

# Deciphering Decisions

## Assignment-4

### Q1. Find Dominant Strategy

Using Iterated Elimination of Dominated Strategies, find the strictly dominant strategy.

	1	2	3
a	(1, 2)	(2, 2)	(5, 1)
b	(4, 1)	(3, 5)	(3, 3)
c	(5, 2)	(4, 4)	(7, 0)
d	(2, 3)	(0, 4)	(3, 0)

Also determine whether Nash Equilibrium(s) can be calculated for the above set of strategies. What can you infer from it?

### Q2. Market Entry Game

In a competitive financial market, two firms, A and B, are launching identical financial products. Each firm must decide whether to adopt Strategy 1 or Strategy 2. The payoff matrix for their decisions is as follows:

Firm A/Firm B	Strategy I	Strategy II
Strategy I	(-5, 3)	(5, -2)
Strategy II	(5, -2)	(-5, 3)

The payoffs represent the profit/loss outcomes based on the strategies chosen by both firms. Both firms are risk-neutral and aim to maximize their expected payoffs. Each firm can adopt Strategy 1 with a probability  $p$  (or  $q$ ) and Strategy 2 with a probability  $1-p$  (or  $1-q$ ).

Analyze the mixed-strategy Nash Equilibrium for both firms in this scenario. For what values of  $p$  and  $q$  will both firms maximize their expected payoffs? Write the assumptions approach clearly used to get to the answer.

### Q3. Cournot Duopoly Model

**What is The Cournot Duopoly Model?** It is a strategic game between two firms choosing how much of a particular product to bring to market, taking the other firm's choice into consideration to maximize their own profit.

**What is the Inverse Demand Function?** As in real-life, the cost of products depends inversely on the supply. In this model we assume the market price to follow inverse demand function. The market price  $p$  is a function of the total quantity  $Q = q_1 + q_2$ , where  $q_1$  and  $q_2$  are the quantities produced by Firm 1 and Firm 2, respectively. By the inverse demand function, market price  $p$  can be written as:  $p = a - bQ$

**Now consider this situation -**

Two firms I and II are selling an identical product, following the inverse demand curve  $p = a - bQ$ . Here,  $Q = q_1 + q_2$ , where  $q_1$  is the quantity produced by firm I and  $q_2$  is the quantity produced by firm II. The cost for making a single product for firm I is  $c_1$ , and for firm II is  $c_2$ . Both firms follow the Cournot Duopoly Model, i.e., they select  $q$  simultaneously.

- (a) Find the Nash Equilibrium quantities for both the firms in this setup.
- (b) What happens if the firms decide to form a cartel? Is this new quantity a Nash equilibrium?
- (c) What, according to you, is a better strategy? Forming a cartel or operating independently.

**NOTE:** For all questions you must clearly explain how you got to the answer and not just write the end result.