

Marks

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

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

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.]

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

1. Each candidate should be prepared to produce his library/AMS card upon request.

2. Read and observe the following rules:

No candidate shall be permitted to enter the examination room after the expiration of one half hour, or to leave during the first half hour of the examination.

Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.

CAUTION - Candidates guilty of any of the following or similar practices shall be immediately dismissed from the examination and shall be liable to disciplinary action.

(a) Making use of any books, papers or memoranda, other than those authorized by the examiners.

(b) Speaking or communicating with other candidates.

(c) Purposely exposing written papers to the view of other candidates. The plea of accident or forgetfulness shall not be received.

3. Smoking is not permitted during examinations.

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3		8
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Total		32