COMP9514 – TAKE HOME EXAM

ADVANCED DECISION THEORY – GAME THEORY COMPONENT

5 questions – 3 pages

Worth: $\frac{4}{13}$ of COMP9514

Due: 4:30pm June 19, 1998 (or before)

Due at School Office – EE313

(can be sent by post but must be postmarked no later than due date)

The solutions must be presented in legible form; preferably typed but hand written solutions are acceptable although be sure that they are clearly written as anything that cannot be understood will unfortunately not be taken into account. Numerical answers must be presented with supporting computations (the numbers alone are not sufficient). Verbal questions should be answered succinctly, avoiding any matters not directly relevant.

This is **not** a group assignment. Please ensure that the solutions are your own work. Do not give help to other students nor accept help from others. Evidence of collaboration will incur a penalty.

The answers should be handed-in or posted to the CSE office. A postage label is provided on the last page for posting your solutions. Solutions handed-in or postmarked after the due date will incur a 5 mark penalty per working day late.

Question 1 (25 marks) Determine the solutions to the following two-person zero-sum games presented in matrix form:

(a)

Player 1 \ *Player 2*	**A**	**B**	**C**	**D**
A	1	0	4	6
B	3	6	0	4
C	5	3	2	3
D	2	1	6	7

(b)

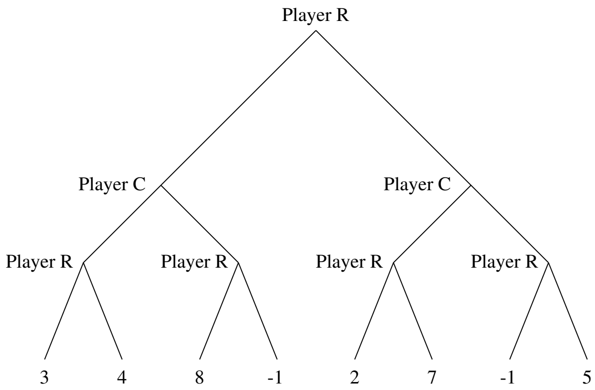
Player 1 \ *Player 2*	**A**	**B**	**C**	**D**	**E**
A	4	-4	0	3	-1
B	5	-2	3	7	0
C	0	5	2	2	6
D	3	-2	2	-2	-2

Question 2 (15 marks) Consider the game tree below for a two-person zero-sum game with payoffs to Player R.

a. Find the solution using the truncation method.

b. Represent the game in matrix form.

c. Find the solution to the resulting matrix game.



d. Suppose that we modify the game shown in the tree so that Player R does not know what choice Player C made before Player R's second move. Draw the tree showing the information sets for this situation.

Question 3 (20 marks) Two companies, Fast Rail and Snail Rail are to tender for the construction of one of two light rail connections from the city: Leichhardt or Bondi. They can submit a tender for only one of the connections. The Leichhardt connection is worth \$20m while the Bondi connection is worth \$50m. If they submit tenders for different light rail connections, each will be awarded the contract to build the connection for which they tendered. If they submit a tender for the same connection, Fast Rail is given the contract to build both light rail connections.

a. Represent this situation as a game in matrix form.

b. Demonstrate (graphically) that the game is equivalent to a zero-sum game.

c. Determine a transformation which, when applied to one of the company's payoffs, will yield a zero-sum game.

d. Write the transformed matrix.

e. Determine the solution to the resulting zero-sum game.

Question 4 (20 marks) Two investors are to simultaneously make sealed bids for a commodity worth \$700. Each can make a bid of one of the following amounts: \$100, \$200, \$300, \$400, \$500. If the bids differ, the higher bidder pays his bid and gets the commodity; the lower bidder pays nothing and receives nothing. If the bids are the same, both investors pay their bids and share the commodity, each receiving $350.

a. Represent the situation as a nonzero-sum game in matrix form.
b. Eliminate dominated strategies, reducing the game to a 3×3 matrix.
c. Find the pure-strategy Nash equilibria of the reduced matrix.
d. Find the Pareto optimal outcomes of the reduced matrix.
e. Draw the payoff polygon for the reduced matrix marking the pure-strategy Nash equilibria, Pareto optimal outcomes and Pareto optimal boundary.

Question 5 (20 marks) Two students Chris and Pat can submit only one application for one of two scholarships. The first scholarship is worth $20 000 while the second is worth $30 000. If they apply for different scholarships they each receive the scholarship for which they applied. If they both apply for the same scholarship the recipient of that scholarship is chosen by the flip of a (fair) coin by the Vice Chancellor with the other receiving nothing.

a. Represent this situation as a game in matrix form.
b. Find the pure-strategy Nash equilibria.
c. Find the Pareto optimal outcomes.
d. Find the mixed-strategy Nash equilibrium together with the value to both players.
e. Draw the payoff polygon indicating the points located in parts *(b)*, *(c)* and *(d)*.
f. Draw the reaction curve.

Label for posting:

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