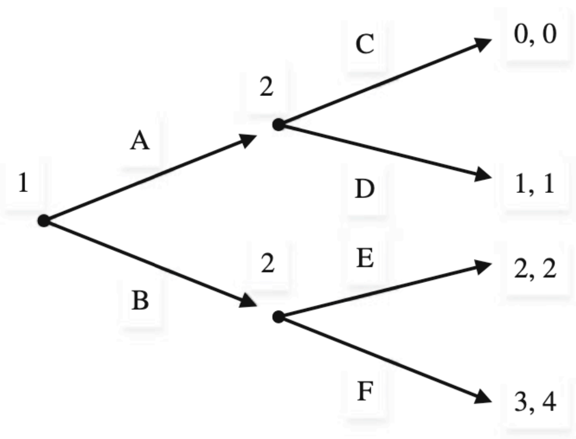
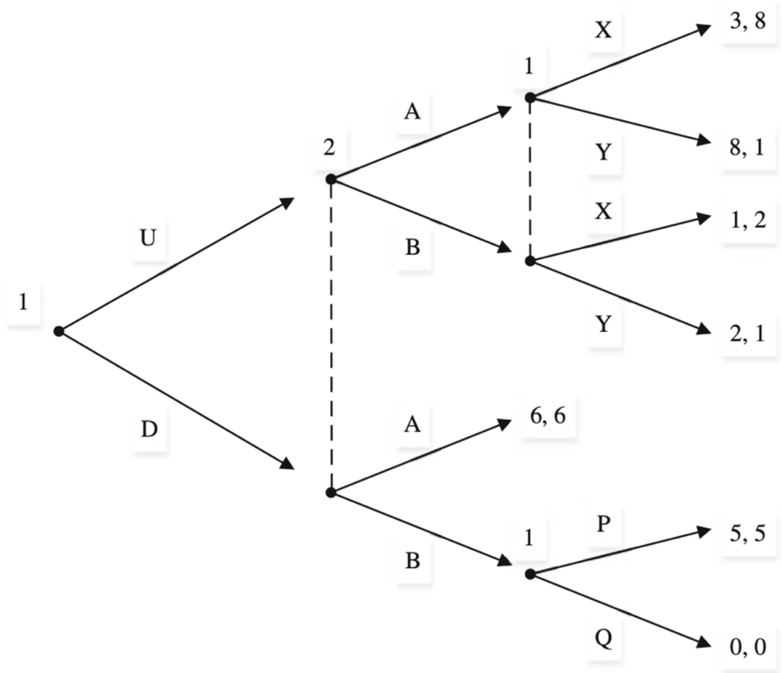
1. From Extensive Form to Normal form Representation-I: Represent the extensive-form game depicted in Fig. 1 using its normal-form (matrix) representation.



2. From Extensive Form to Normal Form Representation-III: Consider the extensive-form game in Fig 2. Provide its normal form (matrix) representation.



3. Dominance Solvable Games: Two political parties simultaneously decide how much to spend on advertising, either low, medium or high, yielding the payoffs in the following matrix (Fig. 3) in which the Red party chooses rows and the Blue party chooses columns. Find the strategy profile/s that survive IDSDS.

		Blue party		
		Low	Middle	High
Red party	Low	80,80	0,50	0,100
	Middle	50,0	70,70	20,80
	High	100,0	80,20	50,50

4. Two students in the Industrial Economics course plan to take an exam tomorrow. The professor seeks to create incentives for students to study, so he tells them that the student with the highest score will receive a grade of A and the one with the lower score will receive a B. Student 1's score equals $x_1 + 1:5$, where x_1 denotes the amount of hours studying. (That is, he assume that the greater the effort, the higher her score is.) Student 2's score equals x_2, where x_2 is the hours she studies. Note that these score functions imply that, if both students study the same number of hours, $x_1 = x_2$, student 1 obtains a highest score, i.e., she might be the smarter of the two. Assume, for simplicity, that the hours of studying for the industrial economics class is an integer number, and that they cannot exceed 5 h, i.e., $x_i \in \{1, 2, \ldots, 5\}$. The payoff to every student i is$10 - x_i$ if she gets an A and $8 - x_i$ if she gets a B. Find which strategies survive the iterative deletion of strictly dominated strategies (IDSDS).

