

Start each problem on a new page. Calculators are permitted.

1. (20 Points) Find all the Nash equilibria with pure strategies for the bimatrix game where the payoff for the row player is given by the matrix A and the payoff for the column player is given by the matrix B , where

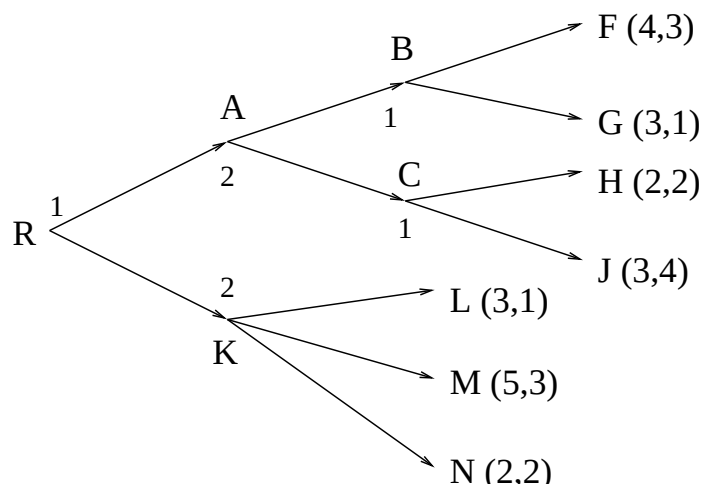
$$A = \begin{pmatrix} 4 & 1 & 0 & 5 \\ 3 & 2 & 1 & 3 \\ 2 & 3 & 1 & 1 \\ 1 & 1 & 2 & 3 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 2 & 1 & 2 & 4 \\ 1 & 5 & 1 & 1 \\ 2 & 4 & 3 & 1 \\ 4 & 2 & 1 & 0 \end{pmatrix}.$$

2. (20 Points) Find the interior Nash equilibrium with mixed strategies for the bimatrix game where the payoff for the row player is given by the matrix A and the payoff for the column player is given by the matrix B , where

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 2 & 0 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 0 & 0 & 3 \\ 2 & 1 & 0 \\ 0 & 3 & 0 \end{pmatrix}.$$

3. (20 Points) Consider the sequential game with perfect information given in the following game tree. The vertices are labeled with a 1 or a 2 depending on whether player one or two owns the vertex.

- (a) Find a subgame perfect equilibrium using pure strategies. Give the decision at each node.
- (b) Give a Nash equilibrium for the game that is not a subgame perfect equilibrium, i.e., is not a Nash equilibrium on some subgame. Explain why your answer is correct.



(problems 4 and 5 are on the back)

4. (20 Points) A person has \$1,000. The person can either keep all the money (and be left with \$1,000) or use \$10 to buy a lottery ticket. The lottery ticket has (i) a 99% chance of returning nothing leaving the person with a net of \$990 and (ii) a 1% chance of returning \$1000 leaving the person with a net of \$1990.
- (a) If the person has a utility function of $u(w) = w^2$ should the person buy the lottery ticket?
- (b) If the person has a utility function of $u(w) = \sqrt{w}$ should the person buy the lottery ticket?
5. (20 Points) Should the person decide to market test or not in the following decision tree, where the market test costs 40 units? Let I be a positive market test and J a negative market test, with $r = P(I) = \frac{4}{7}$ and $P(J) = 1 - r = \frac{3}{7}$. If there a negative market test, then the product is not marketed and there is a payoff of 0. Let G be a good reception of the product and B a bad reception. Let $t = P(G|I) = 0.9$, and $P(G|J) = 0.2$. Note that with no market test

$$\begin{aligned}
 s &= P(G) = P(G|I)P(I) + P(G|J)P(J) \\
 &= 0.9 \left(\frac{4}{7} \right) + 0.2 \left(\frac{3}{7} \right) \\
 &= 0.6.
 \end{aligned}$$

- (a) Calculate the expected payoffs at the nodes owned by “nature”, A , D , and C .
- (b) Given that the test costs 40 units, should the person decide to test (T) or not test (NT)?

