

G51APS, Algorithmic Problem Solving Coursework 4, 2012/2013 Games

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September 28, 2012

Abstract

This document details the fourth of 5 courseworks for the module G51APS in the academic year 2012/2013. The coursework does not count towards the final assessment but, if submitted by the deadline, will be marked and returned for feedback purposes. A substantial proportion of the (unseen 90 minute) examination will be based on the five courseworks. Marks shown are indicative of the marks that would be awarded in a written examination. A record will be taken of submitted work; non-submission may result in your being assumed to have withdrawn from the course.

Answer ALL questions.

(a) Consider the following matchstick game. There is one pile of matches. An allowed move is to remove 2 or 3 matches from the pile. A player who cannot remove any matches loses.

Construct a (partial) game graph for this game. Include only as many positions (nodes) in the graph as you need in order to recognise a pattern in the winning and losing positions. Mark clearly the winning and losing positions, and a winning move from each of the winning positions.

State how to determine, for this game, whether a pile of m matches is a winning or losing position for arbitrary m . (10)

b) Consider the sum of two games. The *left* game is the one detailed in part (a). In the *right* game, an allowed move is to remove 1, 2 or 3 matches.

Complete the following table. If the position is a losing position, enter “losing”; if the position is a winning position enter a winning move in the form “L m ” or “R m ” where “L” indicates a move in the left game and “R” a move in the right game and m is the number of matches to be removed. (10)

Left Game	Right Game	“losing” or winning move
5	5	?
10	22	?
12	18	?
14	2	?
33	12	?

Table 1: Fill in entries marked “?”

(c) Use the sum game in part (b) to explain why it is insufficient to calculate whether or not a position is a winning position in each of the component games in order to determine whether a position in the sum game is a winning position, and why it is thus necessary to calculate mex numbers for each of the component games

(10)

What to Submit and When

Your solutions should be submitted to the School Office by **3.00pm on Friday, 23rd November**. Feedback on this coursework is planned for the week beginning Monday, 3 December.