5. Cournot mergers with Efficiency Gains: Consider an industry with three identical firms each selling a homogenous good and producing at a constant cost per unit c with $1 > c > 0$. Industry demand is given by $P(Q) = 1 - Q$, where $Q = q_1 + q_2 + q_3$. Competition in the marketplace is in quantities.
Part (a) Find the equilibrium quantities, price and profits.
Part (b) Consider now a merger between two of the three firms, resulting in duopolistic structure of the market (since only two firms are left: the merged firm and the remaining firm). The merger might give rise to efficiency gains, in the sense that the firm resulting from the merger produces at a cost $e.c$, with $e \leq 1$ (whereas the remaining firm still has a cost c):
   a. Find the post-merger equilibrium quantities, price and profits.
   b. Under which conditions does the merger reduce prices?
   c. Under which conditions is the merger beneficial to the merging firms?

6. Ultimatum Bargaining Game: In the ultimatum bargaining game, a proposer is given a pie, normalized to a size \$1, and he is asked to make a monetary offer, x, to the

responder who, upon receiving the offer, only has the option to accept or reject it (as if he received an "ultimatum" from the proposer). If the offer x is accepted, then the responder receives it while the proposer keeps the remainder of the pie 1−x. However, if he rejects it, both players receive a zero payoff. Operating by backward induction, the responder should accept any offer x from the proposer (even if it is low) since the alternative (reject the offer) yields an even lower payoff (zero). Anticipating such as a response, the proposer should then offer one cent (or the smallest monetary amount) to the responder, since by doing so the proposer guarantees acceptance and maximizes his own payoff. Therefore, according to the subgame perfect equilibrium prediction in the ultimatum bargaining game, the proposer should make a tiny offer (one cent or, if possible, an amount approaching zero), and the responder should accept it, since his alternative (reject the offer) would give him a zero payoff. However, in experimental tests of the ultimatum bargaining game, subjects who are assigned the role of proposer rarely make offers close to zero to the subject who plays as a responder. Furthermore, sometimes subjects in the role of the responder reject positive offers, which seems to contradict our equilibrium predictions. In order to explain this dissonance between theory and experiments, many scholars have suggested that players' utility function is not as selfish as that specified in standard models (where players only care about the monetary payoff they receive). Instead, the utility function should also include social preferences, measured by the difference between the payoff a player obtains and that of his opponent, which gives rise to envy (when the monetary amount he receives is lower than that of his opponent) or guilt (when his monetary payoff is lower than his opponent's). In particular, suppose that the responder's utility is given by

$$u_R(x, y) = x + \alpha(x - y)$$

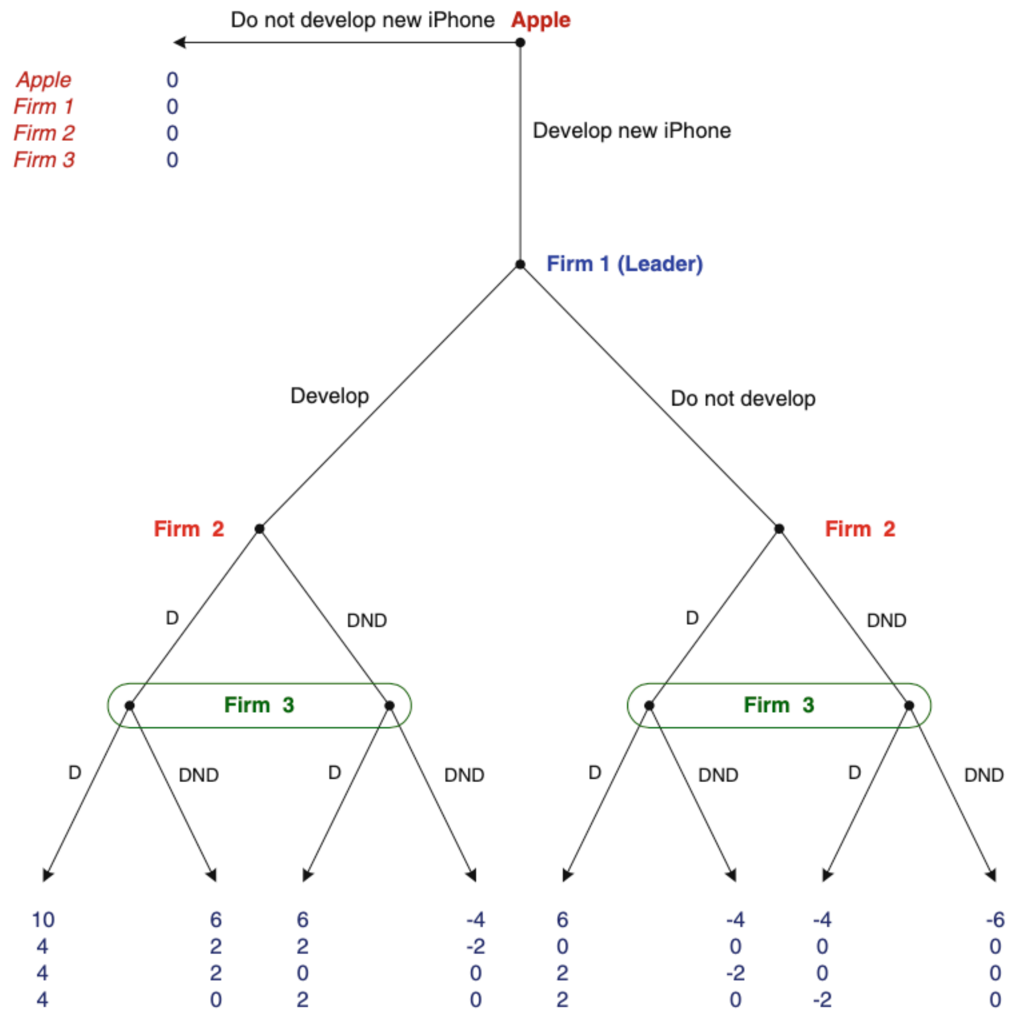
where x is the responder's monetary payoff, y is the proposer's monetary payoff, and a is a positive constant. That is, the responder not only cares about how much money he receives, x, but also about the payoff inequality that emerges at the end of the game, $\alpha(x-y)$, which gives rise to either envy, if x < y, or guilt, if x > y. For simplicity, assume that the proposer is selfish, i.e., his utility function only con- siders his own monetary payoffs $u_P(x, y) = y$ as in the basic model.

