Game Theory **Andreas Blume**
Principles **Second Midterm Exam**

1. Solve for all mixed and pure strategy Nash equilibria in the game:

	L	R
U	9,9	0,7
D	7,0	5,5

2. Consider the following voting game: Three voters simultaneously vote on two alternatives. One voter, voter 1, prefers alternative 1, the other two voters, voters 2 and 3, prefer alternative 2. The payoff from seeing one's preferred alternative win is 2. The payoff from seeing one's preferred alternative lose is 0. The payoff from a tie is 1. Each voter's cost of voting equals $c \in (0, 1)$.

   (a) Find a Nash equilibrium.

   (b) In equilibrium, how does voter participation vary as a function of the costs of voting?

   (c) What happens to voter 1's payoff as the cost of voting increases? Explain.

3. Suppose that you are a physician and have just received the results of a test for disease X in one of your patients. You know that in the general population the frequency of disease X is 5 in 1 million. The test is 99% accurate, i.e. if you have the disease, the test will be positive with probability .99 and if you don't have the disease the test will be negative with probability .99. In the case of your patient, the test is positive. How likely is it that your patient has disease X? (Hint: Use Bayes's rule to calculate the probability of having disease X conditional on the test being positive.)

4. Consider the policy advice game with the following payoff matrix. Suppose that the types s and t of the expert are equally likely and that the expert can send either message m or n. In this game the policy maker has the choice among five actions, a, b, c, d and e.

	a	b	c	d	e
s	$1,5$	$0,-5$	$5,4$	$5,0$	$2,3$
t	$0,-5$	$1,5$	$5,0$	$5,4$	$2,3$

   (a) Show that this game has a *pooling equilibrium* in which both types of the expert send the same message.

   (b) Show that this game has a *separating equilibrium* in which the two types of the expert send distinct messages.

   (c) Show that there is an equilibrium in which type s sends message m with probability $\frac{3}{4}$, type t sends message n with probability $\frac{3}{4}$ and the expert's payoff equals 5. Use Bayes's rule to derive the policy maker's posterior belief after each message.