Problem 1

a) Explain the concept of *strategy* and provide a formal definition.

b) Explain the concept of *Nash equilibrium* and provide a formal definition.

Problem 2

The normal-form game pictured below represents a situation in tennis, whereby the server (player 1) decides whether to serve to the opponent's forehand (F), center (C), or backhand (B) side. Simultaneously, the receiver (player 2) decides whether to favor the forehand, center, or backhand side.

1 \ 2	F	C	B
F	0, 5	2, 3	2, 3
C	2, 3	0, 5	3, 2
B	5, 0	3, 2	2, 3

a) A player's strategy can be strictly dominated by another strategy. Formally define what this means.

b) Are any strategies strictly dominated in the tennis game by another (pure or mixed) strategy?

c) Find the mixed strategy Nash-equilibria of this game.

d) What is the probability that player 1's payoff exceeds player 2's payoff in equilibrium?

Problem 3

Consider the following game describing a contractual relationship in which both players, 1 and 2 have written a contract that specifies the play of (I, I).

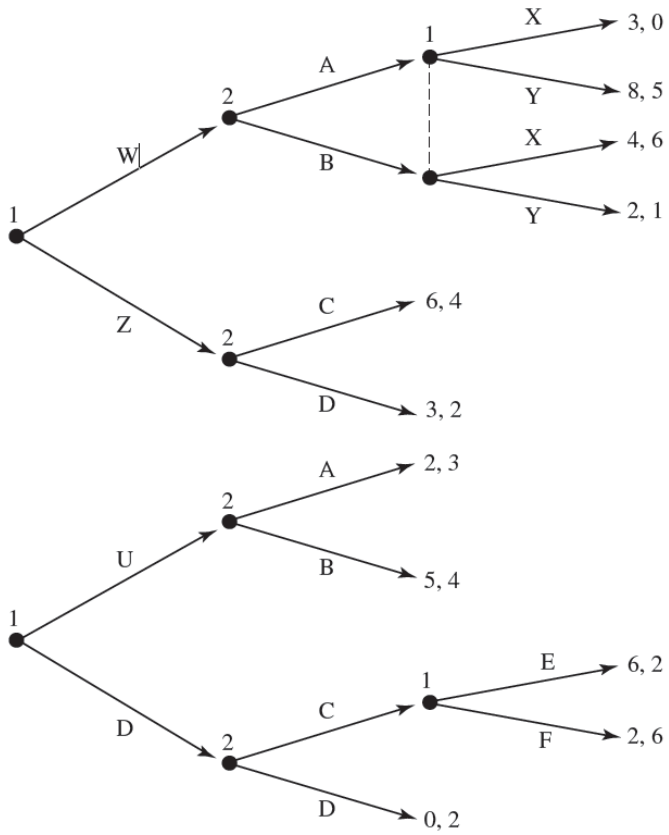
1 \ 2	I	N
I	z_1, z_2	y_1, x_2
N	x_1, y_2	0, 0

a) Use the game to explain the legal principles of expectation damages and reliance damages.

b) Show when and why expectation damages encourage the play of (I, I).

Problem 4

Compute the pure strategy Nash equilibria and subgame perfect equilibria for the two following games. Do so by writing the normal-form matrices for each game and its subgames. Which Nash equilibria are not subgame perfect?



Problem 5

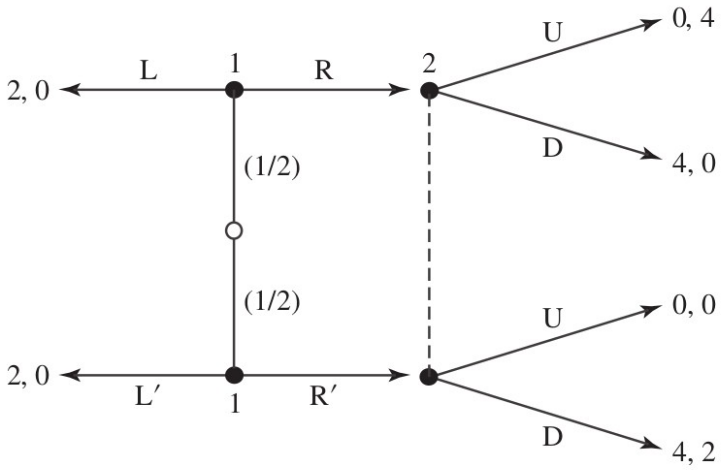
Suppose that a cattle rancher (R) and a corn farmer (F) are located next to each other. Currently, there is no fence between the ranch and the farm, so R's cattle enter F's field and destroy some of F's corn. This results in a loss of 300 to F. Under the current situation, the value of production for R is 1,000, and the value of production for F is 500 (including the loss of 300). A fence that will keep the cattle out of the cornfield would cost 100 for R to build (assume that only R can build the fence).

a) Suppose that R is not legally required to prevent his cattle from entering F's cornfield. The players negotiate from the legal rule (property right), but the legal rule determines the default outcome. Assume the outcome of negotiation is given by the Nash standard bargaining solution with equal bargaining weights. What is the outcome of negotiation?

b) Now suppose that R is legally required to prevent his cattle from entering F's cornfield unless allowed to do so by F. The players negotiate from the legal rule (property right), but the legal rule determines the default outcome. Assume the outcome of negotiation is given by the standard bargaining solution with equal bargaining weights. What is the outcome of negotiation?

Problem 6

Convert this game into the normal form and find all pure Bayesian Nash equilibria.



Problem 7

A game-theoretic model can be used to illustrate the strategic aspects of tariffs. Suppose there are two countries that are labeled 1 and 2. Let x_i be the tariff level of country i (in percent), for $i = 1, 2$. If country i picks x_i and the other country j selects x_j, then country i gets a payoff of: $\Pi_i(x_i, x_j) = 2000 + 60\,x_i + x_i x_j - x_i^2 - 90\,x_j$ (measured in billions of dollars). Assume that x_i and x_j must be between 0 and 100 and that the countries set tariff levels simultaneously and independently.

a) Find the best-response functions for the two countries.

b) Compute the Nash equilibrium of the tariff game. What is the equilibrium payoff to each country in equilibrium?

c) Show that the countries would be better off if they made a binding agreement to set lower tariffs (than in equilibrium). You do not need to speculate how such an agreement could be enforced.

d) Assume now that the game is played repeatedly over infinitely many periods. Find conditions on the discount factor δ such that zero tariffs can be sustained in each period by a subgame perfect equilibrium. Show by using a grim-trigger strategy profile.