

## Economics 644 – Midterm

Please answer ALL questions on this examination. Be sure to explain any non-standard notation that you use. Justify your answers!

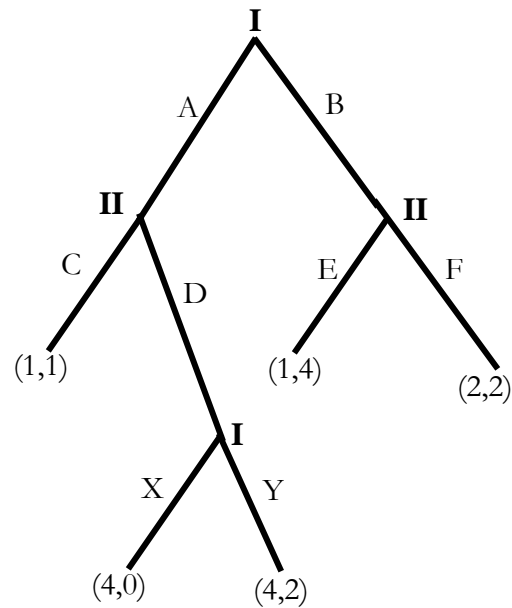
1. (30%) Consider 3 oligopolists facing the (inverse) demand curve  $P = 33 - Q^2$ , where  $Q = q_1 + q_2 + q_3$ . Assume that  $C_i(q_i) = 6 \cdot q_i$  for  $i = 1, 2$  and  $3$ .
  - a. What is the set of strategies that each firm can choose from if they play a Cournot game?
  - b. Find the Nash Equilibrium strategies for each firm if they competed Bertrand-style. Explain your reasoning.
  - c. Write down the optimization problems faced by each firm, which would be used to find the Nash Equilibrium quantities if they competed as Stackelberg competitors with firm 1 moving first, firm 2 moving second, and firm 3 moving third. Do not solve for the actual Nash Equilibrium! Simply write down the three optimization problems taking into account the competitive structure of the game.
  - d. Solve for the equilibrium quantities, prices, and profits of the three firms if they are able to collude and maximize their joint profits.

2. (40%) Consider the following simultaneous move game:

		Player 2		
		L	C	R
Player 1	T	(0, 1)	(0, 2)	(0, 0)
	M	(5, 2)	(0, 0)	(-2, -1)
	B	(4, 0)	(-1, -1)	(5, -2)

- Define what is meant by a *strictly dominated strategy*.
- In the game above, which strategies survive Iterated Elimination of Strictly Dominated Strategies?
- Find all Nash Equilibria of the game above.
- Sketch the best response correspondences on a graph and highlight the NE you found in (c).

3. (30%) Consider the following extensive game with perfect information:



*Payoffs are denoted  $(X, Y)$  where  $X$  is player I's payoff and  $Y$  is player II's payoff.*

- How many subgames are in the above game?
- Write down all possible strategies of each player.
- Write down the game in strategic form (or normal form) and find all Pure Strategy Nash Equilibria.
- Which of the NE you solved for in part (c) are subgame perfect?