1. Consider the following normal form game:

	B	S
B	$3, 1$	$0, 0$
S	$0, 0$	$1, 3$

Ballet or Soccer

(a) What are the pure strategy Nash equilibria of this game? Justify your answer.

(b) What are the mixed strategy Nash equilibria of this game? Justify your answer.

(c) What is the row player's *expected utility* in each Nash equilibrium of this game?

(d) Does this game have any *dominant strategies*? If so, which strategy is dominant?

2. Consider the following normal form game:

	A	B
A	$3, 1$	$\mathbf{2}, 0$
B	$0, 0$	$1, 3$

Artichoke or Banana?

(a) What are the pure strategy equilibria of this game? Justify your answer.

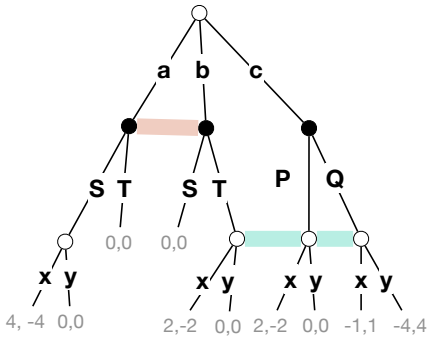
(b) What are the mixed strategy equilibria of this game? Justify your answer.

(c) Consider the *repeated game* in which Artichoke or Banana is played 5 times in a row. Does this repeated game have an equilibrium in which B is played at least once (by either or both players)? Why or why not?

(d) Consider the repeated game in which Artichoke or Banana is played infinitely many times, and where the payoffs are combined using a discount rate of $\beta = 0.9$. Does this repeated game have an equilibrium in which B is played at least 25% of the time (by either or both players)? Why or why not?

(e) Does this game have any dominant strategies? If so, which strategy is dominant?

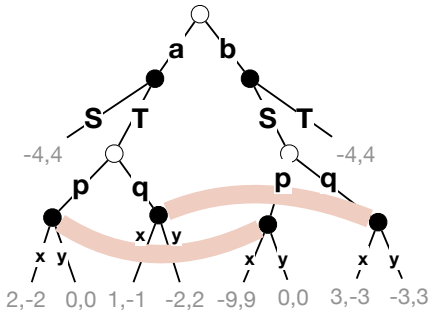
3. Consider the following imperfect information extensive form game:



(a) What are the *information sets* for this game? (You can name *states* by the sequence of actions that lead to them).

(b) Is this a game of perfect or imperfect recall? Why or why not?

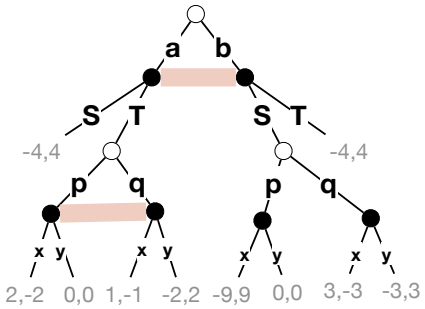
4. Consider the following imperfect information extensive form game:



(a) What are the *information sets* for this game?

(b) Is this a game of perfect or imperfect recall? Why or why not?

5. Consider the following imperfect information extensive form game:



(a) What are the *information sets* for this game?

(b) Is this a game of perfect or imperfect recall? Why or why not?

6. Consider the repeated game in which the Prisoner's Dilemma (below) is played twice.

	C	D
C	$-1,-1$	$-5,0$
D	$0,-5$	$-3,-3$

Prisoner's Dilemma

(a) What are the *pure strategies* for row player?

(b) Is there an equilibrium of this repeated game in which column ever plays C? Why or why not?

7. Consider the following mechanism for allocating an item:

   - Every agent begins standing.
   - The auctioneer calls out prices in increasing order.
   - When the price is too high for a given agent, they sit down.
   - An agent cannot stand up again after they have sat.
   - When only a single agent remains standing, they have won the auction; they receive the item and are charged the last price that the auctioneer called.

   (a) Is this a *direct mechanism*?

   (b) Does this mechanism have a *dominant strategy* for the bidders? If so, what is it?

   (c) Does this mechanism allocate the item to the bidder with the highest valuation in equilibrium? Why or why not?

8. Consider the following mechanism for allocating an item:

   - Each secretly tells the auctioneer a number that they claim to be their valuation for the item.
   - The bidder who reports the largest valuation wins, and receives the item.
   - The winning bidder is charged $3\times$ the next-highest reported valuation.

   (a) Is this a *direct mechanism*?

   (b) Is this a *truthful mechanism*? Why or why not?

   (c) Does this mechanism have a *dominant strategy* for the bidders? If so, what is it?