

ATHLONE INSTITUTE OF TECHNOLOGY

SCHOOL OF ENGINEERING

SEMESTER 1 EXAMINATIONS 2016

December Session



BSc (Hons) SOFTWARE DESIGN (GAME DEVELOPMENT)

YEAR 3

GAME THEORY AND MULTICORE 3

External Examiner(s): Dr. Steven Davy
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Internal Examiner(s): Dr. Mark Daly

Instructions to candidates:

Read all questions carefully.
All questions carry equal marks.
Answer **Three** out of **Four** questions.

Time Allowed: 2 Hours

No. of pages including cover sheet: 3

- Q.1. (a) Define the following:
1. An n -person game in extensive form. (3 Marks)
 2. A pure strategy. (3 Marks)
 3. A saddle point. (3 Marks)

- (b) Two Russian guards (A and B) confiscate a black market sport bag and find it contains two dozen packets of cigarettes, a Colt 45 pistol, one bullet, and the rules for Russian Roulette. The Senior officer (A) plays first. Both guards ante a packet of cigarettes. The "game" progresses thus:
1. A can add two packets of cigarettes to the pot and pass the pistol to B or he can add one packet to the pot, spin the pistol's chambers, put the pistol to his head and pull the trigger, and, if his luck is in, hands the gun to B.
 2. B has the same option: put two packets in the pot or one in the pot, spin the pistol's chambers, and try his luck.
 3. The game is now over with both players splitting the pot, if both are alive, or the survivor taking the whole pot.

Develop this game in extensive form by drawing the game tree, the game matrix, and state the pure strategies for A and B. Identify any saddle points.

(11 Marks)

[20 Marks]

- Q.2. (a) For a two person zero-sum game
1. What is a mixed strategy? (3 Marks)
 2. What is a *maximin* strategy? (2 Marks)
 3. What is a *minimax* strategy. (2 Marks)

- (b) Using the definitions in (a), state the Minimax Theorem (2 Marks)

- (c) What is domination and how is it used to compute optimal strategies? (5 Marks)

- (d) Consider the game matrix

$$\begin{pmatrix} 3 & 2 & 4 & 7 & 2 \\ 0 & 1 & 3 & 6 & 1 \\ 4 & 3 & 3 & 1 & 4 \end{pmatrix}$$

Find its optimal strategies.

(6 Marks)

[20 Marks]

Q.3. Alan and Bill play a game. Alan has a real fly and a fake fly and Bill a fly swatter. The purpose of the game is that Bill should swat the real fly. The game proceed thus:

1. Alan chooses one of his flies and conceals it with his hand on the table.
2. Bill decides whether to swat or not and makes his move when Alan removes his concealing hand.
3. If Bill swats then he wins €1 if the fly was real and loses €1 if not.
4. If Bill doesn't swat and the fly was real then there is no payoff and the game ends (the fly has flown).
5. If Bill doesn't swat and the fly was fake then the game is replayed for double stakes with the change that if Bill doesn't swat the fake fly he wins €2 and the game ends.

- (a) What is the game matrix for this game?
(4 Marks)
 - (b) Use linear programming to find the optimum mix of strategies for the two person zero sum game above.
(14 Marks)
 - (c) What is the value of the game for Player 1 in the game represented by *A* above?
(1 Marks)
 - (d) In relation to the Simplex Algorithm, what is a basic feasible point (bfp)?
(1 Marks)
- [20 Marks]**

- Q.4. (a) Describe in detail how Graphics Processor Units (GPU's) have become a potential solution for cost-effective massively parallel computing architectures. In your answer, refer specifically to the role of CUDA in opening such GPU's to mainstream parallel tasks.
(14 Marks)
- (b) What advantages does MPI have over GPU processing?
(3 Marks)
 - (c) What advantages does CUDA have over MPI?
(3 Marks)
- [20 Marks]**