

Microeconomic Theory EC3.64

Problem Set 3

1. Consider the game depicted in figure 1.
 - (a) How many subgames does this game have?
 - (b) Find the unique subgame perfect Nash equilibrium of this game.
 - (c) Identify all other pure strategy Nash equilibria of this game. Take any one of these other equilibria and argue that it is not sub-game perfect.
2. Consider the 2 player game depicted in figure 2.
 - (a) Find the unique subgame perfect equilibrium of this game.
 - (b) Identify all other pure strategy Nash equilibria of this game. Explain why none of these other equilibria are sub-game perfect.
3. Consider the 3 player game depicted in figure 3.
 - (a) Explain why there is no subgame perfect equilibrium in pure strategies.
 - (b) Find the unique subgame perfect equilibrium.
4. Suppose three firms compete in a market for a single product with industry inverse demand curve $p = A - q$. All three firms have constant marginal cost m . Firm 1 is a leader and selects output level q_1 . Firms 2 and 3 are followers and select q_2 and q_3 after q_1 . (Note, q_2 and q_3 are chosen simultaneously.) Total output is $q = q_1 + q_2 + q_3$. Find a subgame perfect Nash equilibrium solution.
5. (*Exam Paper 1997/98*). A worker produces the output $q = \sqrt{e}$ when she puts in the amount of effort e . Her employer pays her a fraction α ($\alpha < 1$) of the output she produces; if she puts in effort e , the worker's net payoff is $\alpha\sqrt{e} - e$. The employer's payoff is $(1 - \alpha)\sqrt{e}$.
 - (a) Find all the Nash Equilibria of the game (list the equilibrium strategy profiles and the equilibrium payoffs).
 - (b) Assume that first the employer chooses the fraction of output to pay the worker, then the worker chooses her effort level, knowing what the employer has chosen. Find the subgame perfect equilibrium choices of α and e (list the equilibrium strategy profiles, the equilibrium outcome and the resulting equilibrium payoffs)
6. *Strategic Investment in Duopoly*. Firm 1 and Firm 2 currently both have a constant average production cost of 2 per unit. Firm 1 has to decide whether to install a new technology - that would guarantee an average cost of 0 per unit - or to keep the current one. Installing the new technology would cost F . Once Firm 1 investment decision is observed by Firm 2, the two firms will simultaneously choose output levels q_1 and q_2 as in Cournot competition. Suppose that the market demand is given by $p(Q) = 14 - Q$, where $Q = q_1 + q_2$. Find the values of the parameter F such that the game admits a Sub-Game Perfect Nash Equilibrium in which Firm 1 installs the new technology.

Figure 1

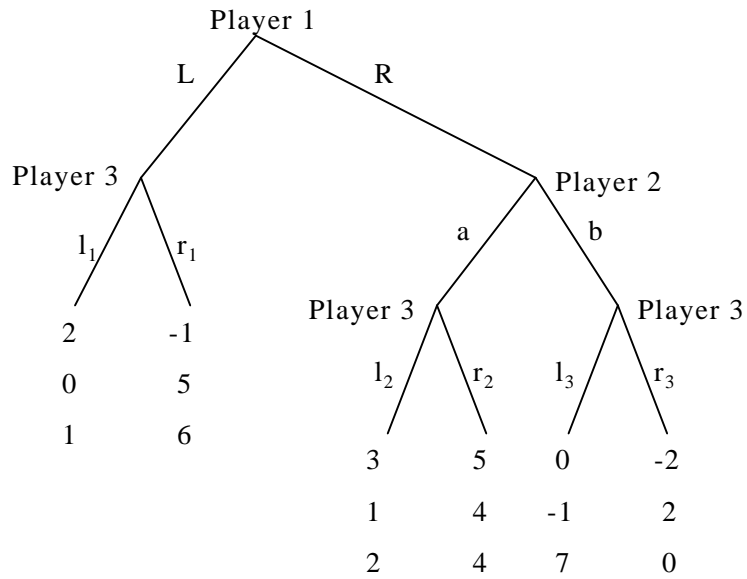


Figure 2

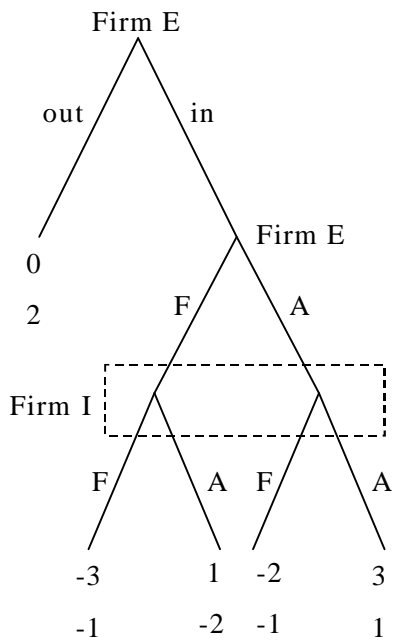


Figure 3

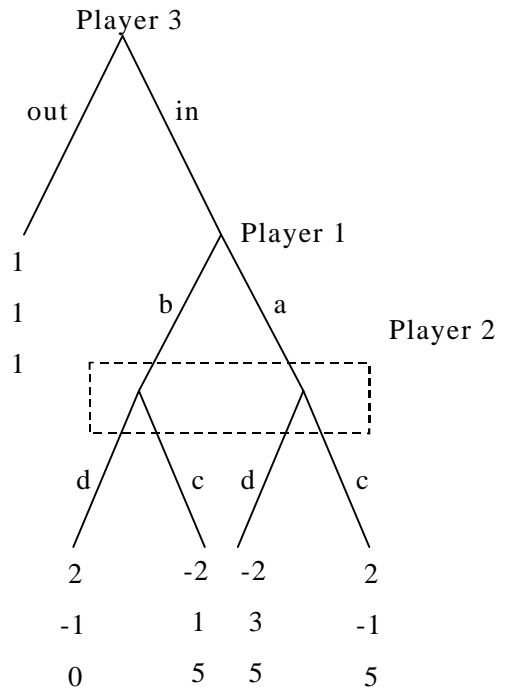


Figure 1: