	
		l	r
Alice	H	(8,8)	(0,0)
	L	(0,0)	(1,1)

3. Which of the following represents the extensive form of the game described above?



4. How many subgames are there in this game?

(a) 1
(b) 4
(c) 5
(d) 10

5. How many strategies does Alice have in this game?

   (a) 8
   (b) 4
   (c) 32
   (d) 64

6. Suppose now that Alice and Bob discount the future by multiplying their second period payoffs by δ. What is the smallest value of δ for which the strategies (C,H,L,L,L) for Alice and (c,l,r,r,r) for Bob form a subgame-perfect Nash equilibrium?

   (a) 1/2
   (b) 4/5
   (c) 3/7
   (d) 1

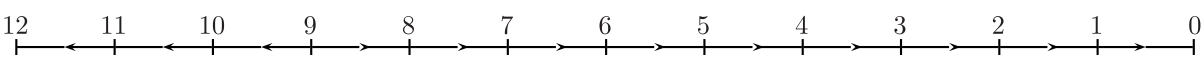
7. In *game theory*, a convention is

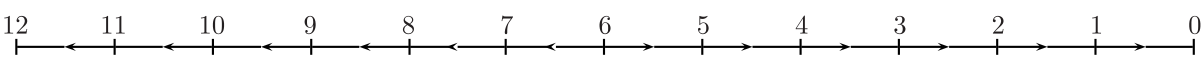
   (a) a Nash equilibrium of a coordination game.
   (b) a gathering of Star Trek fans.
   (c) a game in which the column player always wins.
   (d) an equilibrium of the matching pennies game.

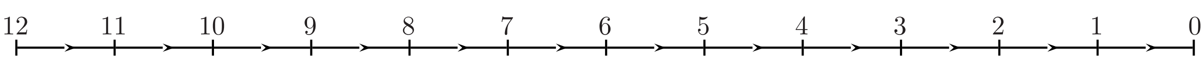
For questions 8 and 9, consider the following "Battle of the Sexes" game:

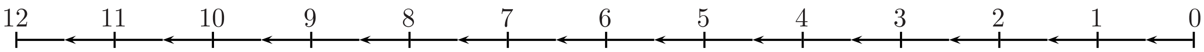
		Man	
		P	B
Woman	P	(3,1)	(0,0)
	B	(0,0)	(1,3)

8. For the dynamic process introduced in class, which of the following diagrams represents the basins of attraction for this game? (12 represents 12 players choosing P and no players choosing B. Also, 0 represents no players choosing P and 12 players choosing B.)

(a) 

(b) 

(c) 

(d) 

9. Consider adding two lamps, a red one and a blue one, to the room in which the game is played. Each lamp is equally likely to turn on. Which one of the following is a *new* equilibrium for the game, now that the lamps have been added?

   (a) (P,P)
   (b) (B,B)
   (c) ((P when blue, B when red), (P when blue, B when red))
   (d) ((P when blue, B when red), (B when blue, P when red))

Consider the following game for question 10:

		Omega		
		vigorously	leisurely	steadily
	vigorously	1,1	0,0	0,0
Alpha	leisurely	0,0	1,1	0,0
	steadily	0,0	0,0	1,1

10. In "Hume's Rowboat," given above, there are

   (a) three Nash equilibria.
   (b) four Nash equilibria.
   (c) five Nash equilibria.
   (d) more than five Nash equilibria.

		Neanderthal Man	
		Hunt Stag	Hunt Hare
CroMagnon Woman	Hunt Stag	(9,9)	(0,7)
	Hunt Hare	(7,0)	(7,7)

11. Consider the stag-hunt game with the payoff matrix given above. For the dynamic process introduced in class, which is the population state with the largest basin of attraction?

    (a) Exactly half of the population hunts hare.

    (b) Each member of the population hunts hare.

    (c) None of the members of the population hunts hare.

    (d) The fraction of the population hunting hare equals the frequency of hare in the mixed strategy equilibrium.

For questions 12-14 consider the following game:

		The Median Effort						
		7	6	5	4	3	2	1
Your Effort	7	1.30	1.15	0.90	0.55	0.10	-.45	-1.10
	6	1.25	1.20	1.05	0.80	0.45	0.00	-.55
	5	1.10	1.15	1.10	0.95	0.70	0.35	-.10
	4	0.85	1.00	1.05	1.00	0.85	0.60	0.25
	3	0.50	0.75	0.90	0.95	0.90	0.75	0.50
	2	0.05	0.40	0.65	0.80	0.85	0.80	0.65
	1	-.50	-.05	0.30	0.55	0.70	0.75	0.70

12. In the median game with the above payoff matrix, the number of (non-degenerate) mixed-strategy Nash equilibria

    (a) equals 1.

