

50 minutes

There are 3 short answer questions (20,25, and 25 marks each) and 5 multi-choice questions worth 6 marks each (30 in total), for a grand total of 100. Time is scarce – you have only 50 minutes in total ; a rough indication of how much time to spend on each question is provided. Answer **all questions** in the answer booklet provided. Please **make sure your name, signature, and student ID** are printed clearly on your answer booklet.

Questions 1-5 (5 multi choice questions, 6 marks each; about 3 minutes each).

1 Firms A and B are the only two firms active in a particular market. Each (independently) must choose between charging a high price or a low price. The one period payoffs of the firms are shown (in the standard way) in the accompanying table.

		FIRM B	
		Low price	High price
FIRM A	Low price	10, 10	7, 12
	High price	12, 7	15, 15

Clearly circle the one answer that correctly fills in the blanks in the following statement: “The game illustrated here _____ a prisoners’ dilemma because _____.”

- (a) is; it has all the characteristics of a prisoners’ dilemma
- (b) is not; neither Firm A nor Firm B has a dominant strategy
- (c) is not; the game has no Nash equilibrium (in pure strategies)
- (d) is not; using their dominant strategies gives the firms a mutually beneficial outcome
- (e) is not; it is an assurance game

2. Consider a game in which Player A and Player B each choose one out of two possible actions, so that the game has four possible outcomes. Suppose that we can rank (with no ties) each of those four so that we know A’s favorite outcome, second-favorite, and so on, and also B’s favorite outcome, second-favorite, and so on. Suppose the game has the following characteristics: the outcome that A likes best is the same one that B likes second best, and the outcome that B likes best is the same one that A likes second best. What sort of game has these features?

- (a) A prisoners’ dilemma
- (b) A battle-of-the-two-cultures game
- (c) A chicken game
- (d) An assurance game
- (e) A pure coordination game
- (f) None of the above are correct.

3 Consider the following (old) quote from *Newsweek* magazine. “Ice Hockey players will not adopt helmets by individual choice for several reasons. Chicago star Bobby Hull cites the simplest factor: “Vanity.” Many players fear the ridicule of opponents. The use of helmets will spread only through fear caused by serious injuries or through a rule making them mandatory. . . . One player summed up most players’ feelings: “It’s foolish not to wear a helmet. But I don’t—because the other guys don’t. I know that’s silly, but most of the players feel the same way. If the league made us do it, though, we’d all wear them and probably be better off.” Viewing the wear helmet–don’t wear helmet choice as though it were a 2 player game, it most closely resembles (circle one):

- (a) a prisoners’ dilemma
- (b) a battle-of-the-two-cultures game
- (c) a chicken game
- (d) an assurance game
- (e) A pure coordination game
- (f) All of the above are correct.

4. Robert Gibbons described the situation of two firms that produce products that consumers may use together (for instance, a computer and software). The most important concern for these two firms is that they coordinate their product designs and agree on one set of technical standards (either both pick standard A or both pick standard B) that will make their products compatible with each other. Such coordination will leave both firms better off than they would be with no coordination. As a secondary concern, each firm has its own favorite standard that it would most like to see both firms adopt. The game between these two firms (in which each chooses its standard) can be best described by saying that is it most like a (circle one):

- (a) a prisoners’ dilemma game.
- (b) a chicken game.
- (c) a battle-of-the-two-cultures game.
- (d) an assurance game.
- (e) a game with no nash equilibrium in pure strategies

5 Consider the following two situations. (i) Two governments choose between imposing (cleverly designed) restrictions on international trade and not imposing such restrictions. Regardless of what other governments are doing, imposing such restrictions always increases the payoff earned by the home country by 5 but also always decreases the payoff earned by the other country by 10. (ii) Fans at a sporting event choose between cheering for the home team and not cheering. Regardless of what other fans are doing, cheering increases a fan’s enjoyment and thus always increases his or her payoff by 5, and also adds to the enjoyment of other fans and thus always increases their payoff by 1. Which of these situations has the characteristics of a prisoners’ dilemma?

