

**Problem 1.** (8 points) Consider the game

|    |    |    |
|----|----|----|
| 3  | -1 | 2  |
| -4 | 2  | 1  |
| -1 | 1  | -1 |

If Row plays the strategy  $P = (2/5, 1/5, 2/5)$ , what is Column's best response?

**Solution:**

$$E(Q_1) = (2/5)(3) + (1/5)(-4) + (2/5)(-1) = 0$$

$$E(Q_2) = (2/5)(-1) + (1/5)(2) + (2/5)(1) = 2/5$$

$$E(Q_3) = (2/5)(2) + (1/5)(1) + (2/5)(-1) = 3/5$$

So the best response is Column 1, which has the lowest expected payoff.

**Problem 2.** (8 points)

Consider the zero-sum game given by the following matrix:

|    |   |
|----|---|
| -1 | 3 |
| 2  | 0 |

Completely solve this game.

**Solution:** We get

$$p = \frac{a - b}{(a - b) + (d - c)} = \frac{-4}{-4 - 2} = \frac{2}{3}$$

$$P = (1/3, 2/3)$$

$$q = \frac{a - c}{(a - c) + (d - b)} = \frac{-3}{-3 - 3} = \frac{1}{2}$$

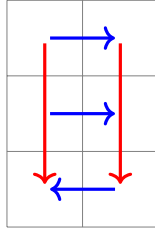
$$Q = (1/2, 1/2)$$

$$v = \frac{ad - bc}{(a - b) + (d - c)} = \frac{0 - 6}{-4 - 2} = 1.$$

**Problem 3.** (4 points) Consider the non-zero-sum game

|   | A      | B     |  |
|---|--------|-------|--|
| A | -2, 1  | -1, 3 |  |
| B | -1, -2 | 1, 1  |  |
| C | 4, 2   | 2, -2 |  |

Draw a flow diagram for this game. Identify any saddle points.

**Solution:**

There is one saddle point at  $(1, 3)$ .