

Step-1

Let us consider the simplified version of Poker matrix.

$$A = \begin{bmatrix} 0 & 1 & -1 & 0 \\ 1 & 0 & -1 & -2 \end{bmatrix}$$

Step-2

Strategy for Y : (Row 1) If X bets, Y folds (Row 2) If X bets, Y matches the extra \$2.

Step-3

Strategy for X : (1) Bet the extra \$2 on a king and fold on a jack (2) Bet the extra \$2 in either case (bluffing) (3) Fold in either case, and lose \$1 (4) Fold on a king and bet on a jack

Step-4

Consider the optimal strategy for x ,
$$x^* = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 \end{bmatrix}$$

Thus,
$$Ax^* = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \end{bmatrix}$$

And,

$$\begin{aligned} y^* Ax^* &= \frac{1}{2} y_1 + \frac{1}{2} y_2 \\ &= \frac{1}{2} \end{aligned}$$

for all strategies of Y

Step-5

Similarly, consider the optimal strategy for y ,
$$y^* = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \end{bmatrix}$$

Thus,
$$y^* A = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & -1 & -1 \end{bmatrix}$$

And,

$$y^* Ax = \frac{1}{2} x_1 + \frac{1}{2} x_2 - x_3 - x_4$$

The above expression cannot exceed $\frac{1}{2}$ for all strategies of X

Step-6

And the in between value is $\boxed{y^*Ax^* = \frac{1}{2}}$