

Math 152 Midterm 2 Definitions

May 15, 2017

- (1) **Zero sum game:** A two-person *zero sum game* is a game with two players, called Player I and Player II, where one player's winnings are exactly equal to the other player's losses.
- (2) **Strategic form:** The *strategic form* of a two-player zero sum game is given by a triple (X, Y, A) , where
 - X is a non-empty set, called the *pure strategies of Player I*.
 - Y is a non-empty set, called the *pure strategies of Player II*.
 - A is a function mapping $X \times Y$ to \mathbb{R} , called the *payoff function*.
- (3) **Value of a game:** The *value* of a zero sum game is the unique real number V such that
 - There is a strategy for Player I where they win at least V no matter what Player II does.
 - There is a strategy for Player II where they lose at most V no matter what Player I does.
- (4) **Fair game:** A game is *fair* if the value $V = 0$, otherwise it is *unfair*.
- (5) **Equalizing strategy:** An equalizing strategy is a strategy where our expected winnings are the same, regardless of our opponents choice of strategy.
- (6) **Saddle point:** A *saddle point* of a matrix A is an entry a_{ij} that is smaller than or equal to every other number in its row, and bigger than or equal to every other number in its column.

- (7) **Domination:** A row i of a matrix A is *dominated* by another row k if $a_{ij} \leq a_{kj}$ for all j . A column i is *dominated* by another column k if $a_{ji} \geq a_{jk}$ for all j .
- (8) **Symmetric game:** A matrix is *skew-symmetric* if $A = -A^T$. A game with payoff matrix A is *symmetric* if the matrix A is skew-symmetric.
- (9) **Best response:** Given a mixed strategy \mathbf{q} for Player II, the *best response strategy for Player I* is a strategy \mathbf{p} that maximizes $\mathbf{p}^T A \mathbf{q}$. Given a mixed strategy \mathbf{p} for Player I, the *best response strategy for Player II* is a strategy \mathbf{q} that minimizes $\mathbf{p}^T A \mathbf{q}$.

Note: These are not the only definitions that we have seen in Part II. But they are the only definitions which you might be explicitly asked to state on Midterm 2. For example, the definition of Extensive Form is excluded, so you will not be asked to state this definition in the exam. Of course, you need to understand what the Extensive Form is, since the exam is likely to involve Extensive Forms of games.