Question 1a) There were generally no problems with this question. b) There was a slight confusion on the third possibility, which is that both players can ensure (*at least*) a draw. It is not that the game will end in a draw. (Think of tic tac toe/ noughts and crosses.) c) (Apologies for the misprinting of the figure.) i) The value of the root node is W = 1. To justify this, note that if player 1 can take b3, then if player 2 takes b6, player 1 takes b12 and if player 2 takes b7, player 1 takes b14. A win is forced for player 1. Alternatively, some people just labelled all the nodes in the tree. Either answer is fine. However, some people just gave the labels for the top three nodes, which was insufficient for full marks. ii) Most people got this, or just missed one or two. The important thing is to see the large branches (b3 and b13) which can be pruned. Of course, also b19 and b15.

d) A few said it was, but it is not the case. Many gave the example from the lecture, but for the final mark show that it violates the condition. e) This question brought out a confusion that many had on two points. Firstly, each cell contains the payoff to players 1 and 2. Some people divided this into two tables, with player 1's payoff in the first and player 2's payoffs in the second. They then found the max-min and min-max of each, and found different values and concluded that there is no equilibrium. This is wrong. The table is written out fully to show that it is a zero-sum game. So it can be written out with only the first set of numbers. The fact that player 2 is trying to minimise the maximum is taking into account the fact that its payoff is minus player 1's payoff. Another error seemed to be finding the minimum of all the rows, the maximum of all the columns, say they are not the same, and concluding that there is no equilibrium. The equilibrium is cC with a value of 3.f) The answer should state that it is an *estimate* of the value of the node (or approximate or words carrying that idea) for nodes which are beyond the depth of search. However, many people said it was used for games too large to store the entire tree in memory. You don't have to store the entire tree in memory, and you shouldn't. It is needed for games which are too large to search to all of the leaf nodes.

Question 2a) It is a two-player, zero sum game with no chance and perfect information. Draws are not possible in this game, so we know that there is a winning strategy for one of the two players. For the (7,7) version it is unsolved, but for (6.6) and smaller versions it has been solved with player 1 able to force a win. b) Here I wanted to see enough detail to determine whether you understood your project. Not just a list of components, but how they fit together. Also, not just a brief description of the program. Some answers were too short. c) Here by significant I meant a completely different approach. So, if you used MCTS, you could describe mini-max search and alpha-beta pruning, or vice versa. Some just described a tweak of their program. d) I wanted to see some thought or meaningful analysis. So, evidence of something looked at but not implemented would be one good answer. e) I wanted to see some insight into what could have been done to result in a significant improvement, and, maybe more importantly, sensible reasons for why this would have made for a stronger program. Many people were able to.

General Feedback to Question 3:

• 42 out of 47 students answered this question.
• The average mark for this question was 67% (i.e., 13.4 marks out of 20). This is better than the last years, where the average mark for this question was 58%.
• 22 or 53.6% students received a 1st class mark of 70% or better (i.e., 14 marks or more).
• 12 or 29% students received a 2nd class mark between 50%-69% (i.e., between 10 and 13 marks).
• 3 or 7% students received a 3rd class mark between 40%-49% (i.e., between 8 and 9 marks), in comparing with 6 out of 39 students or 15% in the last year.
• 4 or 9.5% students received a mark of less than 40% (i.e., 7 marks or fewer), in comparing with 10 out of 39 students or 26% in the last year.

General speaking, the students' performance in this question is very good from the teaching outcome point of view. In particular, there are much less students (16.5%) who get 3rd class or lower marks this year than the last year's 41%. Therefore this is good evidence that the students are much better prepared this year than the last year. One reason that almost all students selected this question is that the students have done a project related to the exam question. Therefore they are familiar to the topic and better prepared for the exam.

General Feedback to Question 4:

• 22 out of 47 students answered this question and therefore less than half of the students selected this question.
• The average mark for this question was 53% (i.e., 10.6 marks out of 20). This question is based on the new teaching material (Mechanism design) added in this year and therefore there is no information being compared with the previous years.
• 5 or 22.2% students received a 1st class mark of 70% or better (i.e., 14 marks or more).
• 4 or 27% students received a 2nd class mark between 50%-69% (i.e., between 10 and 13 marks).
• 4 or 18% students received a 3rd class mark between 40%-49% (i.e., between 8 and 9 marks)
• 7 or 32% students received a mark of less than 40% (i.e., 7 marks or fewer).

General speaking, the students' performance in this question is reasonably satisfactory from the teaching outcome point of view, but the lower average mark in comparing with the other questions shows that this question is more difficult for the students. This is further supported by the fact that less than half of the students selected this question. The likely reasons for these relatively lower marks are that, 1) The content of this part is generally more difficult from a technical point of view and some simplification and modification of the teaching material will be needed; 2) Some degree of simplification in the exam questions will require for the next year, in order to ensure the similar level of difficulty across all the exam questions. Therefore the exam outcome is a very useful feedback to the further exam setting; 3) the students are perhaps less familiar with the part of material as this is the last part of teaching materials and it is no link to any lab work.

Detailed Feedback to Question 3:
• Question a). Only half of students have answered this question correctly and completely. The main reason for this is that some students did not know how to formula the second player, who is the follower of the first player but the leader of the third player. For this reason, it led to the incorrect definition or incomplete formulation.

• Question b). Except to a few students, most students answered this question very well and this is in fact the main reason that the higher marks have been achieved this year. In particular, the common mistake of the previous years, without checking the boundary strategies when finding the best global strategies, has largely disappeared. This is perhaps partially due to the issue being highlighted in teaching. Therefore the only common mistake is some incorrect calculations.

• Question c). Most students did well in this question and got the correct answer. The common mistake is that some students use the intuitive analysis rather than follow the rule of Stackelberg game. Therefore only partially answered this question.

Detailed Feedback to Question 4:

• Question a). Only half of the students have answered this question correctly and completely. Most of the students correctly mentioned designing the rules of playing in game problems, but the common mistake and incompleteness is the fail to mention that the agents in the games have self-interest (a key feature for the games considered) and have the private information (a key feature for the mechanism design). Therefore more than half of students only get half or less marks in this question.

• Question b). There are 6 sub-questions in Question b). There are three conceptual type of questions (i.e. questions i, ii, and vi) and three reasoning type of questions (i.e. questions iii, iv, and v). Overall, the students answered the conceptual type of questions well. The common mistake is the incompleteness in some answers. For example, question vi) asked the main advantages of the second-price auction. Almost all answers mentioned the advantage to the bidders but some failed to mention the benefits to the sellers. For the three reasoning questions, the first two (questions iii and iv) are well answered by most of the students but the last question (question v) is less well answered by about half of students. In this question, the key point is to show that the truth telling strategy maximises a bidder’s utility function no matter what bidders do (so the dominate strategy). The common mistakes are 1) failed to show the maximisation; 2) failed to consider other bidders; 3) explained the result rather than