Marks

[8]   **1.**   Use the two-phase method to solve:

$$\text{maximize} \quad x_1 + x_2, \quad \text{subject to } x_1, x_2 \geq 0 \text{ and}$$
$$x_1 + 2x_2 \leq 10$$
$$-x_1 - 2x_2 \leq -4$$

When there is more than one possible entering or leaving variable, choose the one with the smallest subscript.

[2] **2.** Consider the dictionary:

$$x_3 = 3 + 4x_4 - 5x_1$$
$$x_2 = 9 + 7x_4 + 5x_1$$
$$z = 30 + 5x_4 - x_1$$

Find a setting of x_1, x_2, x_3, x_4 that is feasible and that makes $z = 5030$.

[8] **3.** Give a short explanation as you answer the following questions.

(a) In a zero sum game, which strategies are pareto optimal?

(b) When the simplex method cycles, do you necessarily encounter degenerate pivots?

(c) In a matrix game with probability vector, γ, δ, what is the relationship hold between the two quantities:

$$\text{Scream}_A((\gamma + \delta)/2) \quad \text{and} \quad (\text{Scream}_A(\gamma) + \text{Scream}_A(\delta))/2.$$

(d) Give an example of an application of part (c) to the game battleship done in class.

[8]   **4.**   Consider the matrix game associated to the matrix

$$M = \begin{bmatrix} 1 & 2 \\ 3 & c \end{bmatrix},$$

where c is a given real number.

(a) Assuming that all pure strategies are involved in a unique equilibrium, what is player A's equilibrium strategy, $\vec{\alpha} = (\alpha_1, \alpha_2)$?

(b) For what values of c is it not the case that all pure strategies are involved in an equilibrium? Use domination to explain what are the equilibria for those values of c.

[6]   **5.**   Consider the movie game between Arnold and Maria, with payout matrix:

	Maria to Bambi	Maria to Terminator
Arnold to Bambi	$(2, 1)$	$(0, 0)$
Arnold to Terminator	$(0, 0)$	$(1, 2)$

(where (a, b) means Arnold gets utility a, Maria utility b). This can be alternatively written:

	Maria to Terminator	Maria to Bambi
Arnold to Bambi	$(0, 0)$	$(2, 1)$
Arnold to Terminator	$(1, 2)$	$(0, 0)$

(a) Describe a sense in which the above movie game is symmetric between Arnold and Maria.

(b) Given a game:

	Maria cooks pasta	Maria cooks rice
Arnold cooks quiche	(a_{11}, b_{11})	(a_{12}, b_{12})
Arnold cooks ratatouille	(a_{21}, b_{21})	(a_{22}, b_{22})

write down what it should mean for the game to be symmetric (i.e., write down the equations), such that the above movie game and any zero sum symmetric game are symmetric in your sense.

(c) Are all Nash equilibria in a symmetric game necessarily symmetric? Either show this is the case, or else give a counterexample. [Hint: you might think of the homework problem on this game.]

The End

Be sure that this examination has 6 pages including this cover

The University of British Columbia

Midterm Examinations - March 2007

Mathematics 340–202

Closed book examination   Time: 50 minutes

Name ———————————   **Signature** ———————————

Student Number——————   **Instructor's Name** ——————

                                                          Section Number ——————

Special Instructions:

Calculators, notes, or other aids may not be used. Answer questions on the exam.

Rules governing examinations

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2		2
3		8
4		8
5		6
Total		32