    (b) equals 3.

    (c) equals 5.

    (d) none of the above.

13. In the median game with the above payoff matrix, each players' maxmin strategy is

   (a) to randomize uniformly over all effort levels.
   (b) to choose effort level 1.
   (c) to choose effort level 3.
   (d) to choose effort level 7.

14. When the median game is played in experiments, over time behavior typically

   (a) converges to the highest effort choice.
   (b) converges to the lowest effort choice.
   (c) converges to the initial median of effort choices.
   (d) none of the above.

For questions 15-16 consider the following game:

The Minimum Effort

Your Effort		7	6	5	4	3	2	1
	7	1.30	1.10	0.90	0.70	0.50	0.30	0.10
	6		1.20	1.00	0.80	0.60	0.40	0.20
	5			1.10	0.90	0.70	0.50	0.30
	4				1.00	0.80	0.60	0.40
	3					0.90	0.70	0.50
	2						0.80	0.60
	1							0.70

15. In the minimum game with the above payoff matrix, the number of (non-degenerate) mixed-strategy Nash equilibria

   (a) equals 1.
   (b) equals 3.
   (c) equals 5.
   (d) none of the above.

16. When the minimum game is played in experiments, over time behavior typically

   (a) converges to the highest effort choice.
   (b) converges to the lowest effort choice.
   (c) converges to the mean of initial effort choices.
   (d) none of the above.

Consider a game in which one player, the sender, privately learns her type, t_1, t_2 or t_3; after learning her type the sender sends a message m_1 or m_2 to the other player, the receiver; and finally, after receiving the sender's message, the receiver takes an action a_1, a_2, or a_3. All sender types are equally likely. Both players' payoffs are identical: They both receive a payoff of one if the receiver's action matches the sender's type, i.e. if the receiver takes action a_1 when the type is t_1.

17. In this sender-receiver game, the sender has

    (a) one information set.

    (b) two information sets.

    (c) three information sets.

    (d) four information sets.

18. In the above sender-receiver game, the receiver has

    (a) one information set.

    (b) two information sets.

    (c) three information sets.

    (d) four information sets.

19. In the above sender-receiver game, the highest expected payoff that can be achieved in a Nash equilibrium equals

    (a) 0

    (b) $\frac{1}{3}$

    (c) $\frac{2}{3}$

    (d) 1

20. Which of the following statements is correct:

    (a) Every Nash equilibrium is an ESS.

    (b) Every ESS is a Nash equilibrium.

    (c) Every symmetric Nash equilibrium is an ESS.

    (d) A mixed-strategy Nash equilibrium cannot be an ESS.

	A	B
A	(0,0)	(5,8)
B	(8,5)	(0,0)

21. The game with the payoff matrix given above has
    (a) one ESS.
    (b) two ESSs.
    (c) three ESSs.
    (d) none of the above.

22. The analysis of the quantum version of the Prisoners' dilemma demonstrates that
    (a) the classical analysis of the Prisoners' dilemma has been flawed.
    (b) the only barrier to cooperation in the Prisoners' dilemma is that players cannot talk.
    (c) permitting quantum strategies alters the game.
    (d) the Prisoners' dilemma has Nash equilibria that previously have been overlooked.

23. The ESS concept was first defined by
    (a) John Nash
    (b) John Maynard Smith and George Price
    (c) John Maynard Keynes
    (d) John von Neumann

24. Ronald A. Fisher tried to explain the prevalence of 1:1 sex ratios by
    (a) arguing that any other sex ratio would be unnatural.
    (b) arguing that an excess of males (females) in the population makes it more advantageous to have female (male) offspring.
    (c) arguing that this sex ratio corresponds to the unique ESS of the corresponding population game.
    (d) arguing that with this sex ratio population growth is maximized.

25. David Levine argues that
    (a) quantum game theory has fundamentally altered our understanding of the Prisoners' dilemma.
    (b) quantum game theory will revolutionize all of conventional game theory.
    (c) quantum game theory has nothing new to offer to conventional game theory.
    (d) in quantum game theory the concept of Nash equilibrium has become obsolete.