

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Mid-Autumn Semester 2022-23

Date of Examination: _____ Session (FN/AN): _____ Duration: 2 hrs Full Marks: 30
 Subject No.: HS50001 Subject: ADVANCED ECONOMIC THEORY
 Department/Center/School: HUMANITIES & SOCIAL SCIENCES
 Specific charts, graph paper, log book etc., required: None
 Special Instructions (if any): Answer both Part I and Part II

Part I (Answer all)

1. The Organization of Petroleum Exporting Countries (OPEC) is a consortium of major oil-producing countries. OPEC was formed in 1961 and has tried since then to keep world oil prices high by restricting production levels (through production quotas on its members). Let's assume the number of real-world players being two - OPEC and the non-OPEC oil producing nations. The costs of production are \$5 a barrel for OPEC and \$10 a barrel for the non-OPEC producers. The world demand function for oil is given by $P = (65 - \frac{Q}{3})$, where, Q is the total output by both OPEC and non-OPEC producers.
 - a) Find the best response functions for OPEC and non-OPEC countries (2)
 - b) Find the equilibrium OPEC and non-OPEC outputs (2)
 - c) What will be the equilibrium price(s)? (1)
2. A firm has two divisions, each of which has its own manager. Managers of these divisions are paid according to their effort in promoting productivity in their divisions. The payment scheme is based on a comparison of the two outcomes. If both managers have expended "high effort," each earns \$150,000 a year. If both have expended "low effort," each earns "only" \$100,000 a year. But if one of the two managers shows "high effort" whereas the other shows "low effort," the "high effort" manager is paid \$150,000 plus a \$50,000 bonus, but the second ("low effort") manager gets a reduced salary (for subpar performance in comparison with her competition) of \$80,000. Managers make their effort decisions independently and without knowledge of the other manager's choice.
 - a) Assume expending effort is costless to the managers. Draw the payoff table for this game. Find the Nash equilibrium of the game and explain what type of game is this. (1+1+1)
 - b) Now suppose that expending high effort is costly to the managers (such as a costly signal of quality). In particular, suppose that "high effort" costs an equivalent of \$60,000 a year to a manager who chooses this effort level. Draw the game table for this new version of the game and find the Nash equilibrium. Explain whether and how the game has changed from the game described in part (a). (1+1+2)
 - c) If the cost of high effort is equivalent to \$80,000/year, how does the game change from that described in part (b)? What is the new equilibrium? (2+1)

Part II (Answer any three)

3. An old lady is looking for help crossing the street. Only one person is needed to help her; if more people help her, this is no better. You and I are the two people in the vicinity who can help; we have to choose simultaneously whether to do so. Each of us will get pleasure worth a 3 from her success (no matter who helps her). But each one who goes to help will

bear a cost of 1, this being the value of our time taken up in helping. If neither player helps, the payoff for each player is zero.

- Set this up as a game explaining the rules properly.
- Solve for the pure strategy Nash equilibrium (equilibria).
- What will be the mixed strategy Nash equilibrium?

(2)

(2)

(1)

- Coke and Pepsi are the two dominant firms in the cola industry. The market size is \$8 billion. Each firm can choose whether to advertise. Advertising costs \$1 billion for each firm that chooses it. If one firm advertises and the other doesn't, then the former captures the whole market. If both firms advertise, they split the market 50:50 and pay for the advertising. If neither advertises, they split the market 50:50 but without the expense of advertising.

- What will be the outcome when the two firms move simultaneously?
- Draw the game tree for this game (assume that it is played sequentially), with Coke moving first and Pepsi following. What will be the outcome?

(2)

(2+1)

- Consider a lender lending \$1 with interest r . The borrower can invest either in a safe project with sure return R or in a risky project that yields $Z (> R)$ with probability p and 0 with probability $(1-p)$.

- What would be the preferences (regarding the type of project) of the borrower and the lender? Would these preferences be different?
- What are the major implications of the above game?
- How can use of collateral change the outcome of the above game? Elaborate.

(1)

(2)

(2)

- Consider the following game depicted by the payoff matrix.

- Does the following game have any IEDS (or IEWDS) equilibrium?

- What will be the Nash equilibrium?

- Comment on the reason behind different outcome (if any) following the above solution mechanisms

(2)

(2)

(1)

3-31 = 20 x 2

		Urjit			
		North	South	East	West
Arun	Earth	1, 3	3, 1	0, 2	1, 1
	Water	1, 2	1, 2	3, 3	1, 1
	Wind	3, 2	2, 1	1, 3	0, 3
	Fire	2, 0	3, 0	1, 1	2, 2