Microeconomics, Module 16, “The Theory of Games”

*Illustrative Test Questions*

(The attached PDF file has better formatting.)

Question 16.1: Stable Outcome

In a game, any outcome in which neither player wants to change his strategy given the strategy chosen by the other player is called a

A. Nash equilibrium
B. Stackelberg equilibrium
C. Prisoner’s dilemma
D. Pareto optimal outcome
E. A game theoretic optimum

Answer 16.1: A

A Nash equilibrium need not be an optimal outcome, since both players may be better with some other outcome. But a Nash equilibrium is stable: neither player wants to change the chosen strategy. A Stackelberg equilibrium refers to sequential games. The prisoner’s dilemma is a particular game.

Question 16.2: Pareto Optimal

When will a game’s outcome be Pareto optimal?

A. When it is a Nash equilibrium
B. When the total payoff to the players is positive
C. When any attempt to improve one player’s payoff lowers another player’s payoff.
D. When the players commit to a strategy, even if better options become available.
E. When any change reduces the payoffs to all players.

Answer 16.2: C

A Nash equilibrium need not be Pareto optimal. In many outcomes, the total payoff to all players is positive, but not all these outcomes are Pareto optimal. Statement C is correct; statement E should say “reduces the payoff to at least one player.”

Question 16.3: Dominant Strategy

When both players in a game have a dominant strategy,

A. A Nash equilibrium exists and is unique.
B. No Nash equilibrium exists.
C. Any Nash equilibrium is also Pareto optimal.
D. All entries in the game matrix will be Nash equilibria.
E. A Nash equilibrium may exist but it is not unique.

Answer 16.3: A

If both players have a dominant strategy, each sticks to this strategy, and the outcome is a Nash equilibrium, which may or may not be Pareto optimal.

Question 16.4: Solution Concept

Which of the following is *not* a solution concept for a game?

A. A Nash equilibrium
B. A Pareto optimal outcome
C. A Stackelberg equilibrium
D. Nash equilibria, Pareto optimal outcomes, and Stackelberg equilibria are all commonly used solution concepts for games.
E. Nash equilibria and Pareto optimal outcomes, but not Stackelberg equilibria, are solution concepts for games.

Answer 16.4: B

Pareto optimality is a normative criterion, not a solution concept. A normative criterion says whether one outcome is *better* than another, not whether the outcome is attained.

Question 16.5: Switching Strategies

Consider an outcome for which one player finds that it would be advantageous to switch strategies. We conclude that this outcome

A. Is not a Nash equilibrium.
B. Is Pareto optimal.
C. Will not occur when the players use mixed strategies.
D. Is a Stackelberg equilibrium.
E. Will not occur if players are profit maximizers.

Answer 16.5: A

A Nash equilibrium is stable; if players switch strategies, the outcome is not stable.

Question 16.6: Mixed Strategy

A player is using a mixed strategy when

A. His chosen strategy provides a better outcome than any other strategy.
B. He must commit to using a single strategy 100% of the time.
C. In a sequential game, he takes the other player's optimal response into account.
D. He randomly chooses the strategy to play, with each strategy having a fixed probability of being chosen.
E. The player's response depends on the action most recently taken by the other player.

Answer 16.6: D

Question 16.7: Dominant Strategies

In which of the following games do both players have a dominant strategy?

A. The Pigs in a Box game.
B. The Prisoner's Dilemma game.
C. The Battle of the Sexes game.

D. The Copycat game.
E. In each of these four games both players have dominant strategies.

Answer 16.7: B

The final exam does *not* test particular games, except the prisoner's dilemma, but it may give you a game matrix and ask you to identify any dominant strategies.

Question 16.8: Copycat Game

In the Copycat game, when both players are restricted to pure strategies,

A. There is no Nash equilibrium.
B. There are two Nash equilibria, and both are Pareto optimal.
C. Each player will resist his temptation to play his dominant strategy.
D. No Pareto optimal outcome exists.
E. Players arrive at a Stackelberg equilibrium.

Answer 16.8: A

The final exam does not test particular games, except the prisoner's dilemma, but it may give you a game matrix and ask you to identify any dominant strategies.

Question 16.9: Prisoner's Dilemma

In the Prisoner's Dilemma game, the Nash equilibrium is

A. Unique and Pareto optimal.
B. Is not Pareto optimal.
C. Unstable.
D. Only attained when both players refuse to play their dominant strategies.
E. Does not exist

Answer 16.9: B

Both prisoners are better off if they do not confess. In the Nash equilibrium, both players confess.

Question 16.10: Game Matrix

(The game matrix below relates to several of the following questions.)

Player W can play the strategies α and ß, and player Y can play the strategies γ and δ.

| *Strategies* | | *Player Z* | |
|---|---|---|---|
| | | γ | δ |
| *Player W* | α | W get 0; Z gets 2 | W gets 6; Z gets 4 |
| | ß | W gets 5; Z gets 3 | W gets 7; Z gets 1 |

Does either player have a dominant strategy in this game?

A. Neither player has a dominant strategy.

B. Player W has a dominant strategy.
C. Player Z has a dominant strategy.
D. Both players have dominant strategies, and the equilibrium is stable.
E. Both players have dominant strategies, and the equilibrium is not stable.

Answer 16.10: B

W always prefers ß to α.

Question 16.11: Nash Equilibria

Which outcomes in this game are Nash equilibria?

A. The game does not have any Nash equilibria.
B. The upper right-hand, lower left-hand, and lower right-hand corners are Nash equilibria.
C. Only the upper right-hand corner is a Nash equilibrium.
D. Only the lower left-hand corner is a Nash equilibrium.
E. Only the upper right-hand and lower left-hand corners are Nash equilibria.

Answer 16.11: D

If the players are in the lower left-hand box, neither one switches to a different strategy.

Question 16.12: Pareto Optimal

Which outcomes are Pareto preferred to the upper left-hand corner?

A. No change would be a Pareto improvement over the upper left-hand corner.
B. Only the lower right-hand corner.
C. Both the upper right-hand and lower left-hand corners.
D. Both the lower right-hand and lower left-hand corners.
E. All other outcomes are Pareto preferred to the upper left-hand corner.

Answer 16.12: C

In both the upper right-hand and lower left-hand cells, neither player does worse compared to the upper left-hand cell, and at least one player does better. In this game, both players do better, though that is not necessary for a Pareto optimal outcome. In the lower right-hand cell, player W does better but player Z does worse.

Question 16.13: Pareto Optimal

Which outcomes in this game are Pareto optimal?

A. Only the upper right-hand corner is Pareto optimal.
B. Both the upper right-hand and lower left-hand corners are Pareto optimal.
C. Both the upper and lower right-hand corners are Pareto optimal.
D. Both the lower left-hand and lower right-hand corners are Pareto optimal.
E. There is no Pareto optimal outcome.

Answer 16.13: C

If the players are now in either the upper right hand cell or the lower right hand cell, no other cell makes neither player worse off and at least one of the players better off.