- (a) Only situation (i)
- (b) Only situation (ii)
- (c) Both situations (i) and (ii)
- (d) Neither situation (i) nor situation (ii)
- (e) there isn’t enough information to answer the question using Game theory

Question 6 [20 marks about 10 minutes]

Suppose that Ralph [R] and Cory [C] tried to communicate during the day about what to do during the evening, but the message never got through. Now each has to independently and simultaneously decide where to show up. Each player has two possibilities to choose from—the Warrior’s footie game at the Holy Grail or the jazz concert at the Blues bar. Since Ralph is choosing between footie and jazz, and Cory is making the same choice, there are four possible strategy profiles. If other things are equal for Ralph he prefers footie to jazz, whereas if other things are equal for Cory he prefers to be doing whatever together with Ralph. They both prefer that if they can’t be doing the same thing together Ralph prefers the footie while Cory prefers the jazz, and there is some conflict in their preferences about what to do together if they are going to the same event together. The table below shows the complexities of the intertwinements of their preferences, by indicating how Ralph and Cory rank order all strategy profiles, in terms of their own personal preferences. Assume that both Ralph and Cory know the information in Table 1 and that they know each of them knows the other knows (etc) and that they have to make their choices simultaneously and independently without communication.

TABLE 1

Outcome in words	Rank	Ralph’s preferences for strategy profiles	Cory’s preferences for strategy profiles
Best	4	R at footie, C at jazz	R at footie, C at footie
2nd best	3	R at jazz, C at jazz	R at footie, C at jazz
3rd best	2	R at footie, C at footie	R at jazz, C at jazz
Worst	1	R at jazz, C at footie	R at jazz, C at footie

Use game theory to answer the following questions:

1(a) [10 marks] If you were Ralph, would you go to the footie or to the jazz concert? Why?

1(b) [10 marks] If you were Cory, would you go to the footie or to the jazz concert? Why?

Question 7 [25 marks about 12 minutes]

Suppose we change the strategic game in question 6 to a sequential game. Ralph moves first, sending Cory a message about his choice, with no communication back (effectively Cory observes Ralph’s choice). Cory makes his choice after receiving Ralph’s message and the strategic game ends.

2(a) [7 marks] Draw and carefully label a game tree for this sequential game

2(b) [3 marks] How many pure strategies does each player have? List them.

2(c) [7 marks] Use rollback reasoning to determine the equilibrium of this sequential game. Write out the equilibrium strategies employed by each player and their payoffs in equilibrium.

2(d) [8 marks] Imagine playing this sequential game as a simultaneous game in strategic (matrix payoffs) form with the strategies you identified in 2(b). Make Ralph the row player and Cory the column player. Find the Nash equilibria, if there are any, in the resulting simultaneous game.

Question 8 [25 marks about 12 minutes]

Farmers (F) and a Workers (W) are playing an alternating offer bargaining game at the end of the growing season. F and W must bargain together about how to share out the proceeds of the crop and they also have to work together to harvest the crop in any one week. The harvest season lasts only 3 weeks, with the total value of the crop being \$100 in week 1, \$50 in week 2, and \$25 in week 3. After that the crop is worthless. Workers and Farmers each have to be paid more than \$5 to make it worth their while to work harvesting the crop. Due to circumstances beyond anyone’s control the farmers and workers can meet to make offers and ratify agreements only once a week. The bargaining rules are that the farmers make an offer of a division of the crop’s value in week 1. The workers either accept or reject. If they accept, the crop is harvested that week and the crop value split as agreed. If they reject the farmers offer they have to wait until week 2 to make a counter offer to the farmers. At that time (week 2) the farmers can either accept the workers offer and have the crop harvested and split the money as agreed, or reject, wait until week 3 then come back with a counter-counter-offer to the workers. This last counter offer is either accepted, the crop harvested and the money shared out as agreed, or it is rejected, no harvest is undertaken and they each walk away with nothing. Assume offers and counter offers are made in units of \$1 (ie no fractions) and that either party has to be offered a positive inducement to work.

Use your knowledge of game theory to predict the rollback equilibrium strategies, outcomes, and payoffs. Explain your reasoning.