a. Use a game tree to represent this game in its extensive form, writing the payoffs in terms of m, the monetary offer of the proposer, and parameter α
b. Find the subgame perfect equilibrium. Describe how equilibrium payoffs are affected by changes in parameter α.

7. Stackelberg with Two Firms: Consider a leader and a follower in a Stackelberg game of quantity competition. Firms face an inverse demand curve p(Q) = 1 − Q, where Q = $q_1 + q_2$ denotes aggregate output. The leader faces a constant marginal cost $c_L > 0$ while the follower's constant marginal cost is $c_F > 0$, where $1 > c_F \geq c_L$, indicating that the leader has access to a more efficient technology than the follower.
    a. Find the follower's best response function.
    b. Determine each firm's output strategy in the subgame perfect equilibrium (SPNE) of this sequential-move game.

c. Under which conditions on c_L can you guarantee that both firms produce strictly positive output levels?

8. Backward Induction-II: Consider the sequential-move game depicted in the Figure. The game describes Apple's decision to develop the new iPhone with radically new software which allows for faster and better applications (apps). These apps are, however, still not developed by app developers (such as Rovio, the Finnish company that introduced Angry Birds). If Apple does not develop the new iPhone, then all companies make zero profit in this emerging market. If, instead, the iPhone is introduced, then company 1 (the leader in the app industry) gets to decide whether to develop apps that are compatible with the new iPhone's software. Upon observing company 1's decision, the followers (firm 2 and 3) simultaneously decide whether to develop apps (D) or not develop (ND). Find all subgame perfect Nash equilibria in this sequential-move game.



9. Cournot Competition with Asymmetric Costs: Consider a duopoly game in which firms compete a la Cournot, i.e., simultaneously and independently selecting their output levels. Assume that firm 1 and 2's constant marginal costs of production differ, i.e., $c1 > c2$. Assume also that the inverse demand function is $p = a - bQ$, with $a > c1$ and $Q = q1+q2$
   a. Find the pure strategy Nash equilibrium of this game. Under what conditions does it yield corner solutions (only one firm producing in equilibrium)?
   b. In interior equilibria (both firms producing positive amounts), examine how do equilibrium outputs vary when firm 1's costs change.

10. Collusion when N firms compete in quantities: Consider n firms producing homogenous goods and choosing quantities in each period for an infinite number of periods. Demand in the industry is given by $p = 1 - Q$, Q being the sum of individual outputs. All firms in the industry are identical: they have the same constant marginal costs $c < 1$, and the same discount factor δ. Consider the following trigger strategy:

    - Each firm sets the output q^m that maximizes joint profits at the beginning of the game, and continues to do so unless one or more firms deviate.
    - After a deviation, each firm sets the quantity q, which is the Nash equilibrium of the unrepeated Cournot game.

    a. Find the condition on the discount factor that allows for collusion to be sustained in this industry.
    b. Indicate whether a larger number of firms in the industry facilitates or hinders the possibility of reaching a collusive